

ACCOUNTING DIGITAL TRANSFORMATION TOWARDS SUSTAINABLE DEVELOPMENT: A TECHNOLOGY - ORGANISATION - ENVIRONMENT FRAMEWORK FOR VIETNAMESE ENTERPRISES

Nguyen Thi Van Chi¹, Nguyen Phuong Thao²

Thai Nguyen College of Economics and Techniques, Vietnam

ABSTRACT

Corporate accounting systems in emerging economies are being asked to do something they were not designed for: to supply decision-useful, verifiable information on environmental, social and governance (ESG) matters alongside conventional financial data. This conceptual paper examines how digital technologies can move Vietnamese enterprises from digitised bookkeeping towards what we term a sustainability-ready accounting information system. Drawing on an integrative review of the accounting, information systems and sustainability reporting literature and on an analysis of Vietnamese regulatory texts in force in 2026, the paper makes three contributions. First, it proposes a five-stage data-to-disclosure chain (capture, integrate, control, analyse, disclose and assure) that locates the specific contribution of e-invoicing, enterprise resource planning, cloud platforms, the Internet of Things, analytics and artificial intelligence. Second, it uses the Technology – Organisation - Environment (TOE) framework to explain why adoption in Vietnam remains concentrated in transaction processing while ESG data stay fragmented, manually compiled and rarely assured. Third, it sets out a four-level maturity model and a differentiated agenda for enterprises, regulators and accounting educators. The analysis suggests that the binding constraint is not the availability of technology but the absence of data governance that treats ESG metrics with the same discipline as financial records. The framework offers a basis for empirical testing and for staged, resource-sensitive implementation by Vietnamese firms, particularly small and medium-sized enterprises.

Keyword: Accounting information systems, Digital transformation, ESG reporting, Technology - Organisation - Environment framework, Vietnam

1. INTRODUCTION

Over the past decade the question facing accountants has shifted from whether to digitise to what digitisation is for. Early waves of automation replaced paper vouchers and manual ledgers; later waves connected the finance function to procurement, inventory and payroll through enterprise resource planning (ERP) systems and, more recently, to cloud services, analytics and artificial intelligence (AI) (Bhimani & Willcocks, 2014; Moll & Yigitbasioglu, 2019). A parallel and initially separate debate concerned the capacity of accounting to represent organisational impacts on the environment and society (Gray, 2010; Schaltegger & Burritt, 2010). These two debates are now converging. The issuance by the International Sustainability Standards Board (ISSB) of IFRS S1 and IFRS S2 in

June 2023, effective for annual periods beginning on or after 1 January 2024, positions sustainability-related information as part of general-purpose financial reporting and therefore as something that should be produced with comparable rigour (IFRS Foundation, 2023a, 2023b).

For accounting information systems this convergence creates a practical problem. Financial transactions arrive already structured, double-checked and supported by documents; most ESG data do not. Energy readings sit in meters, emissions in engineering spreadsheets, safety incidents in human-resource files and supplier information in procurement e-mails. Mandatory sustainability reporting regimes have consequently been shown to depend heavily on the quality of the underlying measurement and

control systems (Christensen et al., 2021). Digital technologies promise to bridge this gap, yet the literature warns that digitisation can as easily reproduce fragmentation and create new opacity as it can resolve them (Al-Htaybat & von Alberti-Alhtaybat, 2017; Quattrone, 2016).

Vietnam is an instructive setting. The country has pursued an explicit national digital transformation agenda since Decision No. 749/QĐ-TTg of 3 June 2020, reinforced by Politburo Resolution No. 57-NQ/TW of 22 December 2024 on breakthroughs in science, technology, innovation and national digital transformation. At the same time, its climate commitments have been translated into binding obligations: greenhouse-gas (GHG) inventories for listed facilities under Decree No. 06/2022/NĐ-CP, as amended by Decree No. 119/2025/NĐ-CP, and an updated list of 2,441 facilities required to conduct inventories under Decision No. 42/2026/QĐ-TTg, effective 25 September 2026 (Ministry of Agriculture and Environment, 2026). Listed companies have reported environmental and social information under securities disclosure rules since 2015, but this reporting has remained largely qualitative and rarely externally assured (Håbek & Bui, 2025).

