

THE TRANSFORMATION OF ACCOUNTING COMPETENCIES IN RESPONSE TO DIGITALIZED GREEN SUPPLY CHAINS: IMPLICATIONS FOR ACCOUNTING EDUCATION IN VIET NAM

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ABSTRACT

In the context of Viet Nam's accelerating digital transformation alongside its commitments to sustainable development—particularly the goal of achieving net-zero emissions—green supply chains are increasingly emerging as a strategic priority for enterprises. This transition imposes new requirements on accounting human resources, extending beyond the traditional role of providing financial information to include the ability to measure environmental costs, monitor carbon emissions, analyze ESG data, and ensure information transparency to support supply chain management. However, accounting education programs in Viet Nam remain largely oriented toward traditional financial accounting, while areas such as environmental accounting, carbon accounting, sustainability reporting, and digital data management have not yet been fully and systematically integrated. Employing a qualitative research approach based on literature review and contextual analysis in Viet Nam, this study identifies a significant gap between the competencies required for accountants in digitalized green supply chains and the content of current training programs. This gap is reflected in three key dimensions: technical competencies, digital and data integration competencies, and strategic and managerial competencies. Based on these findings, the study proposes a competency framework for accounting that aligns with the requirements of green supply chains in the context of digital transformation. It also suggests directions for restructuring accounting education programs toward the integration of sustainability accounting, digital technologies, and supply chain management, thereby contributing to the advancement of green economic development in Viet Nam.

Keywords: Green supply chain, accounting competencies, digital transformation, ESG, accounting education.

1. INTRODUCTION

The transition toward a green growth model, together with ongoing digital transformation, is generating profound changes in how enterprises and supply chains operate in Viet Nam. Rather than focusing solely on cost optimization, supply chains are now required to systematically integrate environmental, social, and governance (ESG) factors throughout the entire product lifecycle. This shift necessitates an expansion in the scope of accounting systems, including the identification of environmental costs, monitoring of emissions, processing and analysis of ESG data, and the application of digital technologies to ensure transparency and traceability. Nevertheless, accounting education in Viet Nam remains largely grounded in traditional approaches, while areas such as environmental accounting, carbon

accounting, green supply chain management, and the application of digital technologies have not yet been fully and systematically incorporated into curricula. This situation has led to a significant mismatch between practical demands and the competencies of accounting professionals. Against this backdrop, this study adopts a qualitative approach to examine the accounting competencies required to support green supply chains in the context of digital transformation in Viet Nam. Specifically, the study addresses three main research questions:

(1) How are accounting competencies being restructured and transformed across key dimensions—namely technical competencies, integration and digital competencies, and strategic and governance competencies—in the context of digitalized green supply chains?

(2) What changes in the role and professional position of accountants accompany this shift in competencies?

(3) What implications does this transformation have for the restructuring of accounting education programs?

By synthesizing theoretical foundations and analyzing the practical context, the paper aims to develop a competency framework for accounting in digitalized green supply chains. It also proposes directions for innovating accounting education programs toward the integration of sustainability and digital technologies, in line with Viet Nam's transition toward a green economy.

2. THEORETICAL FRAMEWORK AND METHODOLOGY

2.1. Theoretical Background

A green supply chain refers to a supply chain management approach in which environmental and sustainability considerations are integrated into all activities across the value chain, from product design, material sourcing, production, and distribution to post-consumption treatment, with the aim of minimizing negative environmental impacts and optimizing resource use. Green Supply Chain Management (GSCM) is considered an extension of traditional supply chain management, emphasizing the incorporation of environmentally friendly practices into procurement, production, logistics, and product lifecycle decisions [1]. In this context, green supply chains are viewed as a sustainable business strategy that not only ensures compliance with environmental standards but also enhances resource efficiency and competitive advantage [1].

Digital transformation is defined as the process of adopting and integrating digital technologies into all aspects of an organization—including processes, business models, organizational culture, and value creation—in order to fundamentally transform operations, improve efficiency, and generate new value for stakeholders [2].

In vocational education, competence combines knowledge, skills, and professional values applied in a specific context. The International Education Standards issued by the International Federation of Accountants [3] address technical competence, professional skills, ethics, and professional judgment. ACCA [4] further emphasizes the ability of finance professionals to consider financial and non-financial drivers of sustainable value creation.

Based on these perspectives, accounting competence can be defined as a set of professional knowledge, analytical and information-processing skills, and ethical standards that enable accountants to effectively perform functions such as recording, reporting, controlling, and providing financial advice in specific economic contexts. In the context of green finance, this concept needs to be expanded to include the ability to process non-financial information, measure environmental impacts, and assess sustainability risks, reflecting a shift from traditional accounting toward sustainability-oriented accounting.

In this study, the term “sustainability accounting” is used as an umbrella concept encompassing environmental accounting, ESG-related reporting, and green accounting practices. While “green accounting” primarily focuses on environmental aspects and “ESG accounting” emphasizes disclosure frameworks, this study adopts a broader perspective in which these concepts are integrated within a sustainability-oriented accounting framework.

Drawing on these theoretical foundations, this study develops an analytical framework to clarify the relationship between accounting competencies, digital transformation, and green supply chain management. Within this framework, accounting competence is positioned as a central variable that connects accounting information systems with sustainability-oriented management requirements in supply chains.

Based on the synthesis of the literature, the study proposes a three-pillar competency framework for accounting in green supply chain management: (i) technical competencies, including environmental and carbon accounting within the value chain; (ii) integration and digital competencies, including ESG reporting and the processing of financial and non-financial data on digital platforms; and (iii) strategic and managerial competencies, associated with internal control, climate risk assessment, and sustainability planning.

