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A Collaborative Framework for Digital Internal Control and ESG Governance in Hainan Free Trade Port

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Abstract: With the gradual implementation of the island-wide free trade port policy in Hainan, enterprises in Hainan free trade port are facing the compliance requirements of ESG authentication and EU carbon tariff while adapting to the policy. The triple compliance pressure makes the problem of digital internal control system and ESG governance of import and export enterprises on Hainan Island more and more obvious, and it is difficult to adapt to Hainan's simple tax system of "zero tariff, low tax rate and simple tax system" and the import and export supervision mode of "first line liberalization and second line control". Based on the standard method, theoretical analysis method, and system to analyze the coupling of digital ESG governance and internal control mechanism, in identifying close supervision, ESG verification, carbon tariff related compliance risk, based on establishing collaborative governance system, puts forward the phased implementation of the management system of the specific path. The study finds that there is a logical coupling between digital internal control and ESG governance, and the collaboration between the two can effectively solve the multiple compliance dilemmas of enterprises. Through the establishment of this cooperative mechanism, enterprise establish adaptation policy of free trade port management system, is the enterprise promote compliance ability and realize the sustainable development of the critical path. This paper enriches cross-research on corporate governance, digital internal control and ESG collaboration in Hainan free trade port, provides practical guidance for enterprise compliance management, and provides reference for regulatory authorities to optimize policies.

Keywords: Hainan free trade port; Digital internal control; ESG governance; Collaborative governance; Eu Carbon Tariff (CBAM)

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1. Introduction

Under the dual drivers of global economic integration and China's "dual carbon" goals, Hainan free trade port (FTP), China's only provincial-level free trade port, officially commenced island-wide closure operations in December 2025. Guided by the strategic positioning of "three zones and one center," the port has entered a critical stage of regulatory optimization and enterprise compliance adaptation. While implementing the "first

line liberalized, second line controlled" model along with preferential policies of "zero tariffs, low tax rates, and simplified taxation," the port has simultaneously strengthened cross-border supervision, placing heightened demands on risk prevention and internal governance for import and export enterprises.

Concurrently, ESG governance has shifted toward mandatory compliance. From 2026, China will fully enforce mandatory ESG information verification, requiring third-party authentication. At the same time, the EU Carbon Border Adjustment Mechanism (CBAM) will impose additional carbon tariffs on high-emission imported goods. Given Hainan FTP's strong orientation toward cross-border trade and its high proportion of exports to Europe, carbon accounting and footprint tracking have become essential prerequisites for exports, significantly raising the threshold for ESG management.

The synchronous superimposition of Hainan's island-wide closure policy, mandatory ESG authentication, and the EU carbon tariff has created a period of intensive policy overlap. These three forces form a tightly linked whole-chain compliance process of "regulation–accounting–disclosure–authentication." Any missing link can trigger systemic compliance risks.

In this context, a prominent governance dilemma has emerged: the fragmentation between digital internal control and ESG practices. Digital internal control primarily focuses on financial compliance and internal process optimization, whereas ESG governance emphasizes sustainable development and external responsibility fulfillment.

This study therefore examines the digital divide and governance challenges faced by enterprises in Hainan Free Trade Port under triple compliance pressures. It constructs a tailored collaborative governance framework that integrates digital internal control with ESG practices. The research not only enriches the theoretical intersection of risk management, internal control, and ESG studies, but also offers practical pathways for enterprises to reduce compliance costs, strengthen risk prevention, and achieve sustainable development in the Hainan Free Trade Port.

2. Literature review and theoretical foundations

2.1. Review of research in core areas

2.1.1. Digital internal control

It refers to the integration of big data, artificial intelligence, and other digital technologies with the traditional internal control system to realize the internal control mode of process automation, data accuracy, and real-time risk warning. The core role of the enterprise is to ensure the efficient and accurate implementation of internal control. The internal control of ordinary enterprises is to identify, evaluate and prevent various risks in the operation of enterprises. In the context of Hainan FTP, enterprises must complete the entire process of compliance such as customs declaration and capital flow in addition to the conventional internal control requirements.

Mamatelashvili *et al.* (2021) found that digital transformation can improve the economic security and sustainable development of enterprises and provide a guarantee for enterprises to enhance their internal control capabilities [1]. According to Fähndrich *et al.* (2024), digital internal control and standardized data management can help expand the scope of strategic and operational management control and improve the efficiency of management companies and internal organizations [2].

ESG governance research has now formed a mature research system of "disclosed-governance-performance", Studies focus on the adaptation strategies of enterprises after the implementation of the European

Union ESG Disclosure Directive (CSRD). Sharma *et al.* (2025) discussed the role of ESG compulsory disclosure in reshaping corporate governance [3].