Existing Vietnamese commentary on digital accounting and sustainability tends to list technologies and their benefits. What is less developed is an explanation of where in the information chain each technology adds value, why adoption stalls at particular points, and how firms with very different resources can progress. This paper addresses these gaps by asking two questions: (RQ1) Through which stages of the accounting information chain can digital technologies make ESG information decision-useful and verifiable? (RQ2) Which technological, organisational and environmental conditions explain the current state of adoption among Vietnamese enterprises, and what staged pathway follows from them?

The remainder of the paper is organised as follows. Section 2 describes the approach. Section 3 reviews the relevant theoretical foundations. Section 4 develops the data-to-disclosure framework. Section 5 analyses the Vietnamese context through the TOE lens. Section 6 proposes a maturity model and an implementation agenda, and Section 7 concludes with limitations and directions for empirical research.

2. APPROACH

The paper is conceptual. It combines an integrative literature review with a document analysis of regulation. The integrative review drew on peer-reviewed work in accounting, accounting information systems and sustainability accounting, prioritising widely cited reviews and agenda-setting papers (e.g., Knudsen, 2020; Lodhia et al., 2025; Moll & Yigitbasioglu, 2019) and recent empirical evidence from Vietnam (Håbek & Bui, 2025; Nguyen et al., 2024). Because the aim was theory building rather than effect estimation, no quantitative synthesis was attempted. The regulatory analysis covered Vietnamese legal instruments governing accounting records, electronic invoices, securities disclosure, GHG inventory and personal data, together with the international standards most likely to shape Vietnamese practice (IFRS S1/S2, the GRI Standards and the GHG Protocol). For each instrument the issue date, effective date and status as at October 2026 were checked against official or authoritative legal databases, since several key texts were amended or replaced during 2025–2026. Insights from both strands were organised using the Technology - Organisation - Environment (TOE) framework (Tornatzky & Fleischer, 1990), which is well suited to explaining firm-level adoption of complex information technologies.

3. THEORETICAL FOUNDATIONS

3.1. Digitalisation and the changing nature of accounting information

Research on digital accounting has moved through three broad emphases. The first treated technology as a means of efficiency, reducing the cost of recording and reporting transactions. The second highlighted that large, heterogeneous and fast-moving data sets alter what counts as accounting information: Bhimani and Willcocks (2014) argued that digitisation blurs the boundary between financial and non-financial data, while Vasarhelyi et al. (2015) showed how big data could supplement traditional audit evidence and enable continuous monitoring. The third emphasis concerns the reconfiguration of accounting work and expertise. Moll and Yigitbasioglu (2019) traced how cloud, big data, blockchain and AI redistribute tasks between accountants and machines, and Knudsen (2020) documented the shifting boundaries, power relations and modes of

knowledge production that digitalisation brings to the profession.

Specific technologies have attracted dedicated scrutiny. Distributed ledgers have been proposed as a basis for real-time, tamper-evident accounting and assurance (Dai & Vasarhelyi, 2017), and AI-based tools are already altering audit procedures (Kokina & Davenport, 2017). At the reporting end, the move from documents to machine-readable data (digital tagging, structured reporting) changes how information is consumed and compared (Troshani & Rowbottom, 2021). A recurring caution is that more data are not automatically better information: Quattrone (2016) questioned whether digital management accounting makes organisations wiser, and Al-Htaybat and von Alberti-Alhtaybat (2017) identified paradoxes of big data in corporate reporting, including information overload and the illusion of objectivity.

