THE EVOLVING ROLE OF ACCOUNTING PROFESSIONALS IN SUSTAINABILITY-RELATED RISK MANAGEMENT: A SYSTEMATIC LITERATURE REVIEW

Abstract

Sustainability challenges are exposing firms to new forms of uncertainty that extend beyond traditional financial considerations. As these pressures intensify, accounting professionals have become central to identifying, measuring, and integrating sustainability risks into core management processes. However, existing evidence on the scope of their involvement, evolving competencies, and persistent barriers remains fragmented. This systematic literature review synthesizes how accounting professionals contribute to sustainability risk management. A Web of Science search of peer-reviewed articles published between 2000 and 2024, combined with predefined inclusion and exclusion criteria and a two-stage screening process, identified 97 relevant studies. Data extraction followed a standardized coding protocol capturing methodological, theoretical, and thematic characteristics, and the findings were integrated through thematic synthesis. The review shows that accountants predominantly act as technical information providers, with limited evidence of strategic influence despite growing expectations for their involvement in sustainability risk management. This engagement is concentrated in environmental management accounting, whereas social accounting and integrated control systems remain underexplored. Thematic coverage is skewed toward environmental issues, with notable gaps in social themes and in analyses extending beyond organizational boundaries. Across the studies, capability gaps, institutional constraints, and digital skill deficiencies persist as significant barriers. At the same time, emerging technologies are rapidly transforming sustainability practices and expanding accountants' potential strategic roles, underscoring the need to develop new competencies to exploit these opportunities. The review identifies critical research gaps and outlines avenues for advancing understanding of the competencies, practices, and organizational conditions needed to support accountants' evolving sustainability responsibilities.

Keywords: Accounting professionals; Sustainability risk management; Environmental and social management accounting; Management control systems; Digital technologies; Skills and competencies

1. INTRODUCTION

Growing global awareness of sustainability issues has reshaped the corporate landscape. Sustainability risks have evolved from peripheral concerns to central determinants of organizational resilience and long-term value creation. Recent governance codes and regulatory developments underscore this shift. The updated G20/OECD Principles of Corporate Governance (2023) include, for the first time, a dedicated chapter on "Sustainability and Resilience," urging boards of directors to identify, assess, and integrate sustainability risks into core governance structures. Likewise, the Task Force on Climate-related Financial Disclosures (TCFD) issued pioneering recommendations in 2015, and, in 2023, the International Sustainability Standards Board (ISSB) introduced IFRS S1 and S2, which require standardized reporting of sustainability risks and opportunities and call for appropriate internal control and performance measurement systems to ensure the reliability of sustainability information.

In the European Union (EU), the Corporate Sustainability Reporting Directive (CSRD, Directive 2022/2464) mandates double materiality reporting under the European Sustainability Reporting Standards (ESRS), requiring firms to consider both the financial effects of sustainability issues and their impact on society and the environment. The Corporate Sustainability Due Diligence Directive (CSDDD, Directive 2024/1760) further mandates large companies to identify, prevent, and mitigate human rights violations and adverse environmental impacts across their value chains, embedding due diligence in corporate policies and management systems. However, the recent "Stop-the-Clock" Directive (Directive 2025/794), which postpones some CSRD and CSDDD deadlines, highlights the scale of these changes and the need for a phased yet robust implementation of sustainability governance. Overall, these initiatives signal unprecedented expectations that organizations should adapt to this new environment and develop the capacity to manage and integrate sustainability risks as a core component of corporate governance.

Within this changing environment, the accounting profession has assumed a more prominent and multifaceted role. Traditionally focused on financial reporting and compliance, accountants are now increasingly involved in assessing sustainability risks, developing sustainability performance metrics, and integrating sustainability considerations into enterprise risk management, strategic planning, and investment decisions (Linnenluecke et al., 2015; Nguyen, 2022). Their expertise in measurement functions and internal control positions them at the center of emerging sustainability governance architectures. This shift moves beyond the traditional view of management accountants as information providers and aligns with recent perspectives that define the profession as one that partners in decision-making and designs planning and performance management systems (Johnstone, 2020). As firms commit to ambitious sustainability targets and face growing scrutiny from regulators, investors, and civil society, accounting professionals' contribution to identifying, measuring, and mitigating sustainability risks has become essential for effective governance and organizational resilience (Burritt et al., 2023; Carnegie et al., 2021; Hsiao et al., 2022; Wenzig, 2022).

Accountants are pivotal to embedding sustainability risks within governance and control systems. However, the profession continues to face significant barriers that limit its ability to respond effectively to new regulatory and societal expectations (Khodamipour et al. 2024). Research has long emphasized that traditional accounting practices are poorly equipped to capture the complexity of environmental and social impacts, given their focus on financial quantification and the absence of standardized valuation methods (Gray, 2002; Setthasakko, 2010). Empirical studies consistently report skill gaps in sustainability-related competencies, insufficient environmental knowledge, limited familiarity with physical and forward-looking indicators, and challenges in integrating sustainability information into existing accounting routines (Kwarteng et al., 2023; Rogayan & Eveyen El Elyonna, 2019). Accountants require new technical and analytical skills to interpret emerging sustainability reporting standards, work with complex datasets, and evaluate forward-looking risks. They must also complement these capabilities with broader business competencies, including strategic thinking, communication, and the ability to integrate sustainability considerations into corporate strategy and performance evaluation (Nguyen, 2022).

Recent professional debates, such as those held during the 2025 EU Green Week and initiatives led by the Association of Chartered Certified Accountants (ACCA), Accountancy Europe, and International Federation of Accountants (IFAC), emphasize the need for significant investments in education and capacity-building. Professional accountancy organizations across Europe have begun introducing certification programs on sustainability reporting, assurance, circularity-oriented business models, performance and risk management, and sustainable finance, yet capability gaps remain. Measuring environmental and social impacts presents persistent difficulties due to limited data availability, the use of physical and non-monetary indicators, the absence of standardized valuation methods, and the need to understand energy flows, emission sources, and other environmental technical metrics unfamiliar to many practitioners (Tran et al., 2020). Collaboration with experts in engineering, environmental science, and data analytics is therefore increasingly necessary. Moreover, long-standing barriers such as insufficient sustainability training, difficulties in measuring social and environmental impacts, and limited recognition of non-market values continue to constrain the profession's ability to engage with sustainability risk management (Burritt et al., 2023). These tensions highlight the need for a consolidated understanding of how accountants currently contribute to sustainability risk management, the obstacles they face, and the extent to which emerging educational and institutional initiatives can address these barriers.

Against this backdrop, this systematic literature review (SLR) collects fragmented insights from sustainability risk management to examine how accountants identify, measure, manage, and communicate sustainability risks. The review synthesizes theoretical perspectives, empirical evidence, and methodological approaches to provide a comprehensive account of the profession's evolving role, the constraints that hinder its engagement, and the opportunities created by regulatory change and digital transformation. By synthesizing existing knowledge and highlighting unresolved challenges, the review offers a structured research agenda that advances our understanding of how accounting professionals can support credible, effective, and resilient organizational responses to sustainability risks. Separate streams have emerged around environmental management accounting (EMA), sustainability management accounting (SMA), and the integration of sustainability into management control systems, often employing distinct frameworks and terminologies. This fragmentation limits our ability to understand the evolution of accounting roles, identify the mechanisms through which accountants shape sustainability risk management practices, and assess how emerging technologies are transforming their role.

The present review draws on three strands of work that provide concrete analytical dimensions for structuring this fragmented field. First, the EMA framework proposed by Burritt et al. (2002) links business actors with EMA tools and differentiates key dimensions such as application areas (e.g., waste, material and energy flows, carbon, water, biodiversity) and spatial scope (e.g., the supply chain, planetary boundaries). As EMA has evolved, climate change has become a particularly salient domain of application, giving rise to a distinct subfield known as carbon management accounting (CMA). Research highlights the importance of embedding climate-related accounting practices and shows that introducing CMA can reshape the work and behavior of organizational actors, as well as their responses to authority and climate issues (He et al., 2022). Subsequent work revisiting and extending this framework shows how EMA has progressed toward a broader SMA perspective, incorporating social issues such as diversity and inclusion, working conditions, and health impacts. It also underscores the need to extend the spatial scope beyond organizational boundaries to include supply chains and macro-level goals such as planetary boundaries (Gunarathne et al., 2023; Schaltegger et al., 2022). EMA and SMA encompass a broad set of management accounting tools that support planning, control, and coordination of environmentally and socially relevant activities, motivate employees to engage in sustainability improvements, and inform internal and external communication (Burritt et al., 2002; Herzig et al., 2012; Qian et al., 2011; Tashakor et al., 2019). In this sense, EMA/SMA can be understood as a comprehensive toolkit that provides information to improve sustainability and economic performance, including effects beyond organizational boundaries (Gunarathne et al., 2023; Schaltegger et al., 2022; Tashakor et al., 2019).

Second, research on the integration of sustainability into management control systems (MCSs) provides a complementary lens on how sustainability information becomes embedded in strategic planning, performance measurement, and incentive structures. MCSs shape actors' practices (Ahrens & Chapman, 2007) and support strategy formulation and implementation (Kober et al., 2007; Langfield-Smith, 1997; Otley, 1999). If sustainability is to be integrated into strategy beyond external reporting, discourse, and mission statements, it must be reflected within formal control mechanisms (Gond & Herrbach, 2006). Gond et al. (2012) conceptualize a package of formal MCSs composed of strategic planning, budgeting, financial measurement systems, non-financial measurement systems, hybrid measurement systems (such as balanced scorecards), project management and investment appraisal, and evaluation and reward systems, and show how corresponding MCSs can support strategy and sustainability integration. Related works illustrate how these systems can be used to embed sustainability objectives, manage trade-offs, and influence triple-bottom-line performance. However, the specific roles, competencies, and involvement of accounting professionals in designing and operating such sustainability-oriented control packages, and how these interact with EMA/SMA tools across organizational and beyond organizational scope, remain fragmented.

Third, developments in digital technologies are reshaping management accounting and sustainability practices. The integration of EMA/SMA and MCSs with digital infrastructures, including the Internet of Things (IoT), artificial intelligence (AI), software tools, databases, and advanced analytics, has influenced the evolution of sustainability management accounting (Rautiainen et al., 2024). Digitalization has been described as one of the most critical trends reshaping society and business, with the potential to disrupt organizational business models (Kolbjornsrud, 2024), the management accounting domain, and control practices, as well as the roles of controllers and accountants (Murphy et al., 2024; Rabbani, 2024). Recent advances in computational power, storage capacity, big data availability, and sophisticated algorithms have enabled the rapid development of AI and machine learning, transforming operations, business models, and accounting practices. However, given the pace and complexity of digitalization and AI technologies, the implications of these technologies for the accounting profession remain insufficiently understood, and the literature linking AI, IoT, big data, and the evolving role of accountants in sustainability contexts is still limited (Burritt et al., 2023).

Prior SLR in related areas (e.g., EMA, CMA, sustainability control systems, management accounting, and digitalization) have mapped important developments and identified research gaps but tend to focus on tools, techniques, or organizational outcomes rather than on the accounting profession's evolving role in managing sustainability and climate risk exposure (Abbas, 2025; He et al., 2022; Johnstone, 2020; Maas et al., 2016; Pedroso & Gomes, 2024; Schaltegger et al., 2022; Swalih et al., 2024). These reviews do not provide a consolidated perspective on how accounting functions evolve across different application areas, themes, and spatial scopes, nor do they address how digitalization reshapes these dynamics. Therefore, there is a need for a comprehensive SLR that consolidates these fragmented insights and mobilizes the EMA/SMA framework, MCSs package, and digitalization as guiding analytical dimensions. By doing so, this review seeks to provide an integrated understanding of how accounting professionals' roles, competencies, and practices are evolving to manage sustainability risks, including how AI, IoT, and other digital technologies reconfigure sustainability measurement, control, and decision support.

To address this gap, this study conducts a SLR of peer-reviewed journal articles published in English between 2000 and 2024. The methodology follows established guidance for SLRs in accounting and sustainability research (e.g., Abbas, 2025; Ed-Dafali et al., 2025; Schaltegger et al., 2022; Swalih et al., 2024) and applies the PRISMA procedure (Page et al., 2021) for the identification, screening, and inclusion of studies. A structured search was implemented using four targeted search strings in the Web of Science database (SSCI, SSCI Expanded, ESCI), combining accounting-profession terms with sustainability risk, strategic integration, performance measurement, climate and carbon management, and emerging digital technologies. Predefined inclusion and exclusion criteria were applied through a two-stage screening process, and a standardized coding protocol was used to extract methodological, theoretical, and thematic characteristics. A total of 97 studies were included in the analysis. The SLR uses thematic analysis to synthesize the results and to identify developmental trajectories and gaps within the literature.

The objective of this research is to consolidate and systematize existing evidence on the evolving role of accounting professionals in sustainability risk management by examining the scope of their responsibilities and their level of involvement across key analytical dimensions. Specifically, the review assesses: (i) the extent of their involvement in sustainability risk management; (ii) the design and use of sustainability management accounting and control systems supporting sustainability integration; (iii) the thematic and spatial scope of sustainability issues addressed; and (iv) the influence of AI, IoT, and other digital technologies on sustainability accounting practices. Aligned with this purpose, the review addresses the following research questions:

RQ1. What roles, skills, competencies, and levels of involvement characterize accountants' participation in organizational adaptation to sustainability issues, both within the accounting function and across other organizational areas?

RQ2. What barriers does the accounting profession face in promoting organizational adaptation to sustainability issues?

RQ3. How do accountants engage across sustainability management accounting domains and control systems, and what role does this engagement play in managing sustainability risks?

RQ4. Which sustainability themes (e.g., waste, carbon, energy, water, safety, diversity) are addressed in the literature, and how do accountants contribute to managing and measuring these themes?

RQ5 How do accountants support sustainability practices within organizational boundaries and across extended systems such as supply chains, circular economy processes, and macro-level sustainability frameworks (i.e., planetary boundaries)?

RQ6. How are AI, IoT, data analytics, and other emerging digital technologies reshaping accountants' contributions to sustainability risk management?

RQ7. What conceptual, methodological, and empirical gaps persist, and what avenues for future research exist?

The remainder of the review is structured as follows. Section 2 presents the research methodology. Section 3 reports a descriptive analysis of the results. Section 4 highlights important research gaps and outlines avenues for future research. Section 5 concludes the study and discusses its implications and limitations.

2. RESEARCH METHODOLOGY

This study conducts a SLR to examine how accountants contribute to sustainability risk management and the influence of emerging digital technologies. The SLR approach follows established guidelines in the accounting and sustainability literature (Abbas, 2025; Ed-Dafali et al., 2025; Schaltegger et al., 2022; Swalih et al., 2024) and aligns with best practices for transparent, reproducible, and bias-minimizing evidence synthesis (Page et al., 2021; Siddaway et al., 2019). This methodological choice is particularly appropriate given the study's purpose of consolidating fragmented knowledge on the evolving role of accountants in sustainability risk management processes, while also identifying conceptual, methodological, and thematic gaps to guide future research.

