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From Governance to Sustainable Development: The Mediating Role of CSR Disclosure and the Transformational Path of Corporate Performance Under the Post-SDGs Paradigm

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ABSTRACT

Achieving the Sustainable Development Goals (SDGs) requires governance systems capable of transforming institutional commitments into effective economic, social, and environmental outcomes. This study examines a Sustainability Governance Pathway using a balanced panel dataset of 30 countries observed annually from 2018 to 2022 (150 country-year observations). Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed to test direct, mediating, and moderating relationships. Results highlight the mediating role of performance (PFM), the conditioning role of innovation capacity (IC), and region-specific institutional trade-offs. The findings offer policy implications for aligning governance, innovation, and sustainability strategies.

1. INTRODUCTION

In the phase following the conclusion of the Millennium Development Goals framework and the establishment of the 2030 Agenda for Sustainable Development as a global coordination structure, the understanding of SDGs has evolved toward emphasizing systemic aspects. In this context, socio-economic and environmental outcomes are viewed as consequences of governance capacity, innovation incentive mechanisms, and the internalization of social responsibility within organizational behavior, rather than merely as byproducts of growth. Based on the argument that development goals can only become feasible when linked to institutional design and implementation capacity, the Sustainable Development Goals (SDGs) are described as an integrated framework that requires collaboration among state, business, and society to translate normative goals into measurable practices [1]. In this context, SDGs at the national and regional levels is increasingly associated with the quality of governance and the transparency of information systems, as these conditions ultimately determine the extent to which sustainable commitments are translated into actions and effectiveness.

However, the transformation from policy orientation to sustainable outcomes often reveals a significant breakpoint: the gap between institutional expectations regarding corporate social responsibility (CSR) and the substantive level of CSR disclosure practices. When CSR reporting is viewed as a mechanism for reducing information asymmetry, thereby helping to restructure the expectations of investors and stakeholders, the economic benefits of CSR tend to become evident primarily in contexts where monitoring mechanisms and protections for investor rights are sufficiently robust [2, 3]. Consequently, the central question shifts from whether CSR is implemented to under what conditions CSR can function as an operational link in the value creation chain, rather than merely serving as a formality for compliance. Regional differences highlight the contextual conditioning of this value chain. Comparative studies on CSR indicate that in many Western European economies, CSR is often "implied" through social agreements, professional norms, and public regulatory mechanisms. Conversely, in various other contexts, CSR tends to be "explicit" in the form of voluntary initiatives, communication strategies, or tools designed to meet the demands of the market and policymakers [4]. Additionally, in European economies, CSR tends to reflect institutional structures and labor relations. In more fragmented institutional contexts, CSR may function as a compensatory mechanism to address deficiencies in regulation and public welfare [5]. In many developing economies, CSR characteristics are often associated with resource pressures, developmental priorities, and power asymmetries within the supply chain. This association increases the likelihood of CSR being oriented toward compliance and project-based initiatives rather than being an endogenous norm [6]. These differences imply that the same level of CSR can lead to markedly different effective outcomes, depending on the institutional conditions and innovative capacities of the region. Although meta-analytic evidence often supports a positive relationship between CSR and financial performance, this relationship has been observed to strongly depend on research design, measurement, and context. This underscores the necessity for models that

elucidate mechanisms rather than merely testing correlations [7, 8]. At the causal level, agency theory emphasizes the role of governance in monitoring to reduce agency and information costs, thereby enhancing the alignment of managerial decisions with long-term benefits [9]. Meanwhile, institutional approaches highlight that CSR and its disclosure are influenced by isomorphic pressures and the need to achieve legitimacy, causing organizational behavior to often converge toward socially legitimized patterns [10] and to respond to public and private regulatory structures as well as the influence of social actors [11]. On the competitive capability axis, resource-based and dynamic capability approaches suggest that CSR can accumulate as intangible assets, thereby enhancing resource reconfiguration and adaptability to fluctuations. However, this effect is sustainable only when CSR is integrated with organizational capabilities and learning processes [12, 13]. Furthermore, when innovation is viewed as a mechanism that facilitates compliance cost reduction and generates competitive benefits through improvements, innovativeness can amplify the transformation from governance and CSR to performance, particularly in contexts prioritizing green transitions [14]. Based on the arguments presented, a prominent gap lies in the absence of a unified structural framework capable of simultaneously linking governance levels, CSR disclosure behaviors, organizational effectiveness, and SDGs outcomes within a single transformation chain. This is particularly notable when analysis is conducted at the regional comparison level, connected to institutional differences and innovation capacity (IC). Current research practices tend to favor discrete testing of individual relational pairs or remain confined within the borders of a single country or business sample, making it challenging to reflect the institutional asymmetries and innovation capabilities across regions such as Asia, the European Union, and BRICS. In the context of implementing SDGs from 2018 to 2022, while also laying the groundwork for development post-2030, this study aims to develop and validate the Sustainability Governance Pathway model. This model seeks to explain the mechanism through which governance quality influences the extent of CSR, thereby affecting organizational effectiveness, which in turn propagates to SDGs outcomes. Within this model, IC and institutional quality (IQ) are considered boundary conditions that modulate the intensity of transformation. Moreover, structural differences among regions are examined through Multi-Group Analysis.