3.2. Sustainability accounting and the demand for reliable ESG data

Sustainability accounting seeks to make visible the interactions between an organisation and the natural and social systems on which it depends. Schaltegger and Burritt (2010) framed it as decision support for managers rather than a reporting exercise alone, whereas Gray (2010) warned that much of what is labelled sustainability accounting reports on the organisation rather than on sustainability itself. Later work connected the field to the Sustainable Development Goals (SDGs) adopted by the United Nations (2015), arguing that accounting research and practice can enable SDG progress by measuring externalities and shaping incentives (Bebbington & Unerman, 2018; Unerman et al., 2018).

The standard-setting landscape has since consolidated. The GRI Standards remain the most widely used impact-oriented framework (Global Reporting Initiative, 2021); IFRS S1 and S2 provide an investor-oriented baseline built on governance, strategy, risk management, and metrics and targets (IFRS Foundation, 2023a, 2023b); and the European Union's Corporate Sustainability Reporting Directive extends mandatory reporting and assurance to a broad population of companies and to their value chains (European Parliament & Council of the European Union, 2022). Measurement of GHG emissions, the

most quantified ESG domain, rests on the scope 1–2–3 logic of the GHG Protocol (World Resources Institute & World Business Council for Sustainable Development, 2004). Each of these frameworks presupposes data that are complete, consistent over time, traceable to source and capable of assurance qualities that financial accounting systems have long been engineered to deliver for monetary transactions.

3.3. Linking the two streams: digital technologies as infrastructure for sustainability accounting

Burritt and Christ (2016) were among the first to suggest that Industry 4.0 technologies could revolutionise environmental accounting by providing granular, real-time physical data at the level of processes and products. Lodhia et al. (2025) offer the most comprehensive recent synthesis, mapping how digital technologies can support each step of sustainability accounting, reporting and assurance, from boundary-setting and materiality assessment to data collection, analysis and dissemination. Two implications follow for this paper. First, technology contributes differently at different stages, so frameworks should be stage-specific rather than technology-specific. Second, the stage at which value is realised (decisions, disclosure, assurance) depends on organisational arrangements for data ownership and control, which technology alone cannot supply.

3.4. The Technology - Organisation - Environment framework

The TOE framework explains firm-level adoption of technological innovations through three interacting contexts (Tornatzky & Fleischer, 1990). The technological context covers the characteristics and availability of technologies relative to existing systems. The organisational context covers size, structure, resources, managerial support and human capital. The environmental context covers industry structure, regulation, competitors, customers and the availability of technology providers. Digital transformation research adds that technology triggers strategic responses whose value depends on structural and cultural change (Vial, 2019). The TOE framework is therefore used here not to predict adoption probabilities but to organise the conditions under which a sustainability-ready accounting system can emerge.

4. A DATA-TO-DISCLOSURE FRAMEWORK FOR SUSTAINABILITY-READY ACCOUNTING

We define a sustainability-ready accounting information system as an accounting information system that captures, integrates, controls, analyses and discloses selected ESG data with the same traceability and internal control discipline applied to financial records, and that links those data to the monetary consequences that matter for

decisions. Figure 1 summarises the framework. The upper tier contains the TOE conditions that enable or constrain adoption; the middle tier is a five-stage chain through which data become disclosures; the lower tier distinguishes internal, external and societal value. A feedback loop recognises that disclosure gaps and assurance findings should reshape upstream data capture and controls.