To ensure methodological rigor, we applied the PRISMA 2020 guidelines (Page et al., 2021), which provide a structured and standardized procedure for the identification, screening, eligibility assessment, and inclusion of studies in systematic reviews. The PRISMA protocol was selected because it enhances transparency, ensures systematic and comprehensive coverage of the literature, and reduces bias and random error, consistent with recent reviews in the fields of management accounting and sustainability (Ed-Dafali et al., 2025; Swalih et al., 2024).

2.1 SEARCH STRATEGY

The first step of the PRISMA protocol involves defining the eligibility criteria, information sources, and search strategy (Ed-Dafali et al., 2025; Page et al., 2021). To identify relevant literature on the evolving role of accountants in sustainability risk management, we conducted a structured search using the Web of Science (WoS) database. WoS was selected due to its broad coverage of high-quality peer-reviewed journals and its suitability for systematic reviews in management and accounting research (Abbas, 2025; Pedroso & Gomes, 2024).

The search strategy was designed to capture the analytical dimensions of this review. Specifically, the search aimed to identify studies that examine: (i) the evolution of accountants' roles, skills, competencies, and levels of involvement on sustainability risk management; (ii) how accountants contribute to sustainability risk assessment, measurement, and strategy integration through EMA, SMA, and sustainability management control systems; and (iii) the influence of digitalization on accountants' capabilities and contributions to sustainability measurement, control, and decision-support. To reflect these complementary dimensions, separate search strings were developed. All strings combined accounting profession terms (e.g., accountant, management accounting, auditor) with sustainability-related constructs using WoS proximity operators (NEAR/x) to maximize contextual precision and relevance. Keywords relating to sustainability risk management, EMA/SMA/CMA tools, MCSs, competencies, and digital technologies were iteratively refined through pilot searches to balance recall and precision. The selection of these terms is grounded in established definitions and conceptualizations of the accounting profession (Burritt et al., 2023; Schaltegger et al., 2022), sustainability management accounting and control systems integration (Burritt et al., 2023; Gond et al., 2012; Johnstone, 2020), climate risk and carbon accounting (He et al., 2022; Linnenluecke et al., 2015), and AI and digitalization (Abbas, 2025; Duan et al., 2019; Knudsen, 2020).

The search was restricted to peer-reviewed journal articles published in English between 2000 and 2024 and indexed in SSCI, SSCI (expanded), or ESCI within the subject areas Business, Finance, Management, Accounting, and Economics. We did not limit the review to "*top journals*," as prior research shows that such journals may be biased toward specific topics and methodological preferences, and that management accounting research has been underrepresented in top-tier journals (Abbas, 2025; Summers & Wood, 2017). The selected subject areas are consistent with the corporate focus of this review, which examines the evolving role of accountants within organizational decision-making contexts (Abbas, 2025). The time frame (2000–2024) was chosen to capture the evolution of accountants' involvement in sustainability risk management. The final search was conducted on September 10, 2025. Appendix A summarizes the search parameters and the four search strings used.

2.2 SELECTION AND DATA COLLECTION PROCESS

To ensure methodological rigor and relevance, inclusion and exclusion criteria were established before the screening and selection process (Ed-Dafali et al., 2025; Page et al., 2021). As noted above, the search included peer-reviewed journal articles published in English between 2000 and 2024[1] that examined the role of accounting professionals, including management accountants, auditors, and other accounting practitioners, in relation to sustainability risk management, strategic integration, performance measurement, and the use of emerging digital technologies to support these processes. Studies were excluded if they: (i) did not include a sustainability component or were primarily focused on financial risk or financial performance; (ii) discussed sustainability issues without involving accounting functions in organizational risk management, strategic integration, or performance measurement; (iii) presented technical AI or data-science models unrelated to accounting functions; (iv) were not peer-reviewed journal articles (e.g., conference proceedings, book chapters, theses, editorials, or notes); (v) were written in languages other than English; (vi) were retracted or duplicated, in which case the most complete version was retained; or (vii) were review articles, to avoid duplication of synthesized evidence. Table 1 presents the eligibility and exclusion criteria.

Table 1 near here

In WoS, 398 articles were initially retrieved. Duplicates were removed using RefWorks based on title, author, and publication year, resulting in 286 unique studies that advanced to the screening stage. The screening and selection procedure followed the two-stage procedure recommended by PRISMA 2020 (Page et al., 2021; Swalih et al., 2024). In Stage 1, the two authors independently screened titles, abstracts, and keywords to identify articles referring to accounting professionals in connection with sustainability risk management, strategic integration, performance measurement, or the use of emerging digital technologies to support these functions. Records without direct relevance to these thematic components were excluded from the analysis. A total of 159 articles were excluded at Stage 1 (title/abstract/keywords) and 52 were marked as "*Maybe*" for full-text evaluation.

In Stage 2, full-text screening was conducted independently by both authors to confirm that: (i) accounting functions were central (not tangential), (ii) the study explicitly addressed sustainability risk management, strategy integration, or performance measurement, and (iii) in the case of AI, IoT, data analytics, and other emerging digital technologies, the technological dimension was applied to accounting activities rather than developed in isolation. Any disagreements were resolved through discussion until a consensus was reached. A total of 30 studies were excluded at this stage. Reasons for exclusion at full-text screening were documented and reported in Appendix B using a set of standardized exclusion codes (E1–E3).

[1] Early Access articles indexed in 2024 but assigned a formal publication year in 2025 were classified according to their publication year.

By the end of the screening procedure, a total of 97 papers had been identified and used as the input for our analysis. The complete identification, screening, selection, and data collection steps are summarized in Table 2

Table 2 near here

2.3 DATA ANALYSIS AND SYNTHESIS METHODS

We analyzed the selected articles using thematic analysis, a methodological approach widely applied in accounting research to synthesize heterogeneous conceptual and empirical evidence (Abbas, 2025; Dumay et al., 2018; Swalih et al., 2024). Data extraction followed a systematic and transparent protocol designed to ensure consistency and traceability across all included studies. A coding framework was developed to capture the bibliographic characteristics of each article, its methodological design, theoretical framework, and thematic focus. The coding protocol is presented in Appendix C.

The coding procedure proceeded through an iterative and reflexive process. The first author conducted the initial round of coding, applying the preliminary framework while remaining open to the emergence of unanticipated patterns, concepts, and relationships. As coding progressed, the framework was refined to incorporate additional theoretical frameworks and thematic dimensions not anticipated in advance. To enhance reliability and minimize individual coder bias, the second author recoded the full set of studies using the revised coding rules. The two coding cycles were subsequently compared, and discrepancies were discussed until consensus was achieved (Page et al., 2021).

Given that the thematic approach does not involve estimating pooled effect sizes, a formal risk-of-bias tool was not applied (Abbas, 2025; Ed-Dafali, 2025; Swalih et al., 2024). Instead, we emphasized methodological transparency and coherence in the interpretation of findings.

3. STATISTICAL DESCRIPTION OF STUDIES

This section presents the descriptive characteristics of the dataset. It outlines the quantitative distribution of the included studies, including the evolution of the number of articles published over time. In addition, it reports the qualitative insights derived from the coding and thematic analysis, such as the research methods employed, the theoretical frameworks adopted, and the thematic categories identified across the literature.

3.1 GROWTH RATE OF PUBLICATIONS

The temporal distribution of the 97 articles included in the review shows a clear yet still emerging acceleration of scholarly interest in the accounting profession’s contribution to sustainability risk management. As Figure 1 illustrates, the first publications in this field appeared in 2006, and research output remained sporadic and irregular for several years. A gradual upward trend becomes visible from 2013 onwards, although the annual number of studies remains relatively modest during this period. A more pronounced and sustained growth phase begins around 2017–2018. From 2019 onwards, yearly publication numbers stabilize before rising sharply in 2023 (12 articles) and reaching a peak in 2024 (20 articles)[2]. Notably, more than half of all studies (approximately 58%) were published between 2019 and 2024. This pattern suggests that the field is expanding rapidly; however, it remains in an early stage of scholarly consolidation, with overall publication volumes still limited compared with more established accounting research streams.

The recent acceleration in publications, particularly the sharp rise observed in 2023 and 2024, reflects growing regulatory, societal, and institutional pressures related to sustainability risks, which are redefining the boundaries of accounting practice. This surge aligns with major regulatory developments, such as the CSRD, CSDDD, and the ISSB standards, which require organizations to produce increasingly sophisticated sustainability information and, in turn, demand new competencies from accounting professionals (Linnenluecke et al., 2015; Rogayan & Eveyen El Elyonna, 2019). As these reforms broaden the scope of accountants' roles, the profession is shifting from a traditional financial stewardship orientation toward more strategic functions involving sustainability risk assessment, measurement, and strategy integration. These evolving expectations require not only the adaptation of existing skills, such as data quality, materiality assessment, and judgment, but also the development of new capabilities related to sustainability metrics, value chain analysis, and interdisciplinary collaboration (Burritt et al., 2023; Khodamipour et al., 2024; Nguyen, 2022). These pressures help explain the concentration of recent academic work, as scholars seek to understand how accountants respond to expanding regulatory mandates and the growing complexity of sustainability-related decision-making. Nevertheless, despite this increased attention, research remains fragmented and limited, indicating that the field is developing rapidly but has not yet reached conceptual maturity regarding the role of accountants in sustainability risk management.

Figure 1 near here

3.2 RESEARCH METHODS AND THEORETICAL FRAMEWORK

The distribution of research perspectives reveals that the literature is predominantly quantitative empirical, which accounts for 53 studies (54.6%), followed by qualitative empirical research with 26 studies (26.8%). Theoretical and conceptual contributions represent 10 studies (10.3%), while mixed-methods approaches are the least common, with only 8 studies (8.2%). Regarding research methods, the field is strongly characterized by the use of survey-based empirical designs, which

[2] The four articles dated 2025 correspond to early-access publications released in 2024.

constitute 49 studies (50.5%), and case or field studies, representing 25 studies (25.8%). Other methodological approaches appear less frequently, including conceptual development with 12 studies (12.4%), interviews with 9 studies (9.3%), archival analyses with 7 studies (7.2%), and experimental methods with 4 studies (4.1%). Additional methods categorized under “other”, such as content analysis or model development, appear in 12 studies (12.4%). Note that 12 studies (12.4%) adopt a combination of research methods. These include, for instance, surveys combined with content analysis and/or interviews (Doorasamy, 2016; Egbunike & Emudainohwo, 2017; Kumarasiri, 2015; Nkundabanyanga et al., 2021); case or field studies supplemented with archival information, content analysis, or model development (Abelda, 2011; Cadez & Guilding, 2017; de Beer & Friend, 2006); interview-based designs enriched with archival or content analysis and model development (Aureli et al., 2025; Badroos, 2024; Johnson et al., 2025); and archival research complemented by model development or content-analytic procedures (Figge & Hahn, 2013; Lamboglia et al., 2019) (see Figure 2).

Figure 2 near here

The reviewed studies draw on the following theoretical foundations (see Figure 3). A substantial share of the studies relies on multiple theoretical lenses (29 studies; 29.9%), indicating a clear tendency toward integrative or multi-framework reasoning. This is followed by institutional theory, used in 27 studies (27.8%); the resource-based view, applied in 21 studies (21.6%); and stakeholder theory, which appears in 20 studies (20.6%). Several other theories are used, including contingency theory (14 studies; 14.4%), legitimacy theory (7 studies; 7.2%), and dynamic capabilities theory (5 studies; 5.2%), as well as a set of organizational and sociological lenses, such as organizational theory, resource orchestration theory, voluntary disclosure/proprietary cost theory, and agency theory, each appearing in 2 to 4 studies. A long tail of other perspectives appears only once (1.0% each). Notably, 23 papers (23.7%) do not rely on any theoretical framework.

Figure 3 near here

3.3 THEMATIC ANALYSIS

This section presents the thematic distribution of the 97 reviewed studies across the analytical dimensions defined in the coding framework. Appendix D summarizes the number of papers within each thematic category.

3.3.1. Role of accountants

The studies examine the involvement of accounting functions in sustainability risk management, although the depth, scope, and nature of this involvement vary considerably across the sample. The findings indicate that the literature primarily focuses on the functional contribution of management accounting tools rather than the specific roles and competencies of the accounting profession.

The most prevalent category is *"Accounting functions and level of involvement in sustainability risk management,"* which appears in 73 papers (75.3%). These studies portray accountants as technical providers, coordinators, or integrators of sustainability information, for instance, by preparing sustainability KPIs, monitoring environmental and social indicators, managing sustainability reporting systems, or supporting performance measurement processes (e.g., Asiaei et al., 2021, 2022a, 2022b, 2023; Doorasamy, 2016; Henri & Journeault, 2010; Johnson et al., 2025; Lamboglia et al., 2019; Nkundabanyanga et al., 2021; Solovida & Latan, 2017; Spencer et al., 2013). However, even where their involvement is recognized, these studies rarely provide detailed evaluations of how accountants participate in strategic deliberations, influence cross-functional sustainability decisions, or shape broader organizational responses to sustainability risks.

The category "*Evolving roles, skills, and competencies*" appears in 29 studies (29.9%), reflecting emerging but still limited scholarly attention to how sustainability pressures are reshaping the professional profile of accountants. These contributions emphasize the need for interdisciplinary knowledge (e.g., engineering, environmental science), sustainability expertise, critical and analytical skills, and, more recently, digital competencies. Several studies argue that accountants are becoming increasingly involved in sustainability strategy development, integrated performance measurement, environmental and carbon cost analysis, and innovation-oriented management accounting (e.g., Abdelhalim, 2024; Asiaei et al., 2022a; Ballou et al., 2012; Ferreira et al., 2010; Gunarathne et al., 2021; Jusoh et al., 2023; Linnenluecke et al., 2015; Ratnatunga et al., 2011; Schaltegger & Zvezdov, 2015; Schneider, 2015). A subset of works connects these evolving roles to the rise of AI, IoT, big data analytics, and digital platforms for sustainability measurement, highlighting that accountants require digital literacy to work with automated environmental data feeds, real-time sustainability monitoring, and predictive sustainability analytics (e.g., Badroos, 2024; Johnson et al., 2025).