These three pillars form an integrated competency system, in which professional ethics and the prevention of greenwashing serve as overarching principles to ensure the transparency and reliability of sustainability-related information.

Accounting Competencies in Digitalized Green Supply Chains

The transition toward green supply chain models fundamentally changes the nature of management information systems within organizations. As environmental and sustainability factors are embedded throughout the value chain—from product design to post-consumption stages—firms require measurement and reporting systems that capture not only financial performance but also environmental performance and resource efficiency. In this context, accounting becomes a key function in providing data to support sustainability-oriented supply chain management.

Digital transformation further amplifies this role. The application of digital technologies in production, logistics, and supply chain management generates large volumes of multidimensional data, including both financial and non-financial information. This development requires accountants not only to perform traditional recording functions but also to possess the ability to extract, analyze, and integrate data within digital environments to support strategic decision-making. Consequently, transparency, traceability, and emissions measurement in green supply chains are closely linked to accountants’ data analytics capabilities.

From a professional competency perspective, accountants need to expand their knowledge to include environmental accounting and green supply chain management, while also developing skills in ESG data analysis within digitalized environments. At the same time, professional responsibility and ethical standards remain fundamental in ensuring the integrity and transparency of sustainability-related information. Therefore, accounting competence is not merely a supporting condition but a critical determinant of the effectiveness of green supply chain management in the context of digital transformation.

According to the study’s analytical framework, the relationship among the three elements can be explained as follows:

(1) green supply chains create new requirements for management information, particularly regarding emissions, resource use, and environmental performance across the value chain;

(2) digital transformation provides the technological infrastructure for real-time data collection, processing, and sharing; and

(3) accounting competence acts as an intermediary that transforms financial and non-financial data into decision-useful information.

Accordingly, accounting competence is considered a key factor in ensuring effective integration between green supply chain management requirements and digital transformation technologies. This is reflected in the ability to measure environmental costs, track carbon emissions across the value chain, integrate ESG data into reporting systems, and provide transparent information for sustainable management.

The arguments in this section are developed based on a synthesis of international academic literature combined with an analysis of policy context and business practices in Viet Nam. The primary research methods employed are document analysis and literature synthesis, through which the proposed competency framework for the research context is established.

2.2. Research Methodology

2.2.1. Research Design

This study adopts a qualitative research approach with an analytical and theory-generalization orientation. This approach aims to clarify the competency requirements for accountants in the context of green supply chains associated with digital transformation, while also identifying the gap between current training content and practical demands. The qualitative method enables the integration of theoretical foundations with the practical operating context in Viet Nam.

2.2.2. Research Subject

The research focuses on accounting competencies required for green supply chains in the context of digital transformation. These competencies include sustainability-related professional knowledge, ESG data analysis and processing skills, and ethical as well as institutional professional capabilities. In addition, the study examines current accounting education programs to assess the extent to which sustainability and digital-related content has been integrated.

2.2.3. Data Sources and Data Collection Methods

The study utilizes secondary data collected from academic publications, professional reports, and guidelines related to green supply chains, ESG, sustainability accounting, and digital transformation. A systematic literature review approach is employed to identify competency frameworks and emerging trends in accounting profession requirements.

2.2.4. Data Analysis Methods

Data are analyzed using content analysis combined with comparison and synthesis techniques. The analysis focuses on: (i) identifying key groups of accounting competencies required in green supply chains under digital transformation; (ii) assessing the extent to which these competencies are reflected in current training programs; and (iii) clarifying the gap between education and practical requirements. Based on these findings, the study proposes implications for restructuring accounting education programs toward integrating sustainability and digital technologies.

3. FINDINGS AND DISCUSSION

3.1. The Context of Green Supply Chains and Digital Transformation

Sustainability pressures are reshaping global supply chains. The World Economic Forum [5] reports that eight major supply chains account for more than half of global greenhouse gas emissions. KPMG [6] found that 96% of the world's 250 largest companies report on sustainability or ESG matters. Together these trends increase the demand for reliable environmental and social information.

In Viet Nam, the National Green Growth Strategy for the period 2021–2030 sets a target of reducing greenhouse gas emission intensity per GDP by at least 15% by 2030 compared to 2014 levels [7]. This policy direction requires enterprises to measure, monitor, and report carbon data in production and logistics activities, including information from suppliers.

Digital transformation is also reshaping enterprise information systems. Digital technologies can facilitate the collection, integration, and analysis of financial and non-financial information across organizational processes [2]. For accountants, this creates a need to assess data quality and interpret information from multiple sources in a green supply chain.

The convergence of ESG requirements and digital transformation expands the scope of information that accountants must handle. Beyond recording traditional costs and revenues, accountants are now required to measure carbon emissions, allocate environmental costs, manage traceability data, and ensure the reliability of sustainability reporting. Therefore, the context of green supply chains under digital transformation creates inevitable pressure to restructure the accounting competency framework.

Regulatory Framework and Institutional Pressures on Green Supply Chains

The transition toward green supply chains is strongly influenced by international commitments and regulatory frameworks. Following the Paris Agreement, countries are required to develop greenhouse gas reduction roadmaps, leading to increased pressure on enterprises to control emissions across their entire value chains [8]. In Europe, the Carbon Border Adjustment Mechanism (CBAM) requires exporting firms to disclose emissions embedded in their products, further intensifying the demand for environmental data transparency [9]. In addition, sustainability disclosure standards such as IFRS S1 and IFRS S2 require firms to disclose climate-related risks and impacts across the value chain [10].

In Viet Nam, the National Green Growth Strategy and the commitment to achieving net-zero emissions by 2050 provide a legal foundation for greenhouse gas inventory and management [7]. The 2020 Law on Environmental Protection also mandates emission reduction responsibilities for major production facilities, indirectly promoting environmental governance within supply chains.