The Chinese researchers focus on the mandatory ESG authentication system in 2026. Wang *et al.* (2026) found that there is a two-way promotion relationship between ESG governance and enterprise internal control and audit [4].

2.1.2. Research on collaborative governance of digital internal control and ESG

ESG covers three dimensions: environment (E), society (S), and governance (G), and is an important concept and mechanism for environmental protection and sustainable production and development in China. To achieve win-win cooperation among corporate stakeholders, China will make it mandatory for enterprises to meet the requirements of ESG policies by 2026.

Geng *et al.* (2025) proposed that digitalization can effectively improve the efficiency of ESG governance, effectively improve the efficiency of resource use and help enterprises implement ESG goals [5]. Tian *et al.* (2024), through DML model and empirical test, concluded that supply chain digitalization has a significant role in promoting ESG performance, especially for enterprises with strong cooperative culture, innovation ability and organizational ability [6]. Shen *et al.* (2025) proved that the digitalization of supply chain can significantly improve the ESG efficiency of enterprises by improving the efficiency and timeliness of information use and the efficiency of supply chain resources [7].

2.1.3. Theory of collaborative governance

Collaborative governance theory emphasizes pluralistic main body, organic linkage and integration of multi-dimensional resources, explains the digital collaborative internal logic of the internal control and the ESG governance, for the construction of the collaborative framework, implementation path design provides the core theory support, thereby rendering the orientation of corporate governance research.

2.2. Review of the study

Existing literature provides a theoretical foundation for digital internal control and ESG governance. However, it lacks specificity to the Hainan FTP context. Most studies examine single compliance pressures or focus on general listed companies, failing to address the superimposed triple compliance challenges, customs supervision, mandatory ESG authentication, and EU carbon tariffs, under the island-wide closure policy. Moreover, they rarely consider the unique regulatory model and business characteristics of import and export enterprises in Hainan FTP. This study fills these gaps by constructing a targeted collaborative governance framework that integrates digital internal control and ESG practices to meet the specific compliance and sustainable development needs of enterprises in this special policy environment.

3. The current situation and problems of import and export enterprises' governance in Hainan free trade port

3.1. Development characteristics of import and export enterprises in Hainan free trade port

The unique policy and institutional environment of Hainan FTP shapes its enterprises across three dimensions: ownership structure, business operations, and policy incentives.

Enterprises are private small, medium, and micro-sized firms (SMMEs). While they exhibit strong

operational flexibility and market responsiveness, limited capital and technological resources result in slow digital transformation. Many still rely on manual internal control and ESG practices, creating a significant digital divide compared with larger firms.

In terms of business characteristics, these enterprises engage in high-frequency cross-border transactions featuring complex global supply chains, elevated foreign exchange risks, and stringent compliance requirements. Multi-currency settlements further complicate capital flow management.

Policy-wise, the "zero tariffs, low tax rates, trade facilitation, and capital liberalization" framework reduces costs, simplifies customs procedures, and eases cross-border fund flows, enabling deeper integration into global value chains.

3.2. Characteristics and constructive collaboration of digital internal control and ESG

Despite the favorable policy environment, the governance of digital internal control and ESG in Hainan FTP enterprises remains fragmented. Digital internal control is limited to basic financial and customs compliance, while ESG governance is passive and disconnected from daily operations. This separation manifests in organizational silos, data isolation, insufficient process integration, and the absence of unified evaluation mechanisms. Such fragmentation hinders enterprises from effectively addressing the triple compliance pressures arising from customs supervision, mandatory ESG authentication, and the EU CBAM, constraining high-quality and sustainable development.

4. Internal mechanism of collaborative governance between digital internal control and ESG

Following the implementation of the island-wide closure policy in Hainan FTP, enterprises face heightened compliance pressures alongside growing demands for sustainable development. These forces drive digital internal control and ESG governance from fragmentation toward synergistic collaboration. This section analyzes the internal mechanisms underlying this constructive collaboration, focusing on the four key dimensions, goals, processes, technology, and organization. By addressing the specific development characteristics and governance weaknesses of enterprises in Hainan FTP, the analysis provides theoretical support and practical pathways for constructing an effective collaborative framework.

4.1. Goal constructive collaboration: Two-way fit from risk prevention and control to value creation

The core objectives of digital internal control and ESG governance exhibit strong alignment, both oriented toward enterprise sustainability. Together, they form an integrated goal system encompassing risk prevention, responsibility fulfillment, and value enhancement.

Digital internal control primarily aims to standardize business processes, mitigate financial and operational risks, and ensure regulatory compliance through digital tools. In the context of Hainan FTP, it addresses critical issues such as compliance gaps, capital security, and process irregularities in cross-border transactions, thereby establishing a solid foundation for enterprise survival and growth. This focus closely corresponds to the governance (G) dimension of ESG, which emphasizes robust risk management and transparent internal controls.