Finally, 23 papers (23.7%) are coded under "*Barriers, resistance, and capability gaps,*" identifying a range of obstacles that limit accountants' effective engagement with sustainability risk management. These barriers include insufficient sustainability training, a strong adherence to financial or shareholder-oriented logics, limited organizational authority, misaligned incentives, and resistance to non-financial information (e.g., Aureli et al., 2025; Bresciani et al., 2023; Doorasamy, 2016; Jarvenpaa & Lansiluoto, 2016; Kazemian et al., 2022; Khalid et al., 2022; McNally et al., 2017; Nguyen, 2022; Schaefer, 2007). Several studies also highlight institutional and cultural constraints, such as regulatory ambiguity, the dominance of traditional financial KPIs, entrenched management control routines, and organizational cultural resistance to non-financial metrics, which reduce accountants' ability to support transformative sustainability initiatives (e.g., Albelda, 2011; Deegan, 2013; Schaefer, 2007). Notably, an emerging set of papers identifies digital capability gaps as a growing barrier to accountants' participation in technologically enabled sustainability risk management, including difficulties in using AI-based analytics, IoT monitoring systems, big-data dashboards, and other digital infrastructures (e.g., Burritt et al., 2023).

These findings indicate that while accountants' involvement in sustainability risk management is widely acknowledged, research provides limited evidence on their actual practices, decision-making influence, or strategic contributions. Only a minority of studies examine how accountants adapt to sustainability demands by acquiring interdisciplinary knowledge, developing data-analytic competencies, or engaging in dialogic collaboration, and even fewer explore the organizational and institutional conditions that enable or constrain such adaptation. As a result, the literature continues to conceptualize accountants primarily as technical information providers rather than as strategic actors in sustainability risk management, leaving open critical questions about the professional identities, skill sets, and contextual conditions needed to foster accountants' roles in supporting organizational resilience to sustainability risks.

3.3.2. Application areas

The reviewed studies address sustainability risk management across several accounting domains, with a clear predominance of EMA. EMA appears in 73 studies (75.3%), making it the most frequently examined application area. These studies employ tools such as carbon and energy performance indicators, material and energy flow analysis, life-cycle costing, eco-control mechanisms, and environmental performance dashboards. EMA is often linked to strategic and operational decision-making (e.g., Appannan et al. 2023; Badroos, 2024; Dutta et al., 2013; Ferreira et al., 2010; Henri & Journeault, 2010; Solovida & Latan, 2017; Spencer et al., 2013; Uyar, 2020) and to eco-efficiency improvements (e.g., Chan et al., 2014; Henri & Journeault, 2010; Henri et al., 2017). Other studies emphasize circular economy and eco-innovation (e.g., Aureli et al., 2025; Scarpellini et al., 2020a, 2020b), including performance gains in areas such as energy efficiency (Brown et al., 2020; Christensen & Himme, 2017), water management (e.g., Christ, 2014), or waste and resource use (e.g., Doorasamy, 2016; Figge & Hahn, 2013; Zhu et al., 2009). Several contributions illustrate how EMA helps managers understand win-wins and trade-offs between economic and environmental outcomes and supports decision-making under competing priorities (e.g., Christ et al., 2016), as well as its impact on environmental performance (e.g., Abdelhalim, 2024; Alnaim & Metwally, 2024; Asiaei et al., 2022a, 2022b; Bresciani et al., 2023; de Beer & Friend, 2006; Deb et al., 2023; Latifah & Soewarno, 2023). Moreover, EMA is also positioned as a response to institutional pressures or regulatory compliance requirements (e.g., Chaudhry & Ami, 2020; Chetanraj et al., 2024; Elhossade et al., 2021; Ferdous et al., 2019; Gunarathne et al., 2021; Järvenpää & Länsiluoto, 2016; Kadir et al., 2025; Yusoh et al., 2023; Wang et al., 2019).

Other studies place particular emphasis on CMA practices (e.g., Bui et al., 2024; Burritt et al., 2011; Kazemian et al., 2022), as well as their role in supporting carbon abatement and reduction strategies (e.g., Cadez & Guilding, 2017; Egbunike & Emudainohwo, 2017; Johnson et al., 2025). Several contributions also examine how CMA enables adaptation to climate change and the management of climate risks (e.g., Bui & de Villiers, 2017; Linnenluecke et al., 2015), including evidence on the financial and operational consequences of climate risks for organizations (e.g., Naranjo Tuesta et al., 2021). Further work highlights the importance of inter-organizational arrangements and intra-organizational coordination within CMA, analyzing how firms collaborate externally with stakeholders and internally across functional areas to implement carbon-management projects (Mahmoudian et al., 2021). Across these studies, accountants are primarily depicted as preparers, coordinators, or interpreters of environmental information, while their potential strategic influence and decision-making authority within environmental and climate governance remain insufficiently examined.

SMA is less represented, appearing in 12 studies (12.4%). These contributions address issues such as human rights due diligence, labor conditions, workplace health and safety, diversity and inclusion, and employee well-being. While SMA studies broaden the sustainability agenda, they tend to provide less detail about the specific tools and metrics used to measure and manage social risks (Burritt et al., 2023). Examples include analyses of social and ethical performance measurement, stakeholder-oriented controls, and the integration of social indicators into sustainability objectives and organizational strategy (e.g., Deegan, 2013; Dutta et al., 2013; Dutta et al., 2016; Echanove-Franco et al., 2024; Khodamipour et al., 2024; Jusoh et al., 2023). Some studies also identify the usefulness of safety controls and social accounting practices in managing corporate social sustainability in response to stakeholders' demands and expectations (Gunarathne et al., 2016). Compared with EMA, SMA studies provide fewer insights into accountants' specific responsibilities and operational roles in addressing social risks, with many analyses highlighting a persistent gap in the integration of social metrics into management accounting and control systems (e.g., Schaltegger & Zvezdov, 2015).

A total of 51 studies (52.6%) engage with MCSs. This stream of the literature reflects growing interest in how sustainability information is embedded in planning, budgeting, financial and non-financial performance evaluation, incentives, and hybrid control packages (Gond et al., 2012). Many studies draw on the levers of control framework to examine diagnostic and interactive uses of sustainability-oriented controls (e.g., Asiaei et al., 2023; Gomez-Conde et al., 2019; Gond et al., 2012; Narayanan & Boyce, 2019). Others analyze the integration of environmental and social indicators into balanced scorecards (e.g., Alewine & Stone, 2013; Asiaei & Bontis, 2019; Khalid et al., 2022), strategy and performance (e.g., Ballou et al., 2012; Brown et al., 2020; Gond et al., 2012; Gunarathne et al., 2016; Schneider, 2015; Werastuti et al. 2023), budgeting for environmental items (e.g., Henri & Journeault, 2010; Henri et al., 2017), project management and investment appraisal (e.g., Bui & de Villiers, 2017; Kumarasiri, & Gunasekarage, 2017), and sustainability-linked incentive schemes (e.g., Henri & Journeault, 2010; Virtanen et al., 2013). Additional studies examine the emergence of sustainability-specific control mechanisms, such as eco-control systems (e.g., Henri & Journeault, 2010; Henri et al., 2017), circular economy systems (e.g., Aureli et al., 2025; Scarpellini et al., 2020a), and carbon management routines (e.g., Egbunike & Emudainohwo, 2017; Johnson et al., 2025; Kazemian et al., 2022), highlighting the accounting functions embedded within control infrastructures (e.g., Abdelhalim, 2024; Huy & Phuc, 2024; Schaltegger & Zvezdov, 2015). However, evidence regarding accountants' strategic roles and their influence within MCSs remains fragmented and underexplored.

Finally, 2 studies (2.1%) do not specify an application area. These papers address sustainability risk management in broad terms without attaching their analysis to EMA, SMA, or MCSs. Examples include Huy & Phuc (2025), which discusses accountants' professional identity and sustainability responsibilities without situating these within any defined management accounting tool or control system. Similarly, McNally et al. (2017) analyze the challenges of preparing integrated reports and highlight the links and often disconnects between sustainability management systems, accounting infrastructures, and integrated reporting outputs, but do not relate their analysis to specific management accounting tools.

The distribution of application areas reveals that EMA dominates research on accountants' involvement in sustainability risk management. The emphasis on EMA reflects the historical environmental orientation of sustainability accounting scholarship, whereas the limited development of SMA and the fragmented treatment of MCSs highlight significant opportunities for future research to deepen understanding of how accountants contribute to social sustainability and how they shape and promote integrated control systems that guide sustainability-related decision-making.

3.3.3. Thematic scope

The thematic scope of the reviewed studies reveals substantial variation in the sustainability issues examined, with a clear predominance of environmental themes and comparatively limited coverage of social topics. This pattern reflects the trajectory of sustainability accounting research, which has traditionally centered on environmental impacts (Burritt et al., 2023).

The most prevalent category is a broad consideration of environmental indicators, which appears in 64 studies (66.0%). These papers adopt multi-dimensional environmental measurement frameworks through composite indices, eco-control systems, environmental dashboards, or multi-impact performance frameworks. Common measures include a set of KPIs (e.g., energy use, waste volume, emissions intensity), environmental risk indicators (ERIs), and aggregated eco-efficiency metrics. These indicators are often linked to strategic, performance, or governance variables, such as the mediating role of EMA use between environmental strategies or green intellectual capital and financial or environmental outcomes (e.g., Abdelhalim, 2024; Asiaei et al., 2022a; Ferreira et al., 2010; Gunarathne et al., 2021; Henri & Journeault, 2010; Lamboglia et al., 2019; Solovida & Latan, 2017). However, limited evidence is provided on the roles that accounting functions play in managing trade-offs across environmental dimensions or in prioritizing conflicting environmental objectives (Christ et al., 2016).

Given the review's focus on climate change, carbon emissions constitute another major theme, appearing in 44 studies (45.4%). These articles measure direct and indirect emissions (Scopes 1–3), carbon intensity ratios, and carbon abatement costs. Several studies analyze the relationship between carbon performance and financial outcomes, eco-efficiency, or competitive advantage (e.g., Badroos, 2024; Cadez & Guilding, 2017; Egbunike & Emudainohwo, 2017; Figge & Hahn, 2013; Kazemian et al., 2022; Naranjo Tuesta et al., 2021; Ratnatunga et al., 2011; Solovida & Latan, 2017). Others explore how carbon metrics are incorporated into MCSs, including carbon budgeting, internal carbon pricing, and carbon KPIs in scorecards or dashboards (e.g., Bui et al., 2024; Burritt et al., 2011; Johnson et al., 2025; Kumarasiri, 2015). Closely related, climate risks, adaptation, and resilience appear in 20 studies (20.6%). These examine how climate risks are embedded into strategic planning, risk management, and performance evaluation, through tools such as scenario analysis, stress testing, resilience indicators, and long-term capital planning (e.g., Abdelhalim, 2024; Bui & de Villiers, 2017; Cadez & Guilding, 2017; Kumarasiri & Gunasekarage, 2017; Linnenluecke et al., 2015; Riyath & Jariya, 2024). Across these works, a recurrent gap is the weak integration of physical climate risks (e.g., extreme weather events, supply-chain disruptions, infrastructure vulnerability) into accounting models, despite their growing relevance for climate risk management. Moreover, most contributions focus on mitigation rather than adaptation, and very few examine how accountants operationalize resilience or sector-specific vulnerabilities within planning and control routines.

Themes related to waste and resources appear in 35 studies (36.1%), and energy in 31 studies (32.0%), forming a cluster of research centered on organizational eco-efficiency, waste minimization, and cleaner production. These studies commonly measure waste volumes and disposal costs, non-product output, material losses, energy consumption, and associated environmental costs to quantify inefficiencies and uncover hidden environmental costs embedded in waste streams and energy-intensive processes (e.g., Abobakr et al., 2023, 2024; Badroos, 2024; Doorasamy, 2016; Latifah & Soewarno, 2023; Qian et al., 2015; Solovida & Latan, 2017; Uyar, 2020). A recurrent analytical focus lies in examining the relationships between material and energy efficiency and environmental performance, or between EMA-based waste or energy tracing and cost reduction. These studies often position resource and energy indicators within broader environmental management accounting systems, using them to support operational improvements or justify eco-efficiency investments (Llena-Macarulla et al., 2023). Closely connected are studies addressing material flows and composition, which appear in 21 studies (21.6%) and are primarily operationalized through material flow cost accounting (MCFA) and physical flow analysis (Appannan et al. 2023; Zhu et al., 2009). These contributions trace materials from input to output, distinguishing between product and non-product flows, and often integrate physical flow information with cost allocation and environmental performance evaluation (e.g., Appannan et al. 2023; Bresciani et al., 2023; Scarpellini et al., 2020a; Uyar, 2020). This combined analysis of resource and material flows highlights the role of accountants in making visible the financial and environmental impacts of inefficient production processes. The evidence demonstrates that waste, resource use, material flows, and energy consumption are tightly interrelated themes, frequently analyzed within integrated frameworks that trace how physical resource consumption generates environmental impacts and economic costs. However, despite these conceptual synergies, the majority of studies remain firm-centric and efficiency-oriented, focusing primarily on internal process optimization. Only a minority extend the analysis to product life cycles, circular economy transition, industrial symbiosis, or ecosystem-level impacts (e.g., Appannan et al. 2023; Badroos, 2024; Burritt et al., 2023; Uyar, 2020), limiting empirical evidence of accountants' contribution to broader organizational adaptation to resource scarcity, supply chain dependencies, or planetary boundary constraints.

Water-related themes are covered in 24 studies (24.7%), usually as part of broader environmental performance frameworks. Water indicators include total consumption, contamination, water-use efficiency ratios, wastewater, effluent volumes, treatment and discharge metrics, and compliance with regulatory standards. These measures are often combined with energy and emissions indicators in environmental dashboards or ERI frameworks supporting environmental risk management and compliance (e.g., Alnaim & Metwally, 2024; Lamboglia et al., 2019; Nkundabanyanga et al., 2021; Pumiviset & Suttipun, 2024). Other contributions examine water management accounting (WMA) to assess the long-term consequences of water management decisions (Christ, 2014). However, this literature remains limited in its treatment of water risk (e.g., scarcity, basin-level risk, climate-driven water stress) and in analyzing how such risks are integrated into management controls, investment decisions, or scenario analysis, despite their increasing prominence in regulatory agendas.

Environmental themes with more limited representation include biodiversity and land, appearing in 8 studies (8.2%). Indicators appear as metrics such as land use, biodiversity impact categories, or biodiversity indices embedded within broader ERI frameworks or environmental reports (e.g., de Beer & Friend, 2006; Huy & Phuc, 2025; Lamboglia et al., 2019). These indicators are usually secondary elements within broader environmental frameworks and are rarely linked to decision-making, valuation, or strategic control. Notably, no study is coded under deforestation, despite its centrality in climate and biodiversity debates.