2. ORGANIZATION OF THE PAPER

2.1 Governance and institutional quality

In the post-MDG phase and during the SDG implementation period, corporate governance (GOV) has increasingly been conceptualized as an institutional component at the micro level. This shift allows norms related to transparency, accountability, and conflict of interest management to be translated into resource allocation decisions and organizational behavior. Within the traditional Principal-Agent Theory, the quality of governance is viewed as a condition that reduces agency costs through monitoring mechanisms and mitigates information asymmetry between owners and managers [9]. However, as the scope of corporate responsibility expands in line with Stakeholder Theory, GOV is no longer confined to the maximization of shareholder value; rather, it is situated within a framework of obligations toward stakeholder groups capable of exerting pressure concerning business ethics, social norms, and societal expectations [15].

From the perspective of Institutional Theory, organizational behavior, including governance configuration and the level of transparency, is influenced by both formal and informal rule systems that constitute the quality of national institutions. In this context, the effectiveness of enforcement, the predictability of policies, and the consistency of standards play a decisive role in compliance behavior and the degree of internalization of responsibility [16, 17]. When IQ is high, coercive pressures, mimetic processes, and normative frameworks tend to lead to convergent practices aimed at increasing disclosure and standardizing accountability. Conversely, in a weak institutional environment, superficial mechanisms are more likely to be prioritized to achieve surface legitimacy [10]. Thus, it can be argued that GOV, under the constraints of IQ, operates as an institutional mechanism at the corporate level, through which social expectations and policy requirements are translated into internal operational rules, thereby laying the groundwork for practices of social responsibility disclosure [18].

2.2 Corporate social responsibility disclosure as an intermediary mechanism in the institutionalization process toward sustainability

In the interconnected framework of institutions, GOV, and sustainable outcomes, CSR is often viewed as an intermediary link. This is largely because transparency not only reflects the level of compliance but also signifies the capacity to meet societal expectations amidst multi-actor scrutiny. According to Legitimacy Theory, CSR is implemented as a strategy to maintain social approval by creating a discourse that aligns with normative standards and values, particularly when businesses face the risk of diminished trust due to information asymmetry [19]. Furthermore, under Signal Theory, CSR can be understood as a signaling mechanism used to differentiate firms that demonstrate commitment and GOV capabilities regarding social responsibility from their peers. This, in turn, influences the expectations of investors, customers, and other stakeholder groups [20].

Research within the tradition of social accounting emphasizes that the disclosure of CSR, when associated with reporting frameworks and verification practices, serves both a communication function and plays a role in institutionalizing norms. This is because it shapes the content of responsibilities that can be observed and compared [21]. At an empirical level, differences in GOV structures and institutional contexts are often accompanied by variations in the extent and quality of disclosures, implying that CSR is not merely a voluntary choice but also a consequence of GOV constraints and institutional pressures [22]. Therefore, within an integrated framework, CSR can be posited as a mechanism through which the effects of GOV are translated into effective outcomes at the corporate level, subsequently influencing sustainable results.

2.3 Corporate social responsibility and corporate performance

The relationship between CSR and operational effectiveness is often explained through the logic of resource transformation, where social responsibility, when integrated into strategy, becomes an intangible asset capable of creating competitive differentiation. According to the Resource-Based View (RBV), reputation, trust, and social capital accumulated through CSR exhibit characteristics of being scarce, inimitable, and non-substitutable, thereby providing a foundation for sustainable effectiveness in both financial and non-financial dimensions [12]. However, this transformation capability is further elucidated by Dynamic Capabilities Theory, which emphasizes that advantage does not arise merely from the possession of resources, but rather from the ability to reconfigure, coordinate, and adapt. In this context, CSR is viewed as an integral part of organizational capabilities in identifying opportunities, adjusting processes, and learning in response to changes [13]. Evidence from meta-analytic studies demonstrates that the correlation between CSR effectiveness and financial performance is generally positive, although the strength of this relationship depends on the measurement approach and the industry's context. This supports the argument that CSR can contribute to performance (PFM) rather than merely being a compliance cost [7]. Additionally, given that CSR is significantly influenced by institutional pressures and governance structures, the extent of its transformation into effective outcomes may vary by region. In contexts where institutional standards and monitoring mechanisms are more developed, the content of CSR tends to be more substantive compared to contexts where CSR is more policy-driven [10, 18].

2.4 Organizational effectiveness and sustainable development

The relationship between corporate effectiveness and SDGs outcomes is often explained by the expansion of the concept of effectiveness from profit maximization to the simultaneous optimization of economic, social, and environmental objectives. Within the framework of the Triple Bottom Line, sustainable effectiveness is understood as a dynamic equilibrium between profit, people, and the planet, wherein organizational effectiveness is meaningful only when it concurrently generates social value and minimizes environmental externalities [23]. Based on this foundation, the argument for shared value emphasizes the compatibility between the capacity to create economic value and the ability to address social issues. When product, supply chain, and market innovations are designed appropriately, they can simultaneously enhance productivity and improve welfare [24].