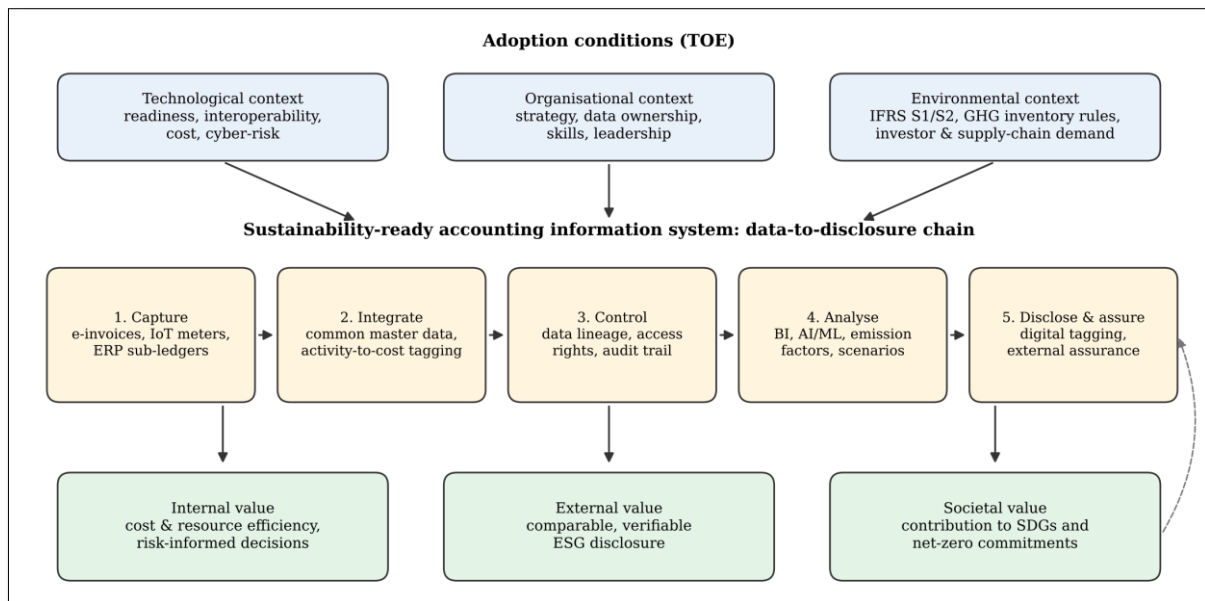


Figure 1. Conceptual framework: TOE conditions, the data-to-disclosure chain and value outcomes

(Source: Authors' proposal)

Table 1 relates each stage to its information objective, the technologies that can serve it and the typical failure points observed in practice. Three features of the chain deserve emphasis. First, integration (stage 2) is where financial and ESG data acquire a shared identity: an electricity invoice captured as an e-invoice becomes simultaneously a cost entry and an energy-

consumption datum when both are tagged to the same cost centre, asset and period. Without such tagging, later analysis must reconcile figures after the fact. Second, control (stage 3) is the stage most frequently neglected. ESG metrics often bypass the segregation of duties, authorisation and change-logging that surround journal entries, which is why internal verification remains the norm and external assurance the exception (Håbek & Bui, 2025). Third, analysis (stage 4) is where AI and analytics add value, but only on top of reliable stages 1- 3; applying advanced tools to unreconciled data amplifies rather than reduces error (Al-Htaybat & von Alberti-Alhtaybat, 2017).

Table 1. Stages of the data-to-disclosure chain, enabling technologies and typical failure points

Stage	Information objective	Enabling technologies	Typical failure points
1. Capture	Record financial and physical/social data once, at source, in structured form	E-invoices and e-vouchers; ERP sub-ledgers; IoT meters and sensors; HR and safety systems	ESG data kept in spreadsheets; no physical quantity attached to financial transactions

Stage	Information objective	Enabling technologies	Typical failure points
2. Integrate	Give financial and ESG records a shared identity (entity, site, asset, period, activity)	Common master data; chart-of-accounts dimensions; ERP and cloud platforms; data warehouses	Inconsistent boundaries between finance and operations; manual year-end reconciliation
3. Control	Ensure completeness, accuracy, traceability and authorisation	Role-based access; workflow approvals; audit trails and change logs; distributed ledgers where justified	ESG metrics outside internal control; no data owner; untraceable adjustments
4. Analyse	Convert data into decision-relevant indicators, costs and scenarios	Business intelligence; AI/ML for anomaly detection and forecasting; emission-factor libraries	Advanced tools applied to unreconciled data; opaque models without human review
5. Disclose & assure	Produce comparable, verifiable disclosures and obtain assurance	Reporting platforms; digital tagging; continuous auditing tools	Narrative-only reporting; internal verification only; inconsistency across regulatory reports

(Source: Authors' synthesis)