On the social side, research is underdeveloped. The most frequent category is broad coverage of social indicators, appearing in 26 studies (26.8%), often alongside environmental measures. These contributions analyze social impacts such as labor conditions, human rights, community impacts, or stakeholder welfare, typically within integrated reporting (e.g., Deegan, 2013; Echanove-Franco et al., 2024; Jusoh et al., 2023; McNally et al., 2017). Measures include employee KPIs, training hours, safety metrics, community investment, social incident indicators, stakeholder surveys, and narrative disclosures (e.g., Asiaei et al., 2023; Huy & Phuc, 2025; Werastuti et al., 2023). However, those indicators are frequently aggregated and weakly defined, with limited evidence that they are embedded in management accounting practices. More specific social categories show very low frequencies. Employee well-being and health and safety appear in 9 studies (9.3%), usually through occupational safety KPIs, injury rates, well-being indicators, and safety compliance metrics. Examples include studies incorporating health and safety indicators into sustainability scorecards or performance systems (e.g., Asiaei et al., 2023; Gunarathne et al., 2016; Huy & Phuc, 2025; Pumiviset & Suttipun, 2024). Diversity, equality, and inclusion appear in only 3 studies (3.1%), usually involving gender equality indicators, diversity KPIs, or disclosures about equal opportunity policies (Abdelhalim, 2024; Asiaei et al., 2023; Narayanan & Boyce, 2019). Health implications (e.g., toxicity, chemicals) appear in 3 studies (3.1%), embedded within environmental compliance or risk management frameworks rather than treated as a distinct social domain (Abdelhalim, 2024; Huy & Phuc, 2025; Werastuti et al., 2023). Human rights appear in only one study (1.0%) as part of a broader ethical performance theme of "*caring for people*" (Abdelhalim, 2024). This limited coverage represents a critical gap, particularly in view of the increasing scrutiny of human rights practices across supply chains.

The thematic distribution reveals a strong environmental bias, with extensive attention to carbon, resource efficiency, energy, emissions, and composite environmental indicators. However, many critical social sustainability themes remain underexplored, as do trade-offs between sustainability indicators and emerging environmental risks such as environmental disasters, biodiversity loss, resource scarcity, deforestation, and water stress.

3.3.4. Spatial scope

The spatial scope of the reviewed studies shows a strong concentration on sustainability risks defined within organizational boundaries, with comparatively few contributions engaging with broader system-level impacts or inter-organizational dynamics. This pattern reinforces the firm-centric orientation already observed in sustainability management accounting research (Burritt et al., 2023).

The majority of studies (87 papers; 89.7%) adopt an organizational-level perspective. These contributions conceptualize sustainability risk primarily as something to be measured and managed within the firm. For example, several papers examine how firms design and use EMA information, environmental performance indicators, or eco-control mechanisms to monitor and improve internal environmental performance (e.g., Abdelhalim, 2024; Appannan et al., 2023; Asiaei et al., 2022b; Ferreira et al., 2010; Henri & Journeault, 2010; Jusho et al., 2023; Solovida & Latan, 2017; Werastuti et al., 2023). Others investigate how sustainability metrics are embedded in internal management control systems, such as budgets, performance measurement systems, and sustainability dashboards (e.g., Abobakr et al., 2024; Bui et al., 2024; Henri & Journeault, 2010; Kumarasiri & Gunasekarage, 2017). In these studies, accountants are portrayed as designers, custodians, or users of internal information systems, with sustainability risks largely framed as internal operational or strategic processes rather than as phenomena emerging from cross-boundary interactions.

By contrast, only 10 studies (10.3%) extend their spatial scope beyond organizational boundaries. These contributions incorporate supply chain risks, industrial ecosystems, circular value networks, or planetary boundaries. Several papers focus on supply chain and logistics networks, analyzing how sustainability performance is measured and managed across various stages of the value chain. Lee & Wu (2014) developed a multi-methodological approach that simultaneously measures environmental performance (carbon emissions, energy use, waste) and economic performance (transport cost, logistics efficiency) in logistics and supply chain networks. Christ (2014) examined physical and monetary WMA information to assess long-term sustainability impacts along the Australian wine supply chain. Chan et al. (2014) combined life-cycle assessment, fuzzy analytic hierarchy process (AHP), and EMA to support green product design across the product life cycle. Mahmoudian et al. (2021) analyzed decarbonization pathways in multi-tier supply chains, linking carbon indicators and management accounting information to cross-organizational emission reduction strategies. Christ et al. (2016) explored carbon risk and sustainable supply-chain management in food retail contexts, emphasizing how emissions and environmental costs propagate along value chains. Across these studies, EMA supports multi-objective decision making rather than only win–win solutions. In Christ et al.'s study, five scenarios exhibit different trade-offs among cost, carbon emissions, and water risk, with no single option emerging as the optimal. EMA helps firms make balanced, satisfying decisions by incorporating cross-functional insights, long-term considerations, and non-market environmental data. The case highlights tensions between short-term economic performance and long-term environmental risk, particularly water scarcity, and demonstrates EMA's potential to inform large-scale supply chain infrastructure decisions.

Other studies move from linear supply chains to broader value networks and socio-technical systems. Aureli et al. (2025) investigated a circular packaging solution developed by a value network of six firms, showing how life-cycle assessment and informal accounting practices are used to coordinate decisions beyond organizational boundaries. The paper examines how management accounting systems support, or fail to support, the implementation of a sustainable circular business model. The study highlights the limitations of mainstream accounting for circular economy transition and proposes a more dialogic, participatory, non-financial, and system-wide approach to management accounting. Alsaid (2022) examined energy distribution and smart-city reforms, highlighting how accounting information supports decisions in energy networks that span multiple institutional actors. Burritt et al. (2023) provided a conceptual review that links sustainability accounting to planetary boundaries and global sustainability constraints, arguing that current accounting practices remain poorly aligned with planetary limits and require broader system-level accounting tools. Finally, Bui & de Villiers (2017) and Johnson et al. (2025) analyzed climate risk and decarbonization responses across sectors and international value chains, indicating how carbon management and carbon accounting actions increasingly involve suppliers, customers, and broader industry initiatives rather than being confined to single firms.

Despite these exceptions, even the cross-boundary studies do not fully integrate system-level metrics (e.g., basin-level water stress, climate disruptions, resource scarcity, biodiversity thresholds, or planetary boundary indicators) into organizational planning, budgeting, or performance evaluation routines. Supply chain and network-level risks are often described qualitatively or treated as contextual factors, while core accounting tools and control systems remain largely firm-focused. Only a very small subset of papers, such as Burritt et al. (2023) and Aureli et al. (2025), engage with concepts such as circular economy, value-network governance, or planetary boundaries, and even these do not provide detailed operational guidance on how such system-level logics can be translated into day-to-day accounting and control practices.

The spatial distribution reveals a pronounced organization-centric bias, with sustainability risks predominantly treated as internal operational challenges. Limited attention is given to cross-boundary dynamics such as supply chain vulnerabilities, circular economy transition, or climate disruptions. This narrow spatial scope constrains understanding of how accountants might engage with systemic sustainability risks that transcend firm boundaries.

3.3.5. Emerging technologies

The analysis of emerging digital technologies indicates that this dimension remains at an early stage in the literature. Only 8 studies (8.3%) address AI, big data, IoT, Industry 4.0, or related digital infrastructures in connection with the role of accounting professionals in sustainability risk management, while 89 papers (91.8%) do not consider digital technologies. This imbalance is notable given the increasingly data-intensive nature of sustainability accounting practice, particularly in light of the rapid expansion and mainstream adoption of AI and advanced analytics since 2022, which have begun to disrupt established accounting routines and reshape expectations about how sustainability risks are measured, analyzed, and governed (Abbas, 2025).

The group of 8 studies covers several technological themes. The first cluster focuses on big data analytics, AI, and digitalized accounting information systems (AIS). Huy & Phuc (2024) examined how AIS in Vietnamese public sector organizations are being transformed through Industry 4.0 technologies such as big data analytics, cloud computing, and AI, with the aim of enhancing information quality, fraud detection, and risk management. In their analysis, big data and AI are framed as critical capabilities that extend accountants' roles from traditional recording functions to predictive and analytical tasks. Forensic accountants, in particular, are portrayed as pivotal actors in the digital transformation of public sector organizations and sustainability risk management. Their responsibilities include ensuring the integrity, reliability, and completeness of the vast volumes of structured and unstructured data generated through big data analytics, supporting fraud detection, and strengthening the quality of both financial and non-financial reporting. These advanced competencies increase the effectiveness of AIS and enhance organizational capacity to identify, assess, and manage sustainability risks. Therefore, the study highlights an evolving professional role in which forensic accountants' digital skills become essential for supporting governance, accountability, and sustainability-oriented decision-making in contemporary public sector environments.

Similarly, Abdelhalim (2024) investigated how big data analytics integrates with management accounting practices and how this integration contributes to corporate sustainability performance. The findings indicate that big data analytics, management accounting practices, and sustainability performance are deeply interconnected and mutually reinforcing. Big data analytics strengthens forecasting accuracy, scenario analysis, risk management, and decision relevance, particularly during supply chain disruptions and the COVID-19 pandemic. Indeed, big data analytics enables new management accounting techniques, including customer profitability analysis, value chain accounting, competitive advantage analysis, and integrated risk management. Management accounting directly supports sustainability performance by quantifying resource use, tracking environmental efficiency, evaluating lifecycle impacts, and monitoring sustainability goals. The integration of big data analytics and management accounting practices enhances sustainable performance through improved data availability, analytics quality, and decision support.

Consequently, accountants are required to upskill in digital and analytical competencies in order to interpret big data, translate analytics outputs into financial and non-financial insights, and support forecasting, sustainability measurement, and risk analysis. Their role shifts from traditional reporting towards data-driven strategic analysis in areas such as resource efficiency, environmental KPIs, lifecycle evaluations, and supply chain resilience.

Riyath & Jariya (2024) extended these insights to the ESG reporting domain. Their study shows how AI and data analytics tools can detect misreporting and fraud and help mitigate greenwashing in sustainability disclosures. Accountants play a central role in preparing, validating, and improving the quality of ESG disclosures while adopting AI tools that enhance accuracy, timeliness, and analytical depth. Through these activities, they support the development of a sustainability-oriented culture and contribute to organizational climate resilience. Their role extends beyond conventional reporting toward data-driven insight generation and active engagement with stakeholders on sustainability issues, signaling a broader evolution in competencies and responsibilities.

A second set of contributions examines Industry 4.0 technologies and their implications for EMA and environmental performance. Badroos (2024) developed a hierarchical framework for prioritizing Industry 4.0 technologies (including IoT, cyber-physical systems, AI, big data, and simulation tools), linking these technologies to the generation of EMA information and to environmental performance improvements. The study conceptualizes EMA as the informational pillar that allows firms to convert technologically generated data streams into decision-useful environmental indicators. The results indicate that waste management and water usage emerge as the most critical environmental performance dimensions. IoT and cyber-physical systems are ranked as the most environmentally impactful technologies due to their capacity for real-time resource monitoring, process control, pollution detection, and waste reduction. Big data analytics offer predictive insights, while cloud computing provides the storage and integration backbone for environmental data. These technologies collectively reinforce EMA by providing real-time environmental accounting information. Thus, accountants become increasingly dependent on digital infrastructures to support environmental decision-making, strategy formulation, regulatory compliance, and SDG monitoring, and they are expected to integrate technologically enriched environmental information into EMA practices. From a conceptual perspective, Burritt et al (2023) reflected how digitalization is reshaping accounting functions. They argue that digital technologies can expand the granularity, timeliness, and traceability of sustainability information, but also caution that accountants must develop new competencies to exploit these opportunities.

A third group of papers addresses digital infrastructures and automation within broader management control settings. Alsaid (2024) analyzed smart city governance, highlighting the central role of enterprise resource planning systems and interconnected digital platforms in capturing real-time environmental and social data that feed into multi-level performance measurement and control. The study shows that integrated digital infrastructures can support complex sustainability monitoring, although it offers limited detail on the concrete involvement of accountants beyond system maintenance and reporting. Brown et al. (2021) investigated automation and management control in dynamic environments, demonstrating how algorithmic systems, robotic process automation, and data analytics reshape control processes and the work of management accountants. Although not exclusively focused on sustainability, the study illustrates the wider transformation of control infrastructures within which sustainability metrics are increasingly embedded. Accountants are depicted as part of the teams that design, monitor, and interpret management control systems linked to automation and energy-efficiency performance. Their role increasingly involves integrating automation-generated environmental and energy data into organizational control processes. Finally, Johnson et al. (2025) linked carbon management to "*digital sustainability transformation*," discussing how AI-assisted emission tracking, IoT-based monitoring, and digital platforms enable more granular carbon data, real-time dashboards, and scenario analysis for decarbonization pathways, and outlining the emerging role of accountants in interpreting and governing these digital sustainability infrastructures.

These studies portray digital technologies as enablers of more granular, timely, and predictive sustainability information. They consistently signal that accountants will require enhanced data-analytic and digital competencies to work effectively with AI, IoT, big data, and Industry 4.0 systems (e.g., Abdelhalim, 2024; Badroos, 2024; Burritt et al., 2023; Huy & Phuc, 2024; Johnson et al., 2025; Riyath & Jariya, 2024). However, most contributions remain conceptual or exploratory. They offer limited empirical evidence on how accountants interact with digital tools in day-to-day work, how digital infrastructures are embedded in sustainability management accounting and control systems, or how algorithmic decision-support reshapes power relations and professional boundaries. Overall, the emerging technologies dimension reveals a substantial research gap. Despite the growing prominence of AI, IoT, and data analytics in contemporary corporate sustainability practices, current scholarship provides only fragmented insights into how these technologies transform sustainability measurement, control, and the role of accountants. This leaves considerable scope for future research to investigate how digital tools are designed, implemented, and governed in sustainability accounting, and how they reconfigure the skill sets, practices, and influence of accounting professionals.

4. ACCOUNTING PROFESSIONALS AND SUSTAINABILITY RISK MANAGEMENT: RESEARCH THEMES AND GAPS

The findings across the 97 reviewed studies reveal significant advances in understanding how accounting professionals contribute to sustainability risk management. However, the evidence also exposes substantial conceptual, empirical, and methodological gaps that limit the field's ability to explain accountants' evolving roles, competencies, and influence in addressing increasingly complex sustainability risks. This section synthesizes these gaps across the five analytical dimensions of the review (professional roles, application areas, thematic scope, spatial boundaries, and emerging technologies) and outlines a future research agenda that responds to the SLR's objective and research questions.

4.1. GAPS IN UNDERSTANDING ACCOUNTANTS' ROLES, CAPABILITIES, AND INFLUENCE

Across the sample, accounting professionals are frequently positioned as technical experts whose primary contribution lies in the preparation and coordination of sustainability information. Studies such as Abdelhalim (2024), Appannan et al. (2023), Asiaei et al. (2021), Lamboglia et al. (2019), Nkundabanyanga et al. (2021), Solovida & Latan (2017), Spencer et al. (2013), and Werastuti et al. (2023) emphasize accountants' involvement in generating environmental performance indicators and managing sustainability dashboards. While these works demonstrate that management accounting tools are widely mobilized to identify and monitor sustainability issues, they offer limited insight into the degree of professional agency accountants exert, the nature of their judgment and influence in decision-making contexts, or the organizational conditions that shape their engagement in sustainability risk management. Even when studies address more advanced sustainability practices, such as carbon budgeting, climate risk assessment, or long-term decarbonization planning, the role of accountants is described in functional terms. Contributions by Bui & de Villiers (2017), Cadez & Guilding (2017), Johnson et al. (2025), Kumarasiri & Gunasekarage (2017), Linnenluecke et al. (2015), Mahmoudian et al. (2021), and Naranjo Tuesta et al. (2021) illustrate how carbon metrics support mitigation and adaptation strategies but do not deeply examine how accountants participate in these decisions or how their professional authority is negotiated within governance structures. As a result, the literature provides a fragmented account of accountants' actual involvement in strategic sustainability deliberations, leaving critical questions unresolved regarding their capacity to shape responses to complex risks or contribute to organizational resilience.