From an institutional theory perspective, this transition is driven by three types of pressures: coercive pressures from regulations, normative pressures from professional standards and investors, and mimetic pressures from leading firms [11]. The combination of these forces makes green supply chain management an inevitable requirement, while simultaneously expanding the scope of information that accounting systems must capture and control.

3.2. Accounting Competency Requirements in the Context of Green Supply Chains

3.2.1. Environmental Cost Accounting

In the context of green supply chains, the scope of accounting costs extends beyond incurred expenses to encompass environmental obligations and long-term climate-related risks. Under the Environmental Management Accounting (EMA) approach, firms are required

to systematically identify and classify environmental costs, including prevention, treatment, remediation, and compliance costs [12]. Embedding these costs into product costing systems enables a more accurate representation of the economic substance of production activities, rather than treating them as incidental expenses. In addition, firms are expected to recognize environmental assets and establish provisions for contingent environmental liabilities in line with the prudence principle.

At the same time, sustainability disclosure standards issued by the International Sustainability Standards Board under the IFRS Foundation [10] require firms to disclose material climate-related risks that may affect financial statements. This requirement implies that accountants must not only measure current environmental costs but also anticipate long-term cost implications associated with both transition and physical risks. Consequently, environmental cost measurement has evolved from a technical function into a strategic competency within modern accounting practices.

This finding is consistent with the EMA framework proposed by IFAC [12], which emphasizes the comprehensive identification of environmental costs. However, prior studies have largely concentrated on cost measurement at the firm level, with limited consideration of how environmental costs are distributed across interconnected activities within the supply chain. This narrow focus may result in incomplete cost visibility when environmental impacts arise across multiple stages, including suppliers, production, and distribution.

In contrast, this study extends the analysis by situating environmental cost accounting within the context of digitalized green supply chains, where cost allocation must span multiple nodes of the value chain. This shift highlights the need to move from firm-centric accounting toward a value chain-oriented sustainability accounting perspective, providing a more integrated approach that remains underexplored in existing literature.

3.2.2. Carbon Accounting

Carbon accounting is closely linked to net-zero emission targets and the development of carbon markets. Firms are required to measure emissions across Scope 1, 2, and 3 in accordance with the GHG Protocol [13], while also recognizing and managing carbon credits and emission obligations.

The emergence of carbon markets transforms emissions into financially relevant elements, requiring accountants to address the recognition of carbon-related assets and liabilities [14]. Furthermore, IFRS S2 requires disclosure of climate-related risks and opportunities that may affect cash flows and the cost of capital, thereby reinforcing the need for reliable carbon measurement and reporting.

From an academic perspective, carbon accounting demands an interdisciplinary skill set, combining accounting expertise with environmental science knowledge, as well as the ability to process large-scale ESG data. This gap has been widely identified as a key challenge in current accounting education.

In particular, measuring Scope 3 emissions remains a major challenge, as it requires data collection across multiple upstream and downstream entities within the value chain. Common approaches include the use of activity-based emission factors, supplier-specific data, and environmentally extended input–output models to estimate indirect emissions.

Because Scope 3 emissions arise across upstream and downstream activities, accountants increasingly need to measure, verify, and interpret emissions data from entities beyond their own organizations. This competency supports transparency and decision-making in digitalized green supply chains [13].

3.2.3. ESG Reporting and Integration

ESG reporting is increasingly standardized under international frameworks such as the Global Reporting Initiative (GRI) and the Task Force on Climate-related Financial Disclosures (TCFD), which emphasize materiality, transparency, and the integration of climate-related risks into corporate reporting. In addition, previous studies suggest that sustainability reporting should be embedded in organizational management processes rather than treated solely as a disclosure requirement, thereby enhancing decision-making and organizational accountability [15].

According to Eccles and Krzus [16], integrated reporting requires “integrated thinking,” referring to the ability to connect strategy, risk management, and financial and non-financial information within a unified system. When climate risks are disclosed in ESG reports but not reflected in accounting estimates, the reliability of corporate information is undermined.

Therefore, ESG reporting competency involves not only data aggregation but also ensuring consistency across reporting systems.

3.2.4. Information Governance and Internal Control

In green supply chains, firms must manage not only financial data but also information on emissions, energy consumption, and environmental compliance of suppliers. Sustainable supply chain management emphasizes transparency and traceability across the entire value chain [17], extending internal control beyond organizational boundaries.

Sustainability disclosure standards such as IFRS S1 and IFRS S2 require firms to disclose climate-related risks and impacts across the value chain, including data from external partners [12]. Additionally, COSO [18] guidance on internal control over sustainability reporting highlights the need to ensure completeness, accuracy, and traceability of ESG data, while integrating sustainability risks into governance and oversight mechanisms.

In the context of digital transformation, ERP systems and integrated data platforms enhance real-time monitoring but also require robust verification processes and clear authorization structures to ensure data reliability.

Thus, competency in information governance and internal control includes the ability to design end-to-end processes for collecting and verifying environmental data, integrate financial and non-financial data on digital platforms, and ensure consistency between financial and ESG reporting.

3.2.5. Ethics and Greenwashing Prevention

Greenwashing refers to practices in which firms exaggerate or distort environmental information to create a positive public image [19], Lyon and Montgomery [20] argue that such practices erode market trust in sustainability reporting.

As ESG becomes a competitive factor, accountants play a critical role in safeguarding the integrity of sustainability disclosures. Ethical competency therefore serves as a foundational element for maintaining transparency and accountability in green capital markets.