In contrast, ESG governance encompasses environmental (E), social (S), and governance (G) responsibilities, requiring enterprises to meet external mandates, including domestic ESG authentication and the EU CBAM, while enhancing brand reputation and long-term competitiveness through green operations and social responsibility. ESG governance complements digital internal control by providing a high-quality

development direction. In turn, digital internal control offers the institutional safeguards and technological support necessary for effective ESG implementation. This mutual reinforcement shifts digital internal control from passive compliance to active value creation, enabling enterprises to evolve from mere risk mitigation to sustainable competitive advantage.

4.2. Process constructive collaboration: Deep integration and linkage of the whole life cycle

Given the cross-border and complex nature of operations in Hainan Free Trade Port, synergistic collaboration requires deep integration of ESG requirements into the entire business life cycle of digital internal control.

In the pre-event risk assessment phase, digital internal control systems should incorporate ESG-related risk indicators, such as international sanctions, export controls, carbon emissions, and labor rights issues in the supply chain. This integration aligns with the port's "first line liberalized, second line controlled" regulatory model, enabling early identification of dual risks and supporting informed business decisions.

During the in-process control phase, ESG verification is embedded directly into core operations. For instance, cross-border procurement should simultaneously conduct internal control qualification audits and ESG screening for environmental and labor standards. In customs declaration and export procedures, compliance checks must account for both regulatory declarations and ESG requirements concerning carbon footprints and rules of origin. In financial settlement, internal fund controls are coordinated with ESG-oriented anti-money laundering and anti-tax avoidance measures. Such integration ensures that business processes satisfy both internal control standards and ESG expectations.

In the post-event audit phase, internal control audits are combined with ESG performance evaluation and disclosure. Digital systems facilitate cross-validation of operational data and ESG metrics, ensuring the reliability of disclosures. ESG performance feedback, in turn, helps identify weaknesses in internal controls, enabling continuous process optimization and improvement.

4.3. Technology collaboration: Bidirectional empowerment and efficiency improvement of digital technology

Digital technology forms the foundational enabler of synergistic governance, facilitating two-way empowerment between digital internal control and ESG practices while breaking down data silos and enhancing efficiency in cross-border operations.

On one hand, digital internal control technologies provide dedicated support for ESG governance. Big data analytics integrate multi-source information, including supply chain, carbon emission, and labor rights data, for comprehensive risk assessment. Artificial intelligence enables predictive early-warning models to detect potential environmental violations or supply chain non-compliance. Blockchain technology ensures full-link traceability of ESG information, addressing the traceability challenges faced by enterprises in Hainan Free Trade Port and guaranteeing data verifiability.

On the other hand, ESG governance demands drive the upgrading of digital internal control systems. The need for diversified and granular ESG data encourages the transition from siloed financial and customs controls to comprehensive, multi-dimensional monitoring. This promotes the embedding of ESG monitoring points, the improvement of data interfaces, and the seamless exchange of information between internal control and ESG modules. Consequently, ESG performance data can feedback into internal control risk assessments, enhancing their relevance and foresight.

4.4. Organizational coordination: Construction and linkage of cross-departmental governance community

Organizational constructive collaboration serves as the critical institutional guarantee for effective collaboration. Its essence lies in dismantling departmental barriers and establishing a cross-functional governance community characterized by unified leadership, clear division of responsibilities, and efficient coordination.

In practice, digital internal control is typically led by risk management, finance, and customs departments, while ESG governance tends to be dispersed across administration, operations, and strategy functions. To bridge this separation, enterprises should establish a high-level ESG and Risk Management Committee under the board of directors to oversee coordination, set unified goals, and clarify authority and accountability.

At the operational level, a cross-departmental working group should be formed, drawing members from risk control, finance, customs, operations, and IT departments. This group manages daily collaborative activities, process optimization, and issue resolution. Regular communication mechanisms, such as joint meetings and shared digital platforms, ensure timely exchange of information and prevent duplicated efforts. Furthermore, incorporating collaborative performance into departmental and individual evaluations incentivizes active cooperation, fostering a culture of shared governance responsibility.

Through these four synergistic mechanisms, goals, processes, technology, and organization, digital internal control and ESG governance can achieve organic integration. This not only helps enterprises in Hainan FTP overcome multi-dimensional compliance challenges but also provides a solid theoretical and practical foundation for the collaborative framework proposed in this study.

5. Establishment of collaborative governance system for import and export enterprises in Hainan free trade port

5.1. Construction principles

Compliance principle, in line with FTP customs supervision, ESG compulsory authentication and EU carbon tariff rules; Systematic principle, covering five core elements and realizing the synergy of modules; The principle of adaptability is in line with the characteristics of frequent cross-border transactions of enterprises and the majority of small, medium and micro enterprises to ensure operation; The cost-benefit principle, taking into account the governance effect and implementation cost, ADAPTS to the capital and technology strength of small, medium and micro enterprises.