A recurring gap across several studies is the limited conceptualization of accountants as strategic actors. Although Abdelhalim (2024), Asiaei et al. (2022a), Ballou et al. (2012), Jusoh et al. (2023), Schaltegger & Zvezdov (2015), and Schneider (2015) highlight emerging responsibilities in strategy formulation, performance evaluation, and integrated control systems, analyses remain focused on tools rather than on the professional roles that underpin them. Consequently, the literature provides little evidence on how accountants influence strategic deliberation and contribute to cross-functional teams involved in environmental risk analysis, circular economy initiatives, sustainable supply chain management, or social sustainability challenges. Therefore, the literature continues to reproduce a dominant view of accountants as "*technical information providers,*" despite the growing need for them to act as strategic partners capable of integrating sustainability risks into planning and control processes (Burritt et al., 2023; Nguyen, 2022; Gunarathne et al., 2021).

Another important gap relates to the underdeveloped treatment of evolving skills and competencies. Although Abdelhalim (2024), Badroos (2024), Burritt et al. (2023), Huy & Phuc (2024), and Nguyen (2022) emphasize the importance of interdisciplinary knowledge, sustainability literacy, and digital capabilities, only a small subset of studies examines how such competencies are developed, institutionalized, or operationalized in practice. Research that considers accountants' professional identity transformation, such as Huy & Phuc (2025) and Jarvenpaa & Lansiluoto (2016), suggests that sustainability introduces tensions between traditional financial logics and broader societal expectations, yet these professional identity dynamics remain insufficiently theorized and empirically underexplored. Overall, the literature provides little evidence on how accountants develop, adapt, and sustain the skills required to navigate the technical, analytical, and ethical complexities of sustainability risk management.

A further gap is the persistent concern with barriers, resistance, and capability deficits, which many studies identify but few examine in depth. Research documents a range of obstacles, including insufficient sustainability training, lack of environmental knowledge, adherence to financial logics, organizational cultures resistant to non-financial metrics, management entrenchment, and misaligned incentives (e.g., Albelda, 2011; Bresciani et al., 2023; Doorasamy, 2016; Kazemian et al., 2022; Khalid et al., 2022; McNally et al., 2017; Schaefer, 2007; Yusoh et al., 2023). However, most analyses treat these factors descriptively rather than investigating the organizational, institutional, and systemic conditions under which barriers are mitigated or reinforced. Consequently, research fails to explain the institutional arrangements, decision-making structures, or governance mechanisms that enable accountants to move beyond compliance-oriented tasks and contribute meaningfully to sustainability risk management. Moreover, the emerging literature on digital capability gaps (e.g., Abdelhalim, 2024; Badroos, 2024; Burritt et al., 2023; Huy & Phuc, 2024; Johnson et al., 2025; Riyath & Jariya, 2024) shows that accountants often struggle to interpret algorithmic outputs, use big data analytics, manage IoT-enabled monitoring systems, or integrate digital dashboards into decision making. However, these studies remain exploratory, pointing to the need for deeper examination of how digital transformation reshapes the profession's ability to engage with sustainability risks.

4.2. GAPS ACROSS EMA, SMA, AND MCSs

The literature exhibits a pronounced imbalance across accounting application areas, which affects the ability of scholars to understand how accountants engage in sustainability risk management.

EMA dominates existing research. Studies including Abdelhalim (2024), Appannan et al. (2023), Chan et al. (2014), Christ et al. (2016), de Beer & Friend (2006), Deb et al. (2023), Ferreira et al. (2010), Henri & Journeault (2010), Latifah & Soewarno (2023), Llena-Macarulla et al. (2023), Solovida & Latan (2017), Uyar (2020), and Wang et al. (2019) consistently show how EMA supports eco-efficiency, environmental performance measurement, and internal cost visibility. However, EMA remains largely oriented toward internal optimization rather than toward addressing broader sustainability risks such as supply chain vulnerabilities, resource scarcity, or planetary boundary constraints, as highlighted by Burritt et al. (2023). This narrow focus limits insights into how accountants use EMA to support resilience, long-term planning, or adaptation to sustainability and climate risks. CMA receives substantial coverage in studies such as Bui et al. (2024), Cadez & Guilding (2017), Egbunike & Emudainohwo (2017), Johnson et al. (2025), Kumarasiri & Gunasekarage (2017), and Linnenluecke et al. (2015), yet CMA is often framed as a reporting or compliance practice rather than as a decision-support instrument. Only a few studies explore how carbon metrics shape risk-adjusted budgeting, capital appraisal, or decarbonization pathways, limiting the field's ability to explain how accountants engage with climate risks.

SMA remains significantly underdeveloped. Studies by Deegan (2013), Dutta et al. (2013, 2016), Echanove-Franco et al. (2024), Gunarathne et al. (2016), Khodamipour et al. (2024), Riyath & Jariya (2024), and Schneider (2015) illustrate SMA's potential for addressing labor conditions, human rights issues, health and safety, and employees' well-being. However, these works often rely on social indicators and rarely operationalize specific tools or metrics for social risk assessment. This gap is particularly concerning given the growing regulatory emphasis on human rights due diligence and assessments of working conditions across supply chains, as well as the incorporation of social dimensions into dual materiality frameworks.

Research on MCSs is more extensive but fragmented. Studies such as Asiaei & Bontis (2019), Ballou et al. (2012), Brown et al. (2020), Gond et al. (2012), Henri et al. (2017), Jusoh et al. (2023), and Schneider (2015) examine the integration of sustainability indicators into planning, budgeting, performance measurement, project management, and incentives. Nonetheless, the literature rarely explains how accountants interpret sustainability signals, navigate trade-offs across environmental and social objectives, or design MCSs packages capable of supporting resilience and long-term value creation. Only limited work, such as Bui & de Villiers (2017), Johnson et al. (2025), and Kumarasiri (2015), addresses climate scenario analysis, internal carbon pricing, or adaptation-oriented budgeting.

4.3. GAPS IN THEMATIC SCOPE AND SUSTAINABILITY DOMAINS

The thematic distribution of sustainability risks reveals a strong environmental focus, with limited engagement in social sustainability and emerging environmental domains. This imbalance constrains the field's ability to understand how accountants address multi-dimensional sustainability risks.

Carbon emissions, energy use, waste, water, and eco-efficiency remain the most examined themes, as shown in Abdelhalim (2024), Asiaei et al. (2023), Figge & Hahn (2013), Gerged et al. (2024), Henri & Journeault (2010), Lamboglia et al. (2019), Solovida & Latan (2017), and Uyar (2020). Although these studies significantly advance environmental performance measurement, they offer limited evidence on how accountants reconcile conflicts across environmental priorities, integrate physical risks into decision-making models, or assess ecosystem-level impacts. Important contributions to climate risk analysis (e.g., Bui & de Villiers, 2017; Cadez & Guilding, 2017; Linnenluecke et al., 2015; and Riyath & Jariya, 2024) highlight the need to incorporate climate adaptation and resilience into management accounting, yet very few operationalize specific tools for these purposes. Most studies focus on operational efficiency or mitigation rather than adaptation, leaving large gaps in understanding how accountants address water stress, extreme weather events, supply chain disruptions, or sector-specific climate vulnerabilities. Biodiversity, land use, and ecosystem impacts appear only marginally across the work of de Beer & Friend (2006), Gunarathne et al. (2021), Huy & Phuc (2025), and Lamboglia et al. (2019). Planetary boundary approaches, as proposed by Burritt et al. (2023), remain predominantly conceptual, lacking operational guidance for management accounting.

Research on social sustainability remains limited, despite its increasing relevance under CSRD, CSDDD, or ISSB requirements. Asiaei et al. (2021, 2023), Deegan (2013), Echanove-Franco et al. (2024), Gunarathne et al. (2016), Huy & Phuc (2025), Jusoh et al. (2023), and Narayanan & Boyce (2019) demonstrate the inclusion of social indicators such as human rights, community impacts, or employee welfare in sustainability reports or integrated control systems. Yet, these indicators are often aggregated and insufficiently embedded in management accounting routines. Sensitive categories, including labor rights, diversity, equality, inclusion, health impacts, and community well-being, remain underexplored, leaving important questions unanswered regarding how accountants can support organizations in addressing social sustainability risks.

4.4. GAPS IN SPATIAL SCOPE: A PERSISTENT ORGANIZATIONAL BIAS

Most studies adopt an organizational perspective, focusing on internal sustainability risk management and performance. While this orientation supports insights into planning, monitoring, and operational control, it restricts understanding of the systemic and cross-boundary nature of sustainability risks.

Notable cross-boundary analyses include Alsaid (2022), Aureli et al. (2025), Bui & de Villiers (2017), Burritt et al. (2023), Chan et al. (2014), Christ (2014), Christ et al. (2016), Johnson et al. (2025), Lee & Wu (2014), and Mahmoudian et al. (2021). These works examine sustainable supply chain initiatives, water management in value chains, circular economy networks, logistics optimization, and industry-level decarbonization pathways. These studies demonstrate that sustainability risks are rarely confined to firm boundaries and often require inter-organizational coordination, shared metrics, and harmonized decision frameworks. However, these contributions seldom integrate systemic risk indicators, such as basin-level water stress, biodiversity thresholds, or regional climate vulnerability, into management accounting processes. Research remains largely qualitative and conceptual, leaving substantial opportunities for advancing the operationalization of cross-boundary risk metrics within accounting tools and control systems (Burritt et al., 2023).

4.5. GAPS IN THE EFFECT OF DIGITALIZATION AND EMERGING TECHNOLOGIES

Digitalization constitutes one of the most promising yet underexplored frontiers of the accounting profession. Studies by Abdelhalim (2024), Alsaid (2022), Badroos (2024), Brown et al. (2020), Burritt et al. (2023), Huy & Phuc (2024), Johnson et al. (2025), and Riyath & Jariya (2024) show how big data analytics, AI, IoT, Industry 4.0 technologies, and interconnected digital platforms are transforming sustainability measurement, monitoring, and reporting. These contributions demonstrate that digital technologies can significantly enhance the granularity, timeliness, and predictive capacity of sustainability information and increase the traceability of environmental and social impacts across organizational processes. However, the evidence remains largely conceptual or exploratory and offers limited insights into how digital tools are embedded in day-to-day accounting work, how they reshape accountants' authority and professional judgment, or how accountants acquire and institutionalize the digital competencies required to work with automated data feeds and algorithmic analytics. The emerging literature also points to substantial digital capability gaps, including limited proficiency in AI-driven analytics, difficulties in managing IoT-based environmental monitoring systems, weak data-analytic skills, and challenges in designing and using digital sustainability dashboards. These shortcomings underline the need for future research to examine how digital tools are designed, implemented, and governed within sustainability accounting and control systems, and how they reconfigure the skill sets, practices, professional identities, and influence of accounting professionals in sustainability risk management.

4.6. METHODOLOGICAL GAPS

Despite the growing academic interest in sustainability risk management, the methodological foundations of the field remain relatively narrow. Longitudinal and panel data studies are notably scarce, which limits the ability to trace how sustainability management accounting practices evolve in response to regulatory changes, technological innovation, or shifts in organizational strategy. Without temporal analyses, it is difficult to understand how accountants adapt their roles, how control systems mature, or how sustainability risk practices stabilize or transform within organizations. Similarly, cross-country comparative research is limited, resulting in insufficient attention to how institutional, cultural, and regulatory contexts shape the adoption, design, and use of sustainability accounting tools. Such comparative insights are essential for capturing the diversity of practices and for theorizing the contextual factors influencing accountants' engagement with sustainability risks.

4.7. FUTURE RESEARCH AGENDA

The gaps identified across roles, application areas, thematic domains, spatial boundaries, digital transformation, and methodological approaches show that research on accounting professionals and sustainability risk management remains limited. Existing studies emphasize environmental measurement and internal efficiency but offer limited insights into accountants' strategic influence, the development of sustainability competencies, social risk assessment, adaptive strategies, cross-boundary sustainability challenges, or the implications of emerging digital technologies. Advancing the field requires positioning accountants within the broader governance, organizational, and technological shifts shaping sustainability risk management, as well as adopting methodological approaches capable of capturing the systemic, evolving, and contextual nature of sustainability risks.

First, future work should reconceptualize accountants as strategic actors in sustainability governance (RQ1, RQ3). Research is needed on how they participate in risk committees, scenario analysis, and resilience planning, and how professional identities and authority evolve as sustainability responsibilities intensify. Second, studies should map and measure sustainability competencies and capability gaps (RQ1, RQ2, RQ6), examining how training, certification, and organizational learning shape accountants' interdisciplinary, analytical, and digital skills. Third, the limited development of SMA highlights the need for robust tools and metrics to assess social risks (RQ4, RQ5), including human rights due diligence, labor conditions, diversity indicators, and community impacts. Fourth, accounting models should increasingly integrate physical climate risks, adaptation costs, and resilience metrics (RQ3, RQ4), moving beyond mitigation toward risk-informed planning, capital investment appraisal, and long-term adaptation strategies. Fifth, carbon management accounting requires further development as a decision-support tool (RQ3, RQ4, RQ6), particularly in relation to internal carbon pricing, carbon scenario analysis, and value chain decarbonization. Sixth, future research should address the strong organizational bias by developing cross-boundary and system-level sustainability accounting approaches (RQ5). This includes supply chain risk mapping, circular economy coordination, and alignment with ecological thresholds such as planetary boundary indicators. Seventh, digitalization offers a major yet underexplored frontier. Studies should investigate how AI, IoT, and big data reshape sustainability risk management and accountants' professional competences (RQ6). Finally, methodological rigor must be strengthened (RQ7). Longitudinal designs, panel data analyses, and cross-country comparisons are essential to understanding how sustainability risk management practices and accountants' functions evolve over time and across institutional contexts.