In practice, this role extends beyond general oversight to the implementation of concrete control and assurance mechanisms. Accountants are responsible for ensuring the consistency and verifiability of sustainability data by cross-checking ESG disclosures with underlying operational data, applying internal control procedures to non-financial reporting, and identifying discrepancies between reported claims and actual performance indicators. These procedures enable the early detection of misstatements and inconsistencies in sustainability reporting.

Furthermore, the application of digital tools and data analytics enhances traceability across the value chain, allowing accountants to track data origins, detect anomalies, and assess the reliability of ESG information. This reflects a shift from traditional compliance-

oriented accounting toward a more proactive role in risk detection and sustainability data governance, thereby reinforcing the credibility of ESG disclosures in increasingly regulated and transparent markets.

In this regard, accountants function as a key line of defense against greenwashing by implementing control mechanisms such as data reconciliation, audit trails for ESG data, and independent verification of sustainability metrics. These mechanisms not only facilitate the detection of misstatements but also contribute to the prevention of opportunistic disclosure practices, ensuring the integrity and reliability of sustainability information.

3.2.6. Layered Competency Model

Based on the synthesis of theoretical perspectives on sustainability accounting, green supply chain management, and digital transformation, this study proposes a three-tier accounting competency framework reflecting the expanded role of accountants in sustainable value chain governance.

Table 1. Proposed Three-Tier Accounting Competency Framework for Digitalized Green Supply Chains.

Tier	Competency Category	Key Competencies
Tier 1	Technical Competencies	Environmental cost measurement; Carbon accounting (Scope 3); Environmental cost allocation
Tier 2	Integration & Digital Competencies	ESG reporting; Financial and non-financial data integration; Digital supply chain analytics
Tier 3	Strategic & Governance Competencies	Internal control; Climate risk assessment; Sustainable strategy formulation
Cross-cutting	Ethics	Professional ethics; Greenwashing prevention

Source: Author's synthesis based on the theoretical framework and literature review

The key contribution of this study lies in the development of a three-tier accounting competency framework that integrates technical, digital, and strategic dimensions within a unified analytical structure. Unlike prior studies, which tend to examine these competencies in isolation, this model highlights their interdependence in responding to the complex demands of digitalized green supply chains.

More importantly, the proposed framework introduces a shift from a firm-centric perspective toward a value chain-oriented approach, in which accounting competencies are extended beyond organizational boundaries to encompass supplier integration, emissions tracking across multiple nodes, and ESG data governance. This perspective remains underexplored in the existing accounting competency literature.

In addition, the model contributes to the literature by explicitly linking competency restructuring with digital transformation and sustainability requirements, thereby providing a more holistic and context-sensitive framework for understanding the evolving role of accountants.

From a practical perspective, the framework offers a structured basis for redesigning accounting education programs, aligning learning outcomes with emerging professional demands in ESG reporting, carbon accounting, and digital data integration.

3.3. Current Status of Accounting Education

3.3.1. Curriculum Structure

Beyond issues related to overall curriculum structure, another significant gap lies in the specific content concerning sustainability. While businesses are increasingly required to implement ESG reporting, disclose emissions data, and comply with international sustainability standards, topics such as environmental accounting, carbon accounting, and sustainability reporting have not yet been formally and systematically incorporated into accounting curricula.

International studies indicate that most educational institutions have not developed standalone courses on sustainability reporting or ESG accounting; instead, these topics are often sporadically embedded within subjects such as management accounting or professional ethics [15, 21]. This fragmented approach makes it difficult for students to develop in-depth competencies in measuring and reporting non-financial information.

In Viet Nam, evidence from five universities suggests that students' exposure to ESG and sustainability-related accounting content remains limited within formal curricula, indicating a need for more structured integration into accounting education [22].

These findings suggest that the gap is not only at the level of training orientation but also in the degree to which ESG and carbon-related content are concretely embedded in formal curricula. This represents a critical bottleneck given the growing practical demand for sustainability reporting and green finance.

3.3.2. ESG and Digital Integration

In the context of digital transformation and the growing prominence of green supply chains, the accounting profession is expected to expand its competencies into areas such as data analytics, digital technologies, and sustainability reporting. However, substantial evidence suggests that current accounting curricula remain heavily oriented toward traditional subjects.

Evidence from the five Vietnamese universities examined by Vu [22] suggests that ESG content is unevenly integrated into accounting curricula. This reinforces the need to connect sustainability topics with data analysis and digital skills rather than treating them as isolated additions.

Similarly, an international literature review on the integration of big data into accounting education indicates that most institutions have only introduced isolated technology-related courses rather than comprehensively restructuring curricula toward digitalization. This suggests that the transformation of accounting education is progressing relatively slowly compared to labor market demands.

In Viet Nam, accounting education has also faced pressures associated with digital transformation, including the need to update professional knowledge and skills [23]. Sustainability-related topics, ESG, and carbon accounting require additional, more systematic attention in curriculum design [22].

A representative study by Vu [22] highlights that ESG and sustainability reporting remain underrepresented in accounting curricula in Viet Nam. The study surveyed 212 undergraduate students from five universities using a standardized questionnaire developed based on ESG competency frameworks adapted from Stubbs & Schapper [24] and Lozano [25]. The questionnaire consisted of 16 items across four dimensions: (1) ESG awareness, (2) exposure to ESG content, (3) interest in ESG topics, and (4) perceived importance of ESG in accounting education, measured using a five-point Likert scale.

While descriptive statistics provided an overview of students’ awareness and interest, deeper insights were obtained through K-means cluster analysis, which identified three distinct student profiles based on their levels of awareness, exposure, interest, and perceived importance of ESG.

Table 2. Quantitative Analysis Results.