5. THE VIETNAMESE CONTEXT THROUGH THE TOE LENS

5.1. Environmental context: a fast-moving regulatory perimeter

Table 2 summarises the instruments that most directly shape the information demands on Vietnamese accounting systems. Three observations stand out. First, the legal infrastructure for digital accounting is comparatively mature: the Law on Accounting has recognised electronic vouchers and electronic ledgers since 2017 (consolidated text No. 25/VBHN-VPQH of 2025), and electronic invoicing has been mandatory for several years, now

governed by Decree No. 254/2026/NĐ-CP, which replaced Decree No. 123/2020/NĐ-CP from 1 July 2026. Second, the legal infrastructure for sustainability information is developing on two separate tracks securities disclosure administered by the Ministry of Finance and GHG inventory administered by the environmental authority with no common data model linking them. Third, the regime is in motion: the IFRS adoption roadmap under Decision No. 345/QĐ-BTC moved from a voluntary phase (2022–2025) to a planned mandatory phase, and in October 2026 the Ministry of Finance was consulting on a replacement for Circular No. 96/2020/TT-BTC that would introduce a dedicated ESG disclosure annex and a comply-or-explain requirement for undisclosed indicators (Mai, 2026).

Table 2. Vietnamese and international instruments shaping the information demands on accounting systems (status as at October 2026)

Instrument	Date / effect	Relevance for a sustainability-ready accounting system
Law on Accounting No. 88/2015/QH13 (consolidated text No. 25/VBHN-VPQH, 2025)	Effective 01/01/2017; amended by Laws No.	Legal validity of electronic vouchers and ledgers; requirements for integrity, storage and correction of electronic records

Instrument	Date / effect	Relevance for a sustainability-ready accounting system
	38/2019/QH14 and 56/2024/QH15	
Decree No. 254/2026/NĐ-CP on e-invoices and e-documents	Issued 30/06/2026; effective 01/07/2026 (replaces Decree No. 123/2020/NĐ-CP as amended by Decree No. 70/2025/NĐ-CP)	Structured capture of purchase and sales data that can be tagged with physical quantities (energy, fuel, materials)
Circular No. 96/2020/TT-BTC on information disclosure on the securities market	Effective 01/01/2021; partly amended in 2026; replacement draft under consultation	Environmental and social information in annual reports of listed companies; draft adds an ESG annex and comply-or-explain
Decision No. 345/QĐ-BTC approving the IFRS application scheme	16/03/2020	Voluntary (2022–2025) then mandatory IFRS phases; foundation for later adoption of IFRS S1/S2-type requirements
Decree No. 06/2022/NĐ-CP on GHG mitigation and ozone layer protection, amended by Decree No. 119/2025/NĐ-CP	Decree 119 issued 09/06/2025; effective 01/08/2025	Facility GHG inventories, emission quotas and a domestic carbon market; activity data overlap with cost data
Decision No. 42/2026/QĐ-TTg on sectors and facilities subject to GHG inventory	Effective 25/09/2026 (updates the 2024 list)	2,441 facilities in six sectors must compile GHG inventories
Law on Personal Data Protection No. 91/2025/QH15	Passed 26/06/2025; effective 01/01/2026	Governs processing of workforce data used in social metrics
Decision No. 749/QĐ-TTg; Resolution No. 57-NQ/TW; Decision No. 1658/QĐ-TTg	03/06/2020; 22/12/2024; 01/10/2021	National digital transformation and green growth orientation (GHG intensity per unit of GDP at least 15% lower than 2014 by 2030)

Instrument	Date / effect	Relevance for a sustainability-ready accounting system
IFRS S1 and IFRS S2 (ISSB)	Issued June 2023; effective for periods from 01/01/2024	Investor-oriented baseline: governance, strategy, risk management, metrics and targets; connectivity with financial statements
GRI Standards; GHG Protocol Corporate Standard	2021 Universal Standards; revised edition 2004	Impact-oriented disclosures; scope 1–2–3 emission accounting

(Source: Authors' compilation)

For accounting systems, this environment generates demand signals that are strong but not yet coherent. A manufacturing firm on the GHG inventory list must produce facility-level activity data and emission estimates for the environmental authority; if it is also listed, it must report environmental and social information to investors; and if it exports to the European Union, it may be asked by customers for product- or supplier-level data aligned with European requirements. Unless these demands are met from a single, controlled data source, the same firm will maintain three partially inconsistent versions of its environmental performance.