5. CONCLUSIONS AND LIMITATIONS

This SLR offers an integrated synthesis of a fragmented body of literature on accounting professionals' contributions to sustainability risk management. By mobilizing EMA, SMA, and MCSs as complementary analytical lenses, the review clarifies how accountants engage with sustainability risks across application areas, thematic domains, spatial boundaries, and digital infrastructures. It extends prior reviews by placing the accounting profession, rather than accounting tools, at the center of the analysis, showing how roles, skills, and competencies are evolving in response to rising sustainability pressures and expanding regulatory expectations. The review also advances emerging debates on digitalization by consolidating the limited but rapidly growing evidence on the influence of AI, IoT, big data analytics, and other digital technologies on sustainability risk management. Notably, the review integrates these elements into a coherent analytical framework that links professional roles, accounting domains, sustainability themes, spatial scales, and digital transformation, an integration not previously employed in the literature. Together, these insights generate a structured future research agenda that identifies critical conceptual, methodological, and empirical gaps.

This review contributes to the literature by addressing a gap left by prior SLRs in related domains, such as EMA, carbon accounting, MCSs, and management accounting and artificial intelligence, which have mapped important developments but tend to focus on tools, techniques, or organizational outcomes rather than on the accounting profession's evolving role in managing sustainability risk exposure (Abbas, 2025; He et al., 2022; Johnstone, 2020; Maas et al., 2016; Pedroso & Gomes, 2024; Schaltegger et al., 2022; Swalih et al., 2024). These reviews do not offer a consolidated perspective on how accounting functions evolve across application areas, thematic domains, and spatial scopes, nor do they systematically examine how digitalization reshapes these dynamics. By synthesizing these fragmented strands, this review advances theory by articulating how sustainability challenges are transforming accounting work from technical information provision toward more strategic, interdisciplinary, and digitally enabled forms of professional engagement.

Practical implications arise for organizations, regulators, and the accounting profession. The findings provide guidance on how to configure sustainability-oriented management control systems, extend the use of environmental and social management accounting, and strengthen accountants' capabilities to support sustainability risk assessment and decision making. They highlight the need to redesign accounting roles to include strategic engagement with sustainability risks; to integrate social, environmental, and climate information into planning and performance evaluation; and to invest in training that builds interdisciplinary and digital skills. For professional bodies and educators, the review underscores the importance of embedding sustainability and digital competencies into qualification frameworks and continuing professional development. For organizations, the synthesis highlights how digital infrastructures, such as AI-enabled dashboards and IoT-based monitoring systems, can be integrated into accountants' work to strengthen sustainability governance and resilience. However, these opportunities can only be realized when accountants have the necessary digital and analytical capabilities.

Despite its contributions, this review has several limitations. Restricting the corpus to peer-reviewed journal articles indexed in Web of Science enhances analytical rigor and coherence but excludes practitioner insights, emerging innovations disseminated in professional fields, and interdisciplinary work outside academic journals. Although the coding and thematic synthesis techniques used promote transparency and replicability, they necessarily involve interpretive judgment in categorization and clustering. The focus on accounting professionals, while essential for addressing the research questions, frames sustainability challenges primarily through an accounting perspective, potentially overlooking broader organizational or institutional dynamics. A further limitation stems from the keyword strategy, which focused on "sustainability", "carbon," and "climate" as thematic anchors for sustainability risk, reflecting their centrality in policy and scientific debates. This approach did not incorporate more specialized environmental accounting terms, such as WMA, MFCA, life-cycle costing, or circular economy accounting. Consequently, the review may have underrepresented technical or sector-specific contributions that rely on domain-specific terminology. While this choice ensures conceptual consistency for a profession-oriented review, it also underscores the value of future theme-specific reviews targeting these specialized subdomains. Finally, the review captures published knowledge up to 2024; given the rapid evolution of sustainability regulation and digital technologies, new developments may quickly reshape the research landscape.

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Table 1. Eligibility and exclusion criteria

Category	Criteria
Inclusion criteria	• WoS database • Peer-reviewed journal articles • Published between 2000–2024 • Business, Finance, Management, Accounting, and Economics fields • Written in English • Indexed in SSCI, SSCI (expanded), or ESCI • Focus on accounting professionals (management accountants, auditors, or accounting practitioners) • Address sustainability and climate risk management, strategic integration, governance, performance measurement, or management control systems • Include studies where AI or emerging digital technologies support accountants' roles in sustainability risk management, strategy integration, governance, or performance measurement
Exclusion criteria	• Studies without a sustainability component or with a primary focus on financial risk/performance • Sustainability component present, but no involvement of accounting functions in organizational risk management, strategic integration, or sustainability performance measurement • Technical AI or data-science papers with no accounting role • Not peer-reviewed (conference papers, book chapters, theses, notes, editorials) • Non-English publications • Retracted or duplicate articles (less complete version removed) • Literature reviews (to avoid duplication of synthesized evidence)

Table 2. Identification, screening, and selection summary

Stage	Description	Articles
Identification	Articles retrieved from the WoS database	398
Deduplication	Duplicates removed in RefWorks (title, author, year)	112
After deduplication	Unique studies advancing to the screening process	286
Stage 1: Title, abstract, and keywords screening	Excluded for lack/no direct relevance	159
	Marked as "*Maybe*" for full-text review	52
	Studies advancing to Stage 2	127
Stage 2: Full-text screening	Excluded after full-text assessment *(Reasons for exclusion are documented in Appendix B)*	30
Total	Final number of articles included in the review	97