Cluster	% of student	Awareness	Exposure	Interest (1-5)	Importance (1-5)
Cluster 0	25 %	0.00	0.00	3.03	2.98
Cluster 1	46 %	45.7 %	100 %	3.23	3.00
Cluster 2	29 %	100 %	0.00	2.96	2.79

Source: Vu [22]

Cluster 0 consists of students who lack both knowledge and experience related to ESG issues. However, their moderate level of interest (3.03) suggests a potential willingness to engage with ESG content if it is delivered in a structured and systematic manner.

Cluster 1 represents the most suitable target group for curriculum development at this stage. These students have had partial exposure to ESG content and demonstrate a high level of interest, along with a strong awareness of its importance.

Cluster 2 presents a more complex challenge. Although these students show full awareness of ESG concepts, they have not been exposed to such content in formal coursework and exhibit the lowest levels of interest and perceived importance.

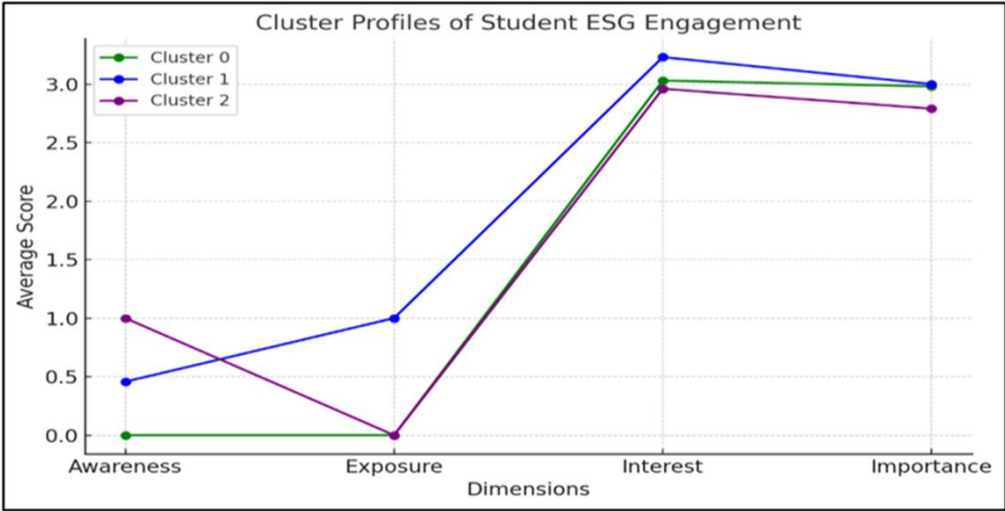


Figure 1. Student Cluster Profiles of ESG Engagement Across Four Impact Dimensions.

Source: Vu [22]

The above findings reveal a significant gap between current accounting education content and professional requirements in the context of the digital economy and green supply chains. This further reinforces the view that accounting curricula remain largely grounded in traditional financial accounting frameworks.

3.3.3. Learning Outcomes and Professional Competency Orientation

Despite the growing demand for sustainability reporting, many accounting programs remain oriented toward traditional financial reporting and compliance. The International Education Standards [3] address technical competence, professional skills, ethics, and

continuing development. IFAC's revised IES 2, 3, and 4 expressly incorporate sustainability-related competence into professional accounting education [21].

ACCA [4] identifies green finance and the ability to assess both financial and non-financial drivers as important capabilities for finance professionals. Accounting curricula should therefore provide opportunities to develop climate risk, sustainability reporting, and related data skills.

IFAC's revised International Education Standards 2, 3, and 4 [21] provide a basis for integrating sustainability-related technical knowledge, professional skills, and ethical values into accounting learning outcomes. The implementation of these standards in individual programs requires curriculum review and appropriate teaching resources.

In addition, KPMG [6] reports that 96% of the world's 250 largest companies have published sustainability reports, indicating that ESG has become a widespread practice in the corporate sector. However, accounting education has not kept pace with this transformation, resulting in a gap between labor market demands and graduate competencies.

In Viet Nam, Vu [22] documents uneven integration of ESG and sustainability reporting in the accounting curricula of five universities. This evidence supports defining clearer learning outcomes for sustainability-related accounting competencies.

These findings highlight a significant gap between the requirements of the modern labor market—which increasingly demands ESG, carbon, and sustainability reporting expertise—and the learning outcomes currently defined in many accounting education programs.

3.3.4. Implementation Conditions: Faculty and Learning Resources

In addition, limitations related to faculty and learning resources represent foundational constraints affecting the development of all three tiers of accounting competencies in green supply chains, particularly technical and integration competencies.

A major barrier to integrating ESG into accounting curricula is the shortage of qualified faculty and standardized teaching materials. According to the IFRS Foundation [10], the issuance of IFRS S1 and IFRS S2 sustainability reporting standards introduces new competency requirements related to climate disclosure and sustainability risk reporting. However, higher education systems in many countries have not yet updated their curricula accordingly. This creates significant pressure on faculty members, who have primarily been trained under traditional financial accounting frameworks.

The lecturer interviews reported by Vu [22] point to limited institutional guidance, uneven faculty preparation, and a shortage of localized ESG teaching materials. These constraints can hinder systematic integration of sustainability reporting into accounting courses.

In the five Vietnamese universities studied by Vu [22], ESG content was often concentrated in electives or addressed on an ad hoc basis. The interviews also identified limited access to localized teaching materials and uneven faculty preparation.

A qualitative study by Vu [22], based on semi-structured interviews with 20 accounting lecturers from the same universities, was conducted to complement the quantitative findings above. Using framework analysis, the study mapped key themes across five critical dimensions: curriculum structure, faculty readiness, institutional support, student interest, and access to resources.

Table 3. Qualitative Analysis Results.