5.2. Technological context: strong transaction digitisation, weak ESG integration

At the transaction level, digitisation in Vietnam is extensive. Nationwide e-invoicing, digital signatures and the widespread use of packaged accounting software mean that most financial source data are already captured electronically. Larger enterprises additionally run ERP systems that connect accounting with purchasing, inventory, production and payroll. However, the systems that hold physical and social data metering, production control, human-resource and safety records are rarely integrated with the general ledger. In the terms of Figure 1, Vietnamese firms are typically strong at stage 1 for financial data, weak at stage 1 for ESG data, and weakest at stages 2–3. Cyber-security and personal-data obligations add to the technological

burden: the Law on Personal Data Protection (No. 91/2025/QH15), effective 1 January 2026, applies to workforce data that feed the social dimension of ESG reporting.

5.3. Organisational context: skills, ownership and leadership

Empirical evidence points to organisational factors as decisive. In a survey of 169 Vietnamese enterprises analysed with partial least squares structural equation modelling, Nguyen et al. (2024) found that accountants' qualifications, management processes, the presence of women on management boards and information technology systems positively affected readiness for ESG reporting, whereas executives' ESG awareness, media pressure and government guidelines showed no statistically supported effect. This pattern is consistent with the international literature on the changing competences of accountants (Moll & Yigitbasioglu, 2019; Knudsen, 2020) and suggests that readiness is built inside the organisation rather than imposed from outside. A further organisational obstacle is data ownership: ESG metrics are produced by engineering, environment, human-resource and procurement units that do not follow accounting control routines, and no single function is accountable for their end-to-end reliability.

5.4. Outcomes so far: disclosure is growing but remains shallow

The cumulative effect of these conditions is visible in disclosure practice. Analysing 673 companies

listed on the Hanoi and Ho Chi Minh City exchanges over 2015–2024, Hąbek and Bui (2025) found that ESG disclosure expanded after the 2015 and 2020 securities disclosure circulars, that GRI and the SDGs were the most frequently used reference frameworks, and that the share of reports using quantitative methods rose from 5.6% to 27.5% while qualitative reporting fell

from 94.4% to 72.5%. Most reports, however, were verified only internally, and third-party assurance remained limited. Read through the framework in Figure 1, this is the signature of a system in which stage 5 (disclosure) has advanced ahead of stages 2–3 (integration and control). Table 3 consolidates the TOE analysis.

Table 3. TOE conditions for sustainability-ready accounting in Vietnamese enterprises

Context	Enablers	Constraints
Technological	Nationwide e-invoicing and digital signatures; affordable cloud accounting; maturing ERP market	Siloed operational systems; limited interoperability with metering and HR data; cyber-security and personal-data compliance costs
Organisational	Qualified accountants and structured management processes associated with ESG readiness (Nguyen et al., 2024); existing internal-control culture for financial data	No end-to-end owner of ESG data; skills gaps in data analytics and sustainability measurement; budget priority for revenue-facing systems, especially in SMEs
Environmental	GHG inventory and carbon-market obligations; IFRS roadmap; investor and export-customer demand; national digital transformation policy	Two regulatory tracks without a common data model; evolving rules; limited availability of ESG assurance providers and of a national ESG taxonomy

(Source: Authors' analysis)

6. A MATURITY PATHWAY AND IMPLEMENTATION AGENDA

6.1. A four-level maturity model

Because Vietnamese enterprises differ greatly in size, sector and exposure to regulation, a single prescription is unhelpful. Table 4 proposes four maturity levels that firms can use for self-

diagnosis and sequencing. The model is cumulative: each level presupposes the controls of the previous one, and progression is defined by data discipline rather than by the sophistication of the tools deployed. Most small and medium-sized enterprises (SMEs) can realistically aim for Level 2 using cloud accounting and simple tagging, whereas facilities on the GHG inventory list and large listed companies face pressure to reach Level 3 within the current regulatory cycle.