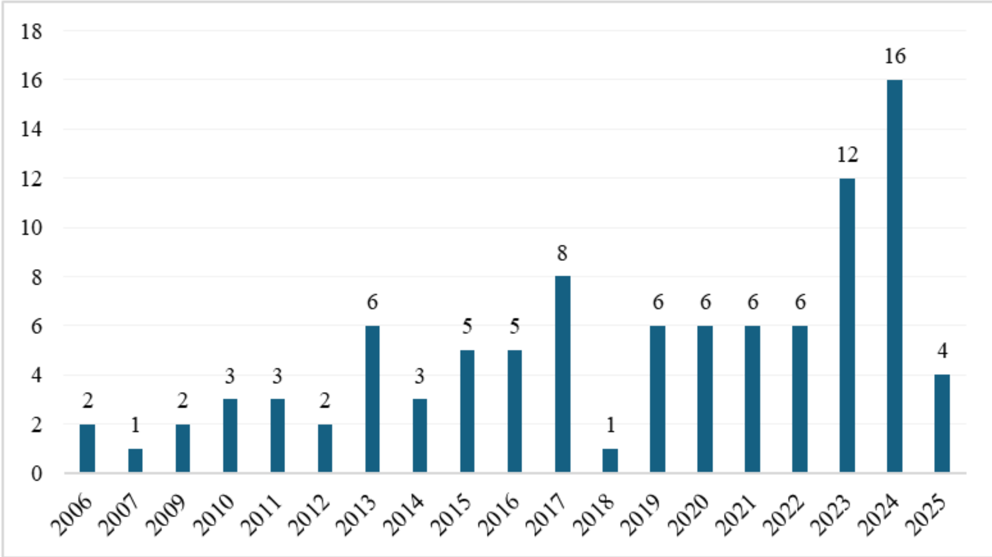

Figure 1. Distribution of published articles over the years

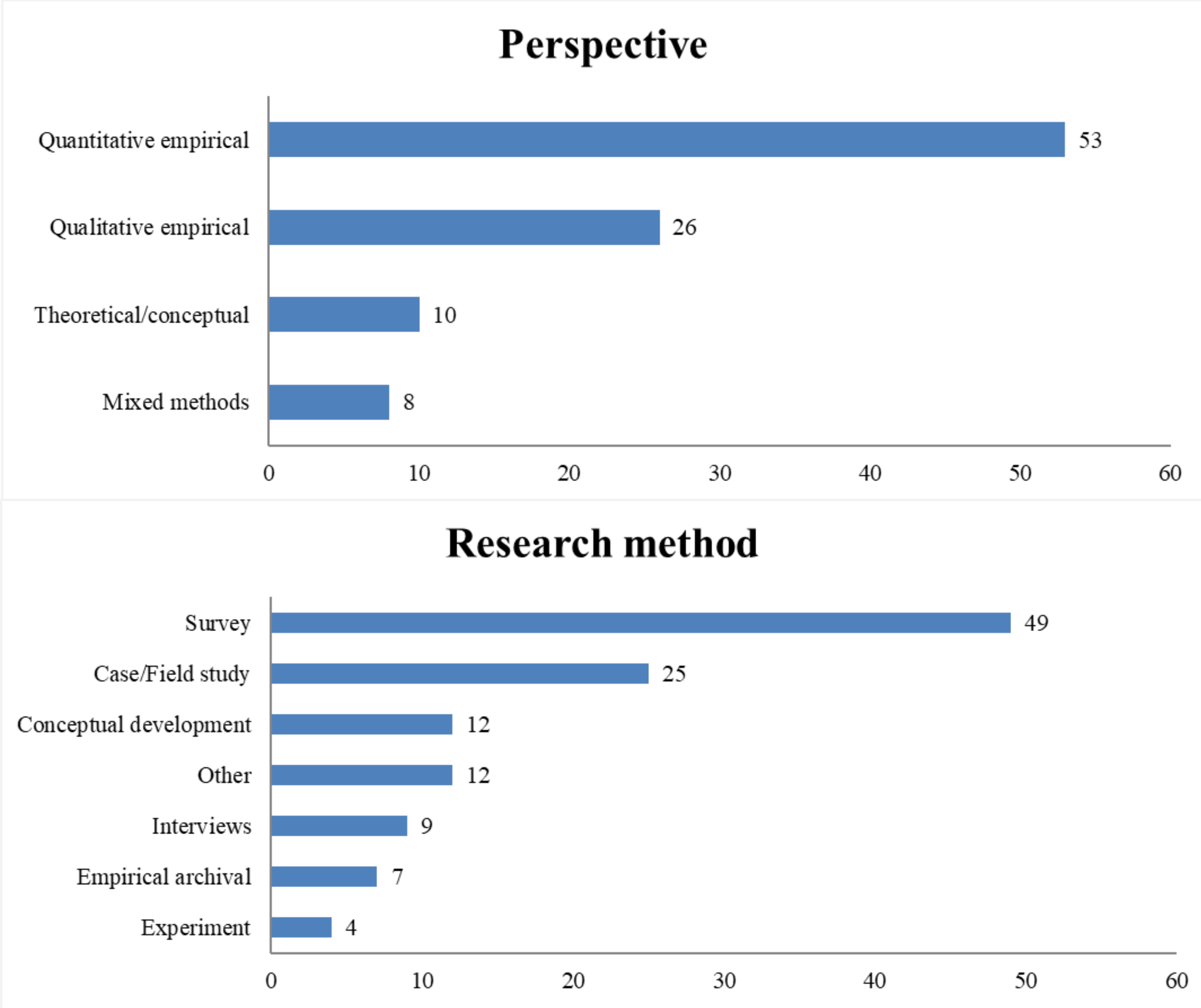

Figure 2. Perspective and research methods used in the review articles

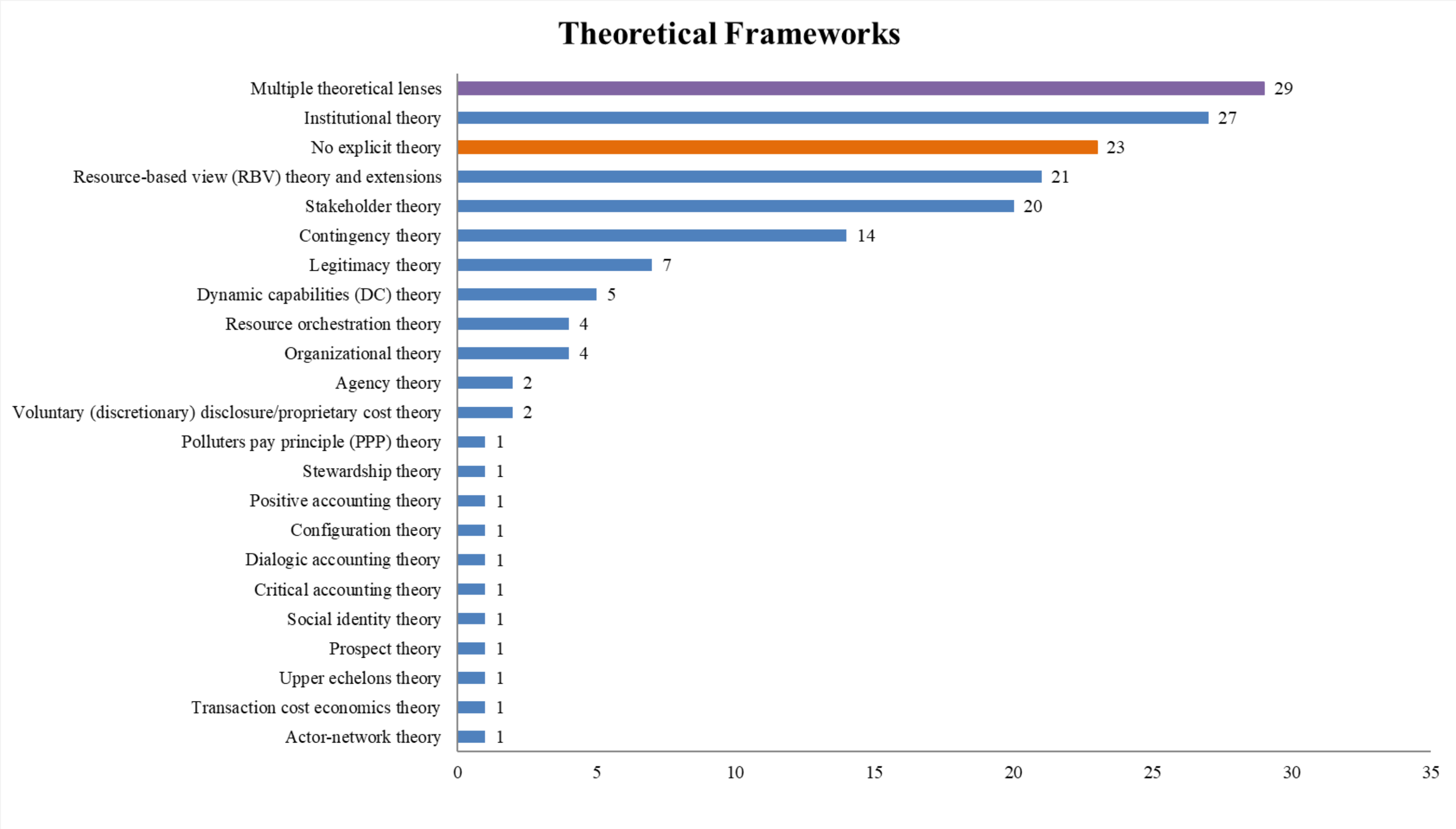

Figure 3. The frequency of theories in the review articles

APPENDIX A. SEARCH STRATEGY

	Review 1	**Review 2**	**Review 3**	**Review 4**
Keywords	TOPIC: ((("account*" NEAR/3 (profession* OR practitioner* OR role* OR auditor* OR management)) OR "management accountant*" OR "management accounting") AND (("account*" OR "management accounting" OR "management accountant*") NEAR/3 (role* OR function* OR responsibility OR practice* OR competenc* OR skill* OR capability OR capabilities OR upskilling OR reskilling)) AND ((ESG OR sustainab* OR "corporate sustainability" OR "environment*" OR “social”) NEAR/3 ("risk" OR "risk management" OR "enterprise risk management" OR ERM OR "risk assess*" OR "risk framework*" OR "risk governance" OR "strategic integration" OR "strategic planning" OR "strategy integration" OR "strategic alignment" OR (strateg* NEAR/3 risk*) OR "business model*" OR "core process*" OR "organizational integration" OR "organizational alignment" OR "management control" OR "management control system*" OR "management	TOPIC: ((("account*" NEAR/3 (profession* OR practitioner* OR role* OR auditor* OR management)) OR "management accountant*" OR "management accounting") AND ((ESG OR sustainab* OR "corporate sustainability" OR "environment*" or “social”) NEAR/3 ("risk" OR "risk management" OR "enterprise risk management" OR ERM OR "risk assess*" OR "risk framework*" OR "risk governance" OR "strategic integration" OR "strategic planning" OR "strategy integration" OR "strategic alignment" OR (strateg* NEAR/3 risk*) OR "business model*" OR "core process*" OR "organizational integration" OR "organizational alignment" OR "management control" OR "management control system*" OR "management system*" OR "performance" OR "performance management system*" OR "performance measure*" OR "performance measurement system*" OR KPI OR "key performance indicator*" OR metric*)))	TOPIC: ((("account*" NEAR/3 (profession* OR practitioner* OR role* OR auditor* OR management)) OR "management accountant*" OR "management accounting") AND (("climate" OR "climate-related" OR "climate change" OR "greenhouse gas*" OR GHG OR carbon OR "carbon emission*" OR "carbon footprint") NEAR/3 ("risk" OR "risk management" OR "enterprise risk management" OR ERM OR "risk assess*" OR "risk framework*" OR "risk governance" OR "strategic integration" OR "strategic planning" OR "strategy integration" OR "strategic alignment" OR (strateg* NEAR/3 risk*) OR "business model*" OR "core process*" OR "organizational integration" OR "organizational alignment" OR "management control" OR "management control system*" OR "management system*" OR "performance" OR "performance management system*" OR "performance measure*" OR "performance measurement system*" OR KPI OR "key performance indicator*" OR metric*)))	TOPIC: ((("account*" NEAR/3 (profession* OR practitioner* OR role* OR auditor* OR management)) OR "management accountant*" OR "management accounting") AND ("artificial intelligence" OR "AI" OR "machine learning" OR "deep learning" OR "big data" OR "data analytics" OR analytics* OR "data mining" OR "digitalization" OR "digital transformation" OR "smart technolog*" OR "predictive analytics" OR "decision support system*" OR "business intelligence" OR "business analytics" OR "data science" OR "Large Language Model*" OR LLM* OR "generative AI" OR "generative artificial intelligence" "natural language processing" OR NLP) AND ((ESG OR sustainab* OR "corporate sustainability" OR "environment*" or “social”) NEAR/3 ("risk" OR "risk management" OR "enterprise risk management" OR ERM OR "risk assess*" OR "risk framework*" OR "risk governance" OR "strategic integration" OR "strategic planning" OR "strategy integration"

	system*" OR "performance" OR "performance management system*" OR "performance measure*" OR "performance measurement system*" OR KPI OR "key performance indicator*" OR metric*)))			OR "strategic alignment" OR (strateg* NEAR/3 risk*) OR "business model*" OR "core process*" OR "organizational integration" OR "organizational alignment" OR "management control" OR "management control system*" OR "management system*" OR "performance" OR "performance management system*" OR "performance measure*" OR "performance measurement system*" OR KPI OR "key performance indicator*" OR metric*)))
Number of papers	90	273	22	13
Information source	WoS	WoS	WoS	WoS
Eligibility criteria	• ***Document type***: Peer-reviewed journal articles indexed in SSCI, SSCI (expanded), and ESCI. • ***Language:*** English • ***Time frame***: 2000–2024 • ***Subject areas:*** Business, Finance, Management, Accounting, and Economics.	• ***Document type***: Peer-reviewed journal articles indexed in SSCI, SSCI (expanded), and ESCI. • ***Language:*** English • ***Time frame***: 2000–2024 • ***Subject areas:*** Business, Finance, Management, Accounting, and Economics.	• ***Document type***: Peer-reviewed journal articles indexed in SSCI, SSCI (expanded), and ESCI. • ***Language:*** English • ***Time frame***: 2000–2024 • ***Subject areas:*** Business, Finance, Management, Accounting, and Economics.	• ***Document type***: Peer-reviewed journal articles indexed in SSCI, SSCI (expanded), and ESCI. • ***Language:*** English • ***Time frame***: 2000–2024 • ***Subject areas:*** Business, Finance, Management, Accounting, and Economics.
Date of search	September 10, 2025	September 10, 2025	September 10, 2025	September 10, 2025

APPENDIX B. ARTICLES EXCLUDED AT STAGE 2 (FULL-TEXT SCREENING)

Author/s (Year)	Article Title	Journal	Exclusion Code(s)
Handoyo & Anas (2024)	The effect of environmental, social, and governance (ESG) on firm performance: the moderating role of country regulatory quality and government effectiveness in ASEAN	Cogent Business & Management	E2
Hutchings & Deegan (2022)	The development and application of a decision-useful measure of environmental best practice for the mining industry	Accounting, Auditing & Accountability Journal	E2
Purnamasari & Umiyati (2024)	Greenwashing and financial performance of firms: the moderating role of internal audit quality and digital technologies	Cogent Business & Management	E2
Liew & Cao (2024)	Green supply chain management for carbon accountability	Energy Economics	E2
Sulaiman & Rahman (2013)	Does the environment matter? Empirical evidence from an institution of higher learning in Malaysia	International Journal of Business and Society	E2
Adler et al. (2022)	Accounting for waste management: a study of the reporting practices of the top listed Indian companies	Accounting and Finance	E2
Hales et al. (2016)	Becoming Sustainable: A Rational Decision Based on Sound Information and Effective Processes?	Journal of Management Accounting Research	E2
Ditkaew (2023)	Strategic Management Accounting on Competitive Advantage	International Journal of Asian Business and Information Management	E1
Oyewo et al. (2025)	Determinants and impact of strategy-driven manufacturing accounting techniques on	Journal of Accounting and Organizational Change	E1

	organisational competitiveness: a structural equation modelling approach		
Gebreiter (2022)	A profession in peril? University corporatization, performance measurement and the sustainability of accounting academia	Critical Perspectives on Accounting	E1, E2
San et al. (2015)	ISO 14001 certification and financial performance of companies	Asia-Pacific Management Accounting Journal	E2
Alshahrani et al. (2023)	Climate change performance and financial distress	Business Strategy and the Environment	E2
Alam & Kuppusamy (2024)	Organization management strategy for Generation Y performance sustainability	Cogent Business & Management	E1
Di Vaio et al. (2022)	Corporate social performance and non-financial reporting in the cruise industry: Paving the way towards UN Agenda 2030	Corporate Social Responsibility and Environmental Management	E2
Schulz et al. (2010)	Environmental Uncertainty, Comprehensive Performance Measurement Systems, Performance-Based Compensation, and Organizational Performance	Asia-Pacific Journal of Accounting & Economics	E1
Hermanson et al. (2012)	How Effective are Organizations' Internal Controls? Insights into Specific Internal Control Elements	Current Issues in Auditing	E1
Gaudy & Malsch (2023)	Auditors' search for meaningfulness in sustainability assurance work	Qualitative Research in Accounting and Management	E2

Amirul et al. (2023)	Synergizing Human Resources and Management Accounting in Managing Flexible Work Arrangement: A Balanced Scorecard Model	Asia-Pacific Management Accounting Journal	E1
Pham & Vu (2024)	Leveraging Accounting Professional Identity to Pave a Route Toward Sustainable Development with the Role of Inclusive Leadership	Review of Pacific Basin Financial Markets and Policies	E2
Abu Afifa & Saleh (2021)	Management accounting systems effectiveness, perceived environmental uncertainty and enterprise risk management: evidence from Jordan	Journal of Accounting and Organizational Change	E1
Milne & Gray (2013)	W(h)ither Ecology? The Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting	Journal of Business Ethics	E2
Luhtala et al. (2025)	Glocalizing sustainability: how accounting begins for sustainable development goals in city administration	Journal of Public Budgeting, Accounting & Financial Management	E2
Corvino et al. (2021)	Extinction accounting and accountability: Empirical evidence from the west European tissue industry	Business Strategy and the Environment	E2
Pedroso et al. (2020)	Management accounting systems: an organizational competitive performance perspective	Benchmarking: An International Journal	E1
Irwandi et al. (2020)	Can Environment Uncertainty Risk and Environment of Management Accounting System Affect Managerial Performance?	Quality-Access to success	E1

Kalash (2023)	Corporate sustainability performance in the emerging market of Turkey: the role of accounting information quality and firm risk	Journal of Economic and Administrative Sciences	E2
Giannarakis et al. (2017)	The Impact of Carbon Performance on Climate Change Disclosure	Business Strategy and the Environment	E2
Bisbe & Malagueño (2012)	Using strategic performance measurement systems for strategy formulation: Does it work in dynamic environments?	Management Accounting Research	E1
Brookfield (2018)	Risk and organizational effectiveness: The role of accounting systems as a managerial process	Journal of Organizational Effectiveness-People and Performance	E1
Maama & Gani (2022)	Carbon accounting, management quality, and bank performance in East Africa	Environmental Economics	E1, E2
Note. Exclusion codes (Stage 2: full-text screening): *E1*- Studies without a sustainability component or with a primary focus on financial risk/performance; *E2*- Sustainability component present but no involvement of accounting functions in organizational risk management, strategic integration, or sustainability performance measurement; *E3*- Technical AI or data-science papers with no accounting role.			

APPENDIX C. CODING PROTOCOL

Coding dimension	**Categories/Values**
Bibliographic information	Authors; Year; Journal
Perspective	Theoretical/conceptual (A1); Qualitative empirical (A2); Quantitative empirical (A3); Mixed methods (A4)
Research method	Conceptual development (B1); Empirical archival (B2); Case/Field study (B3); Interviews (B4); Survey (B5); Experiment (B6); Other (content analysis, model development…) (B7)
Theoretical framework	Institutional theory (C1); Contingency theory (C2); Dynamic capabilities (DC) theory (C3); Stakeholder theory (C4); Resource-based view (RBV) theory and extensions (C5); Resource orchestration theory (C6); Legitimacy theory (C7); Polluters pay principle (PPP) theory (C8); Agency theory (C9); Stewardship theory (C10); Voluntary (discretionary) disclosure/proprietary cost theory (C11); Organizational theory (C12); Positive accounting theory (C13); Configuration theory (C14); Dialogic accounting theory (C15); Critical accounting theory (CAT) (C16); Social identity theory (C17); Prospect theory (C18); Upper echelons theory (C19); Transaction cost economics theory (C20); Actor-network theory (C21); Multiple theoretical lenses (C22); No explicit theory (C23).
Role of accountants	Evolving roles, skills, and competencies (D1); Barriers, resistance, and capability gaps (D2); Accounting functions and level of involvement of accountants in sustainability risk management (D3).

Application areas	Environmental management accounting (EMA) (E1); Social management accounting (SMA) (E2); Management control systems (MCSs) (E3); No mentioned (E4).
Thematic scope	Waste/ resources (F1); material flows and composition (F2); carbon emissions (F3); water (F4); energy (F5); biodiversity/land (F6); deforestation (F7); modern slavery/human rights (F8); diversity/equality/inclusion (F9); health implications (toxicity, chemicals) (F10); employee well-being/health & safety (F11); broad interpretation/multiple environmental indicators (F12); broad interpretation/multiple social indicators (F13); climate (risk, adaptation, resilience) (F14).
Spatial scope	Organizational boundaries (G1); Beyond organizational boundaries (supply chain, ecosystems, planetary boundaries) (G2).
Emerging technologies	AI, IoT, big data, and other emerging digital technologies in accounting for sustainability risk management (H1); No mentioned (H2)

APPENDIX D. THEMATIC ANALYSIS

Dimension	Category	Freq.	%	Articles
Role of accountants	Evolving roles, skills, and competencies	29	29.90	Abdelhalim (2024); Alewine & Stone (2013); Asiaei & Bontis (2019); Asiaei et al. (2022a); Badroos (2024); Ballou et al. (2012); Brown et al. (2020); Bui & de Villiers (2017); Burritt et al. (2023); Christ et al. (2016); Christensen & Himme (2017); Dutta et al. (2013); Egbunike & Emudainohwo (2017); Ferreira et al. (2010); Gond et al. (2012); Gunarathne et al. (2021); Huy & Phuc (2024); Huy & Phuc (2025); Jusoh et al. (2023); Khodamipour et al. (2024); Linnenluecke et al. (2015); Mahmoudian et al. (2021); Nguyen (2022); Ratnatunga & Balachandran (2009); Ratnatunga et al. (2011); Riyath & Jariya (2024); Scarpellini et al. (2020a); Schaltegger & Zvezdov (2015); Schneider (2015)
	Barriers, resistance, and capability gaps	23	23.71	Albelda (2011); Aureli et al. (2025); Bresciani et al. (2023); Burritt et al. (2011); Burritt et al. (2023); Cadez & Guilding (2017); Deegan (2013); Doorasamy (2016); Elhossade et al. (2021); Jarvenpaa & Lansiluoto (2016); Kazemian et al. (2022); Khalid et al. (2022); Khodamipour et al. (2024); Kumarasiri (2015); Llena-Macarulla et al. (2023); McNally et al. (2017); Narayanan & Boyce (2019); Nguyen (2022); Qian et al. (2015); Schaefer (2007); Schaltegger & Zvezdov (2015); Scarpellini et al. (2020b); Yusoh et al. (2023)
	Accounting functions and level of involvement	73	75.26	Abobakr et al. (2023); Abobakr et al. (2024); Abu Afifa et al. (2024); Akankunda et al. (2024); Albelda (2011); Alnaim & Metwally (2024); Alsaid (2022); Appannan et al. (2023); Asiaei et al. (2021); Asiaei et al. (2022a); Asiaei et al. (2022b); Asiaei et al. (2023); Brown et al. (2020); Bui & de Villiers (2017); Bui et al. (2024); Burritt et al. (2011); Chan et al. (2014); Chaudhry & Amir (2020); Chetanraj et al. (2024); Christ (2014); Christensen & Himme (2017); de Beer & Friend (2006); Deb et al. (2023); Doorasamy (2016); Dutta et al. (2016); Echanove-Franco et al. (2024); Egbunike & Emudainohwo (2017); Einhorn et al. (2024); Elhossade et al. (2021); Ferdous et al. (2019); Figge & Hahn (2013); Fuzi et al. (2020); Gerged et al. (2024); Gomez-Conde et al. (2019); Gunarathne et al. (2021); Hasan et al. (2024); Henri & Journeault (2010); Henri et al. (2017); Hoai et al. (2023); Huy & Phuc (2025); Jarvenpaa & Lansiluoto (2016); Johnson et al. (2025); Jusoh et al. (2023); Kadir et al. (2025); Kazemian et al. (2022); Kumarasiri (2015); Kumarasiri & Gunasekarage (2017); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Latifah & Soewarno (2023); Lee & Wu (2014); Llena-Macarulla et al. (2023); Linnenluecke et al. (2015); Mahmoudian et al. (2021); Masanet-Llodra (2006); Naranjo Tuesta et al. (2021); Narayanan & Boyce (2019); Nartey (2018); Nkundabanyanga et al. (2021); Pumiviset & Suttipun (2024); Qian et al. (2015); Ratnatunga & Balachandran (2009); Riyath & Jariya (2024); Scarpellini et al. (2020b); Schaltegger & Zvezdov (2015); Solovida & Latan (2017); Spencer et al. (2013); Uyar (2020); Virtanen et al. (2013); Wang et al. (2019); Werastuti et al. (2023); Yusoh et al. (2023); Zhu et al. (2009)