Framework Dimension	Key Findings from Lectures
Curriculum Structure	ESG content is mostly ad hoc and concentrated in electives
Faculty Readiness	Many lecturers lack formal training in ESG
Institutional Support	Minimal guidance for ESG curriculum design
Student Engagement	Some lectures perceive low student interest
Resource Accessibility	Shortage of localized ESG materials

Source: Vu [22]

These findings indicate that the shortage of specialized human resources and standardized teaching materials constitutes a structural barrier that slows down the integration of ESG into accounting education programs.

Overall, the synthesis of current conditions suggests that accounting education continues to operate largely under a traditional model, while the demands of digital transformation and green finance have evolved significantly. ESG and carbon accounting have not yet been systematically integrated into curricula, learning outcomes remain slow to adapt, and both teaching capacity and specialized learning resources are still limited.

These factors create a clear gap between the competencies developed through education and the practical requirements of the profession in the context of the digital economy and sustainable development.

3.4. Education–Practice Gap

In the context of green supply chains and digital transformation, the role of accountants has expanded beyond internal reporting to include measuring emissions across the entire value chain (particularly Scope 3), integrating supplier data, and ensuring ESG transparency on digital platforms. This evolution has created a clear gap between the competencies developed through education and those required in professional practice.

3.4.1. Technical Competency Gap

The demand for sustainability-related accounting knowledge is evident in corporate reporting practice. KPMG [6] found that 96% of the world's 250 largest companies report on sustainability or ESG matters, while 64% acknowledge climate change as a risk to their business. These developments strengthen the case for accounting education that covers sustainability disclosure and climate-related risk.

IFAC's revised education standards [21] incorporate sustainability-related competence into technical, professional, and ethical learning outcomes. Accounting programs can use these standards to develop learning activities on climate-related disclosures, emissions data, and professional judgment.

In Viet Nam, Vu's study of five universities [22] found that ESG content was unevenly covered and often concentrated in electives. At the same time, value chain emission measurement, particularly Scope 3, requires skills in collecting and evaluating information from suppliers and other partners [13].

Thus, the technical competency gap stems not only from the absence of ESG-related content but also from the misalignment between traditional accounting education structures and the expanded, mandatory scope of sustainability reporting across value chains.

This finding is consistent with the evidence of uneven ESG curriculum integration reported by Vu [22]. The present study extends the discussion by emphasizing the need to align education with value chain-based sustainability information requirements.

3.4.2. Integration and Digital Competency Gap

Enterprises increasingly need the capacity to analyze climate risks, measure emissions, and connect ESG data with financial information. ACCA [4] highlights the importance of green finance skills and considering financial alongside non-financial drivers. These capabilities require more integrated learning activities in accounting education.

In contrast, accounting education continues to focus predominantly on traditional financial reporting. Skills such as ESG metric development, assessing the financial impacts of climate change, and integrating non-financial data into consolidated reporting are not systematically taught. Therefore, the gap lies not only in missing content but also in limited interdisciplinary thinking and practical application.

In Viet Nam, Vu [22] identifies uneven curriculum coverage, limited faculty preparation, and shortages of localized teaching resources for ESG education. These constraints can affect graduates' preparation for environmental risk analysis, emissions measurement, and ESG data integration.

Furthermore, the ability to collect and process ESG data across multiple nodes in the supply chain using digital platforms remains underdeveloped in current curricula. While businesses operate based on value chain logic and multi-source data systems, academic programs remain fragmented into separate subjects, widening the integration and digital competency gap.

Prior research on digital transformation [2] and professional guidance on green finance skills [4] point to the importance of analytical capabilities. This study links those capabilities to sustainability requirements in green supply chains, where accountants must work with financial and non-financial information from multiple sources.

3.4.3. Institutional and Governance Gap

Sustainability reporting requirements continue to evolve, particularly following the issuance of IFRS S1 and IFRS S2 in 2023 [10]. IFRS S2 addresses climate-related risks and opportunities and calls for consideration of information across the value chain where relevant. These developments increase the need for current accounting education.

Formal curriculum revision requires institutional review and approval, which can slow responses to evolving reporting requirements. Programs therefore need mechanisms to update teaching materials and learning activities as standards change.

In Viet Nam, although national strategies for green growth and sustainable development have been introduced, ESG integration into accounting learning outcomes has not yet been standardized. Existing ESG training initiatives are largely fragmented and implemented by individual organizations or training centers, rather than being embedded as mandatory components within national curricula. This lack of alignment highlights a significant institutional gap in the transition toward green supply chains and sustainable development.

This observation aligns with institutional theory, which suggests that regulatory pressures often evolve faster than organizational and educational responses. However, prior studies mainly examine these pressures at the firm level, with limited focus on their implications for education systems. By highlighting the time lag in curriculum reform, this study contributes to understanding how institutional misalignment shapes competency gaps in the context of sustainability transitions.

General Discussion

Overall, the misalignment between accounting education and professional practice is becoming increasingly evident in the context of digitalized green supply chains. While prior studies acknowledge the growing importance of ESG and sustainability reporting, they often

address these issues in a fragmented manner—either focusing on technical knowledge, digital skills, or regulatory changes in isolation.

Key competencies such as non-financial data analytics, carbon emission measurement, and climate impact assessment have not yet been systematically embedded into curricula. In Viet Nam, ESG is mostly introduced as a supplementary or pilot component rather than a formal learning outcome.

From the perspective of the proposed three-tier competency model for green supply chains, current educational structures fail to simultaneously develop technical expertise, digital integration capabilities, and strategic sustainability thinking. Without structural reforms toward comprehensive integration, this gap is likely to widen further.