Table 4. Four-level maturity model for sustainability-ready accounting

Level	Defining characteristics	Typical technologies	Priority action to progress
1. Digitised bookkeeping	Financial transactions digital; ESG data absent or ad hoc	Accounting software; e-invoices; digital signatures	Select material ESG metrics and assign data owners
2. Tagged and connected	Key ESG quantities captured with financial records via cost centres and activity codes	Cloud accounting or ERP with dimensions; simple meter integration	Document metric definitions; reconcile physical and financial data monthly
3. Controlled and integrated	ESG metrics within internal control; traceable to source;	Integrated ERP/data warehouse; workflow and audit-trail tools; IoT feeds	Prepare for limited external assurance of priority metrics

Level	Defining characteristics	Typical technologies	Priority action to progress
	one dataset serves several regulators		
4. Analytical and assured	ESG information used in budgeting, pricing and investment decisions; disclosures assured and machine-readable	BI and AI analytics; scenario tools; digital reporting and tagging	Extend to value-chain (scope 3, supplier) data and continuous assurance

(Source: Authors' proposal)

6.2. Implications for enterprises

Start from material metrics, not from technology. Firms should identify a short list of material ESG metrics, typically energy, fuel, water, waste, GHG emissions, workforce and safety indicators and define for each the unit, boundary, calculation method, data owner, frequency and source system, before selecting tools.

Tag at the point of capture. Configuring chart-of-accounts dimensions, cost centres and asset codes so that every relevant e-invoice, purchase order and payroll record carries a physical quantity and an activity code is the lowest-cost step towards integration, and it exploits infrastructure that Vietnamese firms already have.

Extend internal control to ESG data. Segregation of duties, approval workflows, change logs and periodic reconciliation between physical and financial records (for example, kilowatt-hours versus electricity cost) should apply to ESG metrics. This is the precondition for credible external assurance.

Introduce AI selectively and under human oversight. Anomaly detection, document extraction and emission-factor mapping are mature use cases; outputs used in external disclosures should be reviewed by qualified staff and documented, consistent with the caution in the audit literature (Kokina & Davenport, 2017).

6.3. Implications for regulators and professional bodies

The principal regulatory opportunity lies in coherence. Aligning the data definitions used for GHG inventory under Decree No. 06/2022/NĐ-CP (as amended) with those required in securities disclosure would allow one controlled dataset to

serve both purposes. A national digital taxonomy for ESG indicators, modelled on financial reporting taxonomies, would support machine-readable reporting (Troshani & Rowbottom, 2021). Proportionality is also essential: simplified templates and shared cloud tools for SMEs, and a phased introduction of limited assurance for the most material metrics, would reduce the risk that new requirements simply generate more unverified narrative.

6.4. Implications for accounting education

The competence profile implied by the framework combines accounting judgement, data management and sustainability literacy. Curricula should therefore integrate data analytics and information-systems control with sustainability measurement (GHG Protocol scopes, emission factors, social metrics) and with the conceptual architecture of IFRS S1/S2, preferably through case-based learning on Vietnamese firms. Given the finding that accountants' qualifications predict ESG reporting readiness (Nguyen et al., 2024), such investment has a direct pay-off for enterprises.

7. CONCLUSIONS

This paper has argued that the contribution of digital technology to sustainable development through accounting is best understood as a sequence of information stages rather than as a catalogue of tools. In Vietnam, transaction digitisation is well advanced and the regulatory perimeter for sustainability information is expanding quickly, yet ESG data remain fragmented, weakly controlled and rarely assured. The binding constraint is organisational data ownership, internal control and skills, rather than technological availability. A staged pathway that begins with material metrics, tags data at the point

of capture and extends internal control to ESG information offers a realistic route, including for SMEs.

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