Application areas	EMA	73	75.26	Abdelhalim (2024); Albelda (2011); Alewine & Stone (2013); Alnaim & Metwally (2024); Appannan et al. (2023); Asiaei & Bontis (2019); Asiaei et al. (2022a); Asiaei et al. (2022b); Aureli et al. (2025); Badroos (2024); Bresciani et al. (2023); Brown et al. (2020); Bui & de Villiers (2017); Bui et al. (2024); Burritt et al. (2011); Burritt et al. (2023); Cadez & Guilding (2017); Chan et al. (2014); Chaudhry & Amir (2020); Chetanraj et al. (2024); Christ (2014); Christ et al. (2016); Christensen & Himme (2017); de Beer & Friend (2006); Deb et al. (2023); Deegan (2013); Doorasamy (2016); Dutta et al. (2013); Dutta et al. (2016); Egbunike & Emudainohwo (2017); Elhossade et al. (2021); Ferdous et al. (2019); Ferreira et al. (2010); Figge & Hahn (2013); Fuzi et al. (2020); Gerged et al. (2024); Gomez-Conde et al. (2019); Gunarathne et al. (2021); Hasan et al. (2024); Henri & Journeault (2010); Henri et al. (2017); Hoai et al. (2023); Jarvenpaa & Lansiluoto (2016); Johnson et al. (2025); Kadir et al. (2025); Kazemian et al. (2022); Khodamipour et al. (2024); Kumarasiri (2017); Latifah & Soewarno (2023); Lee & Wu (2014); Linnenluecke et al. (2015); Llena-Macarulla et al. (2023); Mahmoudian et al. (2021); Masanet-Llodra (2006); Naranjo Tuesta et al. (2021); Nartey (2018); Nguyen (2022); Nkundabanyanga et al. (2021); Qian et al. (2015); Ratnatunga & Balachandran (2009); Ratnatunga et al. (2011); Riyath & Jariya (2024); Scarpellini et al. (2020a); Scarpellini et al. (2020b); Schaltegger & Zvezdov (2015); Schneider (2015); Solovida & Latan (2017); Spencer et al. (2013); Uyar (2020); Virtanen et al. (2013); Wang et al. (2019); Yusoh et al. (2023); Zhu et al. (2009)
	SMA	12	12.37	Abdelhalim (2024); Asiaei & Bontis (2019); Burritt et al. (2023); Deegan (2013); Dutta et al. (2013); Dutta et al. (2016); Echanove-Franco et al. (2024); Gunarathne et al. (2016); Khodamipour et al. (2024); Riyath & Jariya (2024); Schaltegger & Zvezdov (2015); Schneider (2015)
	MCSs	51	52.58	Abdelhalim (2024); Abobakr et al. (2023); Abobakr et al. (2024); Abu Afifa et al. (2024); Akankunda et al. (2024); Albelda (2011); Alewine & Stone (2013); Alsaid (2022); Asiaei & Bontis (2019); Asiaei et al. (2021); Asiaei et al. (2022a); Asiaei et al. (2023); Aureli et al. (2025); Badroos (2024); Ballou et al. (2012); Brown et al. (2020); Bui & de Villiers (2017); Burritt et al. (2011); Burritt et al. (2023); Christ et al. (2016); Dutta et al. (2013); Dutta et al. (2016); Egbunike & Emudainohwo (2017); Einhorn et al. (2024); Ferdous et al. (2019); Ferreira et al. (2010); Fuzi et al. (2020); Gomez-Conde et al. (2019); Gond et al. (2012); Gunarathne et al. (2016); Henri & Journeault (2010); Henri et al. (2017); Huy & Phuc (2024); Jarvenpaa & Lansiluoto (2016); Johnson et al. (2025); Jusoh et al. (2023); Kazemian et al. (2022); Khalid et al. (2022); Kumarasiri, & Gunasekarage (2017); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Lee & Wu (2014); Masanet-Llodra (2006); Narayanan & Boyce (2019); Pumiviset & Suttipun (2024); Scarpellini et al. (2020a); Schaefer (2007); Schaltegger & Zvezdov (2015); Schneider (2015); Virtanen et al. (2013); Werastuti et al. (2023)
	No mentioned	2	2.06	Huy & Phuc (2025); McNally et al. (2017)

Thematic scope	Waste/resources	35	36.08	Abdelhalim (2024); Abobakr et al. (2023); Abobakr et al. (2024); Albelda (2011); Alnaim & Metwally (2024); Appannan et al. (2023); Asiaei et al. (2023); Aureli et al. (2025); Badroos (2024); Chan et al. (2014); Chaudhry & Amir (2020); de Beer & Friend (2006); Doorasamy (2016); Gomez-Conde et al. (2019); Gunarathne et al. (2016); Henri & Journeault (2010); Jarvenpaa & Lansiluoto (2016); Kadir et al. (2025); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Latifah & Soewarno (2023); Lee & Wu (2014); Llena-Macarulla et al. (2023); Masanet-Llodra (2006); Narayanan & Boyce (2019); Nguyen (2022); Nkundabanyanga et al. (2021); Pumiviset & Suttipun (2024); Qian et al. (2015); Scarpellini et al. (2020a); Scarpellini et al. (2020b); Solovida & Latan (2017); Uyar (2020); Wang et al. (2019); Werastuti et al. (2023)
	Material flows/composition	20	20.62	Abdelhalim (2024); Abobakr et al. (2024); Alnaim & Metwally (2024); Appannan et al. (2023); Asiaei et al. (2023); Aureli et al. (2025); Badroos (2024); Bresciani et al. (2023); Chan et al. (2014); Chaudhry & Amir (2020); Henri & Journeault (2010); Llena-Macarulla et al. (2023); Nguyen (2022); Qian et al. (2015); Scarpellini et al. (2020a); Scarpellini et al. (2020b); Solovida & Latan (2017); Uyar (2020); Wang et al. (2019); Zhu et al. (2009)
	Carbon emissions	44	45.36	Abobakr et al. (2023); Abobakr et al. (2024); Albelda (2011); Alewine & Stone (2013); Alnaim & Metwally (2024); Appannan et al. (2023); Asiaei et al. (2023); Aureli et al. (2025); Badroos (2024); Bresciani et al. (2023); Bui & de Villiers (2017); Bui et al. (2024); Burritt et al. (2011); Cadez & Guilding (2017); Chan et al. (2014); Chaudhry & Amir (2020); Christ et al. (2016); de Beer & Friend (2006); Egbunike & Emudainohwo (2017); Figge & Hahn (2013); Gomez-Conde et al. (2019); Gunarathne et al. (2021); Hasan et al. (2024); Hoai et al. (2023); Johnson et al. (2025); Kazemian et al. (2022); Kumarasiri (2015); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Lee & Wu (2014); Mahmoudian et al. (2021); Masanet-Llodra (2006); Naranjo Tuesta et al. (2021); Nartey (2018); Nguyen (2022); Nkundabanyanga et al. (2021); Qian et al. (2015); Pumiviset & Suttipun (2024); Ratnatunga & Balachandran (2009); Ratnatunga et al. (2011); Solovida & Latan (2017); Uyar (2020); Wang et al. (2019); Werastuti et al. (2023)
	Water	24	24.74	Abdelhalim (2024); Albelda (2011); Alnaim & Metwally (2024); Badroos (2024); Chan et al. (2014); Chaudhry & Amir (2020); Christ (2014); Christ et al. (2016); de Beer & Friend (2006); Ferdous et al. (2019); Gomez-Conde et al. (2019); Gunarathne et al. (2021); Jarvenpaa & Lansiluoto (2016); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Narayanan & Boyce (2019); Nguyen (2022); Nkundabanyanga et al. (2021); Pumiviset & Suttipun (2024); Qian et al. (2015); Solovida & Latan (2017); Schaefer (2007); Wang et al. (2019); Werastuti et al. (2023)
	Energy	31	31.96	Abobakr et al. (2023); Albelda (2011); Alsaid (2022); Appannan et al. (2023); Asiaei et al. (2023); Badroos (2024); Bresciani et al. (2023); Brown et al. (2020); Bui & de Villiers (2017); Burritt et al. (2011); Chan et al. (2014); Chaudhry & Amir (2020); Christensen & Himme (2017); Deb et al.

				(2023); Gomez-Conde et al. (2019); Hasan et al. (2024); Jarvenpaa & Lansiluoto (2016); Kumarasiri (2015); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Lee & Wu (2014); Llena-Macarulla et al. (2023); Masanet-Llodra (2006); Narayanan & Boyce (2019); Nguyen (2022); Qian et al. (2015); Scarpellini et al. (2020a); Solovida & Latan (2017); Uyar (2020); Virtanen et al. (2013); Wang et al. (2019)
	Biodiversity/land	8	8.25	Abdelhalim (2024); Asiaei et al. (2023); Chan et al. (2014); de Beer & Friend (2006); Gunarathne et al. (2021); Huy & Phuc (2025); Lamboglia et al. (2019); Nkundabanyanga et al. (2021)
	Deforestation	0	0	-
	Human rights	1	1.03	Abdelhalim (2024)
	Diversity	3	3.09	Abdelhalim (2024); Asiaei et al. (2023); Narayanan & Boyce (2019)
	Health	3	3.09	Abdelhalim (2024); Huy & Phuc (2025); Werastuti et al. (2023)
	Employee well-being	9	9.28	Abobakr et al. (2023); Abobakr et al. (2024); Asiaei et al. (2023); Gunarathne et al. (2016); Huy & Phuc (2025); Kadir et al. (2025); Narayanan & Boyce (2019); Pumiviset & Suttipun (2024); Uyar (2020)
	Multiple environmental indicators	64	65.98	Abdelhalim (2024); Abobakr et al. (2023); Abobakr et al. (2024); Abu Afifa et al. (2024); Akankunda et al. (2024); Albelda (2011); Alewine & Stone (2013); Alnaim & Metwally (2024); Appannan et al. (2023); Asiaei & Bontis (2019); Asiaei et al. (2021); Asiaei et al. (2022a); Asiaei et al. (2022b); Asiaei et al. (2023); Ballou et al. (2012); Bresciani et al. (2023); Burritt et al. (2023); Chan et al. (2014); Chaudhry & Amir (2020); Chetanraj et al. (2024); de Beer & Friend (2006); Deb et al. (2023); Deegan (2013); Dutta et al. (2013); Dutta et al. (2016); Einhorn et al. (2024); Elhossade et al. (2021); Ferreira et al. (2010); Fuzi et al. (2020); Gerged et al. (2024); Gomez-Conde et al. (2019); Gond et al. (2012); Gunarathne et al. (2021); Hasan et al. (2024); Henri & Journeault (2010); Henri et al. (2017); Hoai et al. (2023); Huy & Phuc (2024); Huy & Phuc (2025); Jarvenpaa & Lansiluoto (2016); Jusoh et al. (2023); Kadir et al. (2025); Khalid et al. (2022); Khodamipour et al. (2024); Lamboglia et al. (2019); Lansiluoto & Jarvenpaa (2010); Lee & Wu (2014); Llena-Macarulla et al. (2023); Masanet-Llodra (2006); McNally et al. (2017); Narayanan & Boyce (2019); Nguyen (2022); Nkundabanyanga et al. (2021); Pumiviset & Suttipun (2024); Qian et al. (2015); Schaefer (2007); Schaltegger & Zvezdov (2015); Schneider (2015); Spencer et al. (2013); Solovida & Latan (2017); Uyar (2020); Yusoh et al. (2023); Wang et al. (2019); Werastuti et al. (2023)
	Multiple social indicators	26	26.80	Abdelhalim (2024); Abu Afifa et al. (2024); Abobakr et al. (2023); Abobakr et al. (2024); Akankunda et al. (2024); Asiaei & Bontis (2019); Asiaei et al. (2021); Asiaei et al. (2023); Ballou et al. (2012); Burritt et al. (2023); Deegan (2013); Dutta et al. (2013); Dutta et al. (2016); Echanove-Franco et al. (2024); Gond et al. (2012); Huy & Phuc (2024); Huy & Phuc (2025); Jusoh et al. (2023); Kadir et al.

				(2025); Khodamipour et al. (2024); McNally et al. (2017); Narayanan & Boyce (2019); Schaltegger & Zvezdov (2015); Schneider (2015); Uyar (2020); Werastuti et al. (2023)
	Climate (risk, resilience, adaptation)	20	20.62	Abdelhalim (2024); Bui & de Villiers (2017); Bui et al. (2024); Burritt et al. (2011); Burritt et al. (2023); Cadez & Guilding (2017); Deegan (2013); Egbunike & Emudainohwo (2017); Figge & Hahn (2013); Huy & Phuc (2025); Johnson et al. (2025); Kazemian et al. (2022); Kumarasiri (2015); Kumarasiri & Gunasekarage (2017); Linnenluecke et al. (2015); Mahmoudian et al. (2021); Nartey (2018); Ratnatunga & Balachandran (2009); Ratnatunga et al. (2011); Riyath & Jariya (2024)
Spatial scope	Beyond organizational boundaries	10	10.31	Alsaid (2022); Aureli et al. (2025); Bui & de Villiers (2017); Burritt et al. (2023); Chan et al. (2014); Christ (2014); Christ et al. (2016); Johnson et al. (2025); Lee & Wu (2014); Mahmoudian et al. (2021)
Emerging digital technologies	Mentioned	8	8.25	Abdelhalim (2024); Alsaid (2022); Badroos (2024); Brown et al. (2020); Burritt et al. (2023); Huy & Phuc (2024); Johnson et al. (2025); Riyath & Jariya (2024)
Note. Since many studies are classified into several categories of each thematic dimension, the total papers per dimension may not match the total reviewed studies.				