5.2. Framework of collaborative governance system (“Five-in-One”)

With “collaborative empowerment, compliance and efficiency enhancement, and sustainable development” as the core, the system supports each other in five dimensions, solves the pain points of corporate governance, and fits the logic of collaborative mechanism.

5.2.1. Target layer: Strategic constructive collaboration target system

The overall goal is to build a compliant, efficient, green, and transparent governance model to help enterprises cope with the triple compliance pressure. Sub-objectives include: compliance objectives, prevention and control of cross-border tax, foreign exchange, customs and other risks. Environmental objectives include promoting green logistics, energy conservation and emission reduction, and adapting to carbon tariff requirements, social goals include standardizing labor rights and strengthening supply chain responsibility, while governance

objectives to achieve transparent operation and high-quality information disclosure.

5.2.2. Organizational layer: Collaborative governance of the organizational structure

To establish a three-level structure of "decision-making, execution and supervision", ESG and risk management committee are set up to coordinate and work together at the decision-making level; At the executive level, a cross-department working group was set up to be responsible for daily control and policy implementation. At the supervision level, the internal audit department is responsible for collaborative effectiveness audit to ensure the implementation of the system.

5.2.3. Process layer: Collaborative control mechanism of the entire process

By carrying out internal control qualification audit and ESG screening simultaneously in the procurement process, ESG requirements was embed into the core business process; Integration of energy consumption, production safety and quality internal control in production and storage; Customs declaration takes into account compliance declaration, carbon footprint and origin requirements; In the settlement process, the internal control of funds and ESG anti-money laundering and anti-tax avoidance should be coordinated.

5.2.4. Technology layer: Digital collaborative technology platform

At the technology layer, the construction of a digital collaborative platform is fundamental to enabling integrated governance and efficient data utilization. This involves establishing a unified database that connects industry, finance, and customs data, while opening interfaces between internal control systems and ESG-related information to facilitate seamless data exchange. On this basis, intelligent risk control modules should be deployed to enable real-time monitoring and early warning of cross-border ESG risks. Furthermore, the introduction of a blockchain-based traceability system can effectively address issues related to ESG data authenticity and traceability. To enhance operational efficiency and compliance, an automated information disclosure module should also be developed, reducing labor costs while ensuring adherence to relevant certification and disclosure requirements.

5.2.5. Evaluation layer: Collaborative performance evaluation system

At the evaluation layer, it is necessary to construct a comprehensive performance evaluation system that integrates both qualitative and quantitative approaches. This system should encompass three key dimensions, internal control, ESG performance, and collaborative effectiveness, and include indicators such as compliance rate, environmental compliance rate, and degree of data sharing. Through regular assessments and dynamic adjustments, the evaluation framework can be continuously refined to align with evolving enterprise needs and policy requirements, thereby ensuring the sustained effectiveness and adaptability of the overall system.

6. Conclusion

This paper focuses on the governance pain points of import and export enterprises after the closure of Hainan FTP, and studies the collaborative governance of digital internal control and ESG. It is found that the policy superposition of customs regulation, ESG compulsory authentication and EU carbon tariff makes enterprises face the compliance pressure of the whole chain of "supervision–accounting–disclosure–authentication", and the separation of digital internal control and ESG at the level of organization, data, process and evaluation is the core

bottleneck restricting the high-quality development of enterprises. Based on this, this paper constructs a five-in-one collaborative governance system of "goal–organization–process–technology–evaluation", which provides a theoretical framework and practical path for enterprises to solve the collaborative dilemma by clarifying the strategic collaborative goals, optimizing the three-level organizational structure, embedding the whole process collaborative control, building a lightweight technology platform and designing a composite evaluation system. The research shows that the system can effectively reduce compliance costs, strengthen risk prevention and control, and adapt to the special regulatory environment of free trade ports and international compliance requirements through target guidance, organizational coordination, process integration, technology empowerment, and evaluation closed loop. This study relies primarily on normative and theoretical analysis without empirical validation across enterprises of varied sizes and industries in Hainan. Consequently, the quantitative assessment of the framework's effectiveness remains limited. Future research could usefully employ post-closure operational data to empirically evaluate the framework's impact and develop differentiated implementation pathways tailored to various enterprise types. Additionally, researchers may explore the innovative application of emerging technologies such as generative AI and cross-border data platforms to further enhance collaborative governance, thereby supporting regulatory adaptation and sustainable development in Hainan FTP.

Disclosure statement

The author declares no conflict of interest.

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