3.5. Implications for Accounting Education and Research

The proposed three-tier competency framework not only contributes to theoretical development but also provides a practical foundation for restructuring accounting education. By integrating technical, digital, and strategic competencies within a unified structure, the model offers a comprehensive basis for curriculum redesign that better aligns with the evolving demands of digitalized green supply chains and helps bridge the gap between education and professional practice.

Building on this framework, the following implications are proposed to support the transformation of accounting education in response to these emerging requirements.

3.5.1. Program-Level Implications

(i) Redesigning accounting curricula based on green supply chain competency frameworks

Reforming accounting education should begin at the level of learning outcomes rather than merely adding fragmented content. Curricula should be systematically designed around ESG-oriented competency frameworks, in which students are expected to develop a solid understanding of sustainability reporting standards, carbon accounting, and emission measurement methodologies. At the same time, competencies in climate risk analysis and the ability to process non-financial data should be embedded as core learning outcomes and assessment criteria.

Professional guidance from ACCA [4] and IFAC [21] offers a basis for integrating green finance, sustainability information, and professional competence into accounting learning outcomes.

In the Vietnamese context, learning outcomes should be gradually expanded to include competencies such as value chain emission measurement (particularly Scope 3), environmental cost allocation across supply chains, and ESG data quality control across supplier networks.

While formal curriculum revisions are being developed, institutions can introduce elective courses, short-term modules, and collaborations with professional bodies and enterprises to address immediate skill gaps.

Such transitional approaches can effectively bridge the gap between rapidly evolving market demands and the slower pace of formal curriculum reform.

(ii) Deep integration of ESG into existing accounting courses

In addition to adjusting learning outcomes, ESG content should be systematically embedded into existing accounting courses. In financial accounting, topics such as environmental liabilities, provisions for environmental remediation, and emission-related obligations can be incorporated. In auditing, the scope should be extended to include assurance of sustainability information and verification of non-financial data. In financial statement

analysis, ESG indicators can be integrated into performance evaluation and risk assessment models.

An integrative approach can embed sustainability reporting and ESG analysis in core accounting and auditing courses, helping students connect financial information with environmental and governance matters [4, 21].

(iii) Developing specialized courses in sustainability accounting

Alongside integration into existing courses, higher education institutions should develop dedicated courses on sustainability accounting. Course content may include sustainability reporting preparation and analysis, greenhouse gas accounting, ESG performance measurement, and regulatory frameworks for sustainability disclosure.

A potential course structure may consist of three components:

- (1) theoretical foundations of sustainability accounting and ESG standards;
- (2) methodologies for measuring emissions and environmental costs within supply chains;
- (3) practical analysis of corporate sustainability reports.

This approach enables students to develop ESG data analysis skills and better understand the role of accounting in green supply chain management.

3.5.2. Institutional-Level Implications

The institutional gap reflects the misalignment between the rapid development of sustainability reporting standards and the slower pace of curriculum reform in higher education. As ESG-related regulations continue to evolve, training programs operating under slow adjustment mechanisms may struggle to keep pace with market demands.

Therefore, universities should establish continuous collaboration mechanisms with businesses and professional organizations to ensure timely updates on ESG practices. Partnerships with companies that have implemented emission reporting or green supply chain management can help align academic content with real-world practices. Additionally, it is necessary to introduce more frequent curriculum review cycles and enhance the involvement of ESG experts and professional bodies in curriculum design and evaluation processes.

3.5.3. Implications for Accounting Research

From an academic perspective, accounting research should expand toward sustainability-oriented topics to provide theoretical foundations and empirical evidence supporting educational reform. Key research directions include: developing and validating ESG-oriented accounting competency frameworks; examining the role of accountants in measuring and verifying emissions data within supply chains; and analyzing the impact of sustainability reporting standards on professional practices.

Moreover, empirical studies should be conducted to assess the effectiveness of ESG integration in accounting education in meeting labor market demands. Surveys involving both enterprises and educational institutions can provide robust evidence to support curriculum redesign toward sustainability integration.

3.6. Limitations and Future Research Directions

This study is primarily based on theoretical synthesis and contextual analysis; therefore, its conclusions remain exploratory and have not yet been validated through empirical data. The proposed three-tier accounting competency model is currently conceptual and has not been empirically tested across different stakeholder groups or types of enterprises.

Future research should incorporate empirical investigations, particularly through surveys and interviews with enterprises, employers, and educational institutions, to validate the identified

competency gaps and assess the alignment between learning outcomes and professional requirements in green supply chains. Such empirical evidence would strengthen the robustness of the proposed model and enhance its practical applicability in curriculum design.

4. CONCLUSION

The transition toward green growth and the restructuring of supply chains are fundamentally transforming the role of accounting within organizations. Accounting is no longer confined to recording and financial reporting functions but is increasingly involved in emission measurement, integration of non-financial data, ESG disclosure, and providing information for sustainable risk management. These changes necessitate a reconfiguration of professional competencies as well as the orientation of accounting education in higher education institutions. This study identifies a significant gap between current accounting education and the practical requirements of green supply chains, particularly in terms of technical competencies, digital integration capabilities, sustainable data analytics, and strategic management participation. Based on this analysis, the study proposes a three-tier accounting competency framework to systematize the core competencies required in the context of green transformation. From a theoretical perspective, the study contributes to expanding the conceptualization of accounting competencies by incorporating sustainability and green supply chain perspectives, while also offering an analytical framework that can serve as a foundation for future empirical research. From a practical standpoint, the findings provide implications for updating learning outcomes and redesigning accounting curricula toward integrating sustainability and digital transformation in the coming period.

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REFERENCES

- [1] F. Fehlberg Herrmann, A. P. Barbosa-Povoa, M. A. Butturi, S. Marinelli, and M. A. Sellitto, "Green supply chain management: Conceptual framework and models for analysis," *Sustainability*, vol. 13, no. 15, Art. no. 8127, 2021, doi: <https://doi.org/10.3390/su13158127>
- [2] A.F. Rizana, I. I. Wiratmadja, and M. Akbar, "Exploring capabilities for digital transformation in the business context: Insight from a systematic literature review," *Sustainability*, vol. 17, no. 9, Art. no. 4222, 2025, doi: <https://doi.org/10.3390/su17094222>
- [3] International Federation of Accountants, 2019 Handbook of International Education Standards. New York, NY, USA: IFAC, 2019. [Online]. Available:

- <https://www.ifac.org/education/publications/2019-handbook-international-education-standards>
- [4] Association of Chartered Certified Accountants, *Green Finance Skills: The Guide*. London, U.K.: ACCA, 2023. [Online]. Available: <https://www.accaglobal.com/policy-and-insights/reports/2023/green-finance-skills-guide.html>
- [5] World Economic Forum and Boston Consulting Group, *Net-Zero Challenge: The Supply Chain Opportunity*. Geneva, Switzerland: World Economic Forum, 2021. [Online]. Available: <https://www.weforum.org/publications/net-zero-challenge-the-supply-chain-opportunity/>
- [6] KPMG, *Big Shifts, Small Steps: Survey of Sustainability Reporting 2022*. Amstelveen, The Netherlands: KPMG International, 2022. [Online]. Available: <https://kpmg.com/bm/en/insights/2022/09/survey-of-sustainability-reporting-2022.html>
- [7] Prime Minister of Vietnam, *Decision No. 1658/QĐ-TTg dated October 1, 2021 Approving the National Green Growth Strategy for 2021–2030, with a Vision to 2050*. Hanoi, Vietnam: Government of Vietnam, 2021.
- [8] *United Nations Framework Convention on Climate Change, Paris Agreement*. New York, NY, USA: United Nations, 2015.
- [9] *European Commission, Carbon Border Adjustment Mechanism*. Brussels, Belgium: European Commission, 2023.
- [10] *IFRS Foundation, IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information and IFRS S2 Climate-related Disclosures*. London, U.K.: IFRS Foundation, 2023.
- [11] P. J. DiMaggio and W. W. Powell, “The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields,” *American Sociological Review*, vol. 48, no. 2, pp. 147–160, 1983, doi: <https://doi.org/10.2307/2095101>
- [12] International Federation of Accountants, *International Guidance Document: Environmental Management Accounting*. New York, NY, USA: IFAC, 2005. [Online]. Available: <https://www.ifac.org/knowledge-gateway/professional-accountants-business-paib/publications/international-guidance-document-environmental-management-accounting>
- [13] *World Resources Institute and World Business Council for Sustainable Development, The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*. Washington, DC, USA: WRI and WBCSD, 2004.
- [14] F. Ascui and H. Lovell, “As frames collide: Making sense of carbon accounting,” *Accounting, Auditing & Accountability Journal*, vol. 24, no. 8, pp. 978–999, 2011.
- [15] C. A. Adams and G. R. Frost, “Integrating sustainability reporting into management practices,” *Accounting Forum*, vol. 32, no. 4, pp. 288–302, 2008, doi: <https://doi.org/10.1016/j.accfor.2008.05.002>
- [16] R. G. Eccles and M. P. Krzus, *One Report: Integrated Reporting for a Sustainable Strategy*. Hoboken, NJ, USA: John Wiley & Sons, 2010.
- [17] S. Seuring and M. Müller, “From a literature review to a conceptual framework for sustainable supply chain management,” *Journal of Cleaner Production*, vol. 16, no. 15, pp. 1699–1710, 2008, doi: <https://doi.org/10.1016/j.jclepro.2008.04.020>

- [18] *Committee of Sponsoring Organizations of the Treadway Commission, Achieving Effective Internal Control over Sustainability Reporting (ICSR)*. Durham, NC, USA: COSO, 2023.
- [19] M. A. Delmas and V. C. Burbano, “The drivers of greenwashing,” *California Management Review*, vol. 54, no. 1, pp. 64–87, 2011.
- [20] T. P. Lyon and A. Wren Montgomery, “The means and end of greenwash,” *Organization & Environment*, vol. 28, no. 2, pp. 223–249, 2015.
- [21] International Federation of Accountants, International Education Standards 2, 3, and 4 (Revised). New York, NY, USA: IFAC, 2025. [Online]. Available: <https://www.ifac.org/publications/international-education-standards-2-3-and-4-revised>
- [22] T. M. T. Vu, “Integrating ESG and sustainability reporting into accounting curriculum: A step toward responsible education,” *Educational Process: International Journal*, vol. 17, Art. no. e2025400, 2025, doi: <https://doi.org/10.22521/edupij.2025.17.400>
- [23] P. T. Le and T. T. H. Nguyen, “Improving the Quality of Accounting Human Resource in Vietnam in the Context of Digital Transformation: From Educational Perspective,” *Tạp chí Thiết bị Giáo dục*, no. 280, pp. 67–69, 2023. [Online]. Available: <https://vjol.info.vn/tctbgd/vi/issue/view/7486/>
- [24] W. Stubbs and J. Schapper, “Two approaches to curriculum development for educating for sustainability and CSR,” *International Journal of Sustainability in Higher Education*, vol. 12, no. 3, pp. 259–268, 2011, doi: <https://doi.org/10.1108/14676371111148045>
- [25] R. Lozano, “The state of sustainability reporting in universities,” *International Journal of Sustainability in Higher Education*, vol. 12, no. 1, pp. 67–78, 2011, doi: <https://doi.org/10.1108/146763711111098311>