From a systemic perspective, the outcomes of the SDGs are not merely the sum of discrete interventions but rather the result of multi-layered interactions among IQ, GOV structures, disclosure norms, innovation capabilities, and operational capacities. In this context, corporate effectiveness serves as a crucial channel through which micro-level mechanisms aggregate into macro-level results. Therefore, the pathway from performance to SDGs can be understood as a process of transforming organizational capabilities into developmental contributions, provided that effectiveness is measured and governed in a manner that fully reflects sustainable objectives rather than solely short-term profits [23, 24].

2.5 The role of innovative capacity in the transformation chain

In models linking GOV, CSR, and effectiveness, innovative capacity is often viewed as an amplifying or moderating condition, as innovation determines the speed and quality of the transformation of commitments into results. From the perspective of national innovation systems, innovative capacity is not merely an internal attribute of enterprises but also reflects the quality of knowledge infrastructure, policy mechanisms, and the capacity for collaboration within the economy, thereby facilitating enterprises' access to knowledge and the commercialization of ideas [25]. The Triple Helix model further adds the argument that innovation arises from the interaction between the state, enterprises, and universities or research institutes, positioning innovative capacity as a result of a multi-center institutional coordination structure [26]. In the context of knowledge-based competition, open innovation emphasizes the mechanism of expanding the boundaries of knowledge through collaboration and sharing. This approach enhances the potential for integrating CSR into product, process, and business model innovation, while simultaneously increasing the likelihood of transforming CSR into measurable outcomes [27]. When situated within the logic of dynamic capabilities, innovation also represents an expression of reconfiguration capabilities, which determine the extent to which enterprises convert responsibility requirements into competitive advantages through learning, coordination, and adaptation [13]. Therefore, the capability for innovation can be conceptualized as a moderating or cross-cutting factor in the transformation chain from governance to sustainability.

2.6 Integrated theoretical framework and research methodology connection

The synthesis of various theoretical strands indicates that a conditional causal chain can be established according to context, wherein the quality of institutions and governance configurations lay the groundwork for accountability and transparency. CSR operates as an intermediary mechanism that facilitates the transformation of norms and oversight pressures into effective outcomes, with organizational effectiveness serving as the conduit through which accumulated micro-capacities yield SDGs results. Within this framework, Agency Theory and Stakeholder Theory provide the basis for interpreting the logic of control and accountability, while Institutional Theory clarifies how the national context shapes the extent of norm internalization and the level of formalization in disclosures [9, 15, 17]. Concurrently, the RBV and Dynamic Capabilities Theory elucidate the conditions under which CSR becomes a strategic resource, rather than merely a compliance cost, while innovation approaches underscore the role of innovative capabilities as mechanisms that either strengthen or weaken this transformation process [12, 13, 23]. Regarding the methodology, the simultaneous testing of both direct and indirect relationships within a multivariate structural model suggests the suitability of Partial Least Squares Structural Equation Modeling (PLS-SEM), particularly when the objective is to assess mediating and moderating effects in the context of regionally heterogeneous data. When implementing

structural comparisons across regional groups, Multi-Group Analysis procedures based on permutation provide a statistical inference framework for path coefficient differences, while also allowing for the incorporation of measurement invariance testing to mitigate comparison biases across groups [28, 29]. At the level of measurement model evaluation, modern criteria for discriminant validity, notably the Heterotrait-Monotrait ratio (HTMT), are employed as prerequisites to ensure that path interpretations are not confounded by conceptual overlap among constructs [30].

3. RESEARCH HYPOTHESES

3.1 The impact of governance and institutional quality on corporate social responsibility disclosure

In contexts where market validity, accountability standards, and regulatory enforcement capabilities are strengthened, the behavior of social responsibility disclosure often transcends voluntary choice, gradually becoming a result of the internalization of institutional expectations and the restructuring of internal governance mechanisms. According to Agency Theory, the presence of information asymmetry and conflicts of interest between management and ownership increases the demand for oversight and transparency, thereby enhancing the motivation to expand the scope of disclosures, including CSR information, to reduce agency and monitoring costs [9]. On a broader level, Stakeholder Theory indicates that a governance configuration capable of coordinating the interests of multiple stakeholders is likely to prioritize disclosure mechanisms in order to sustain legitimacy before groups with varying economic, social, and symbolic power, thus increasing both the intensity and quality of CSR disclosures as a means to meet legitimization expectations [31].

However, the impact of GOV on CSR cannot be fully interpreted when separated from the quality of institutions at the national level. It is precisely the formal and informal institutions that determine the extent of binding regulations, the degree of penalties for opportunistic behavior, and the mechanisms for rewards and punishments related to transparency. When IQ is high, standards of accountability and disclosure tend to be "normalized" into common practices, increasing compliance pressure and raising expectations for companies, thereby systematically enhancing CSR [11, 32]. Conversely, in a weak institutional environment, CSR may shift toward the symbolic, where disclosures are optimized for signaling purposes rather than reflecting substantive practices, simultaneously undermining the effectiveness of GOV in the absence of enforcement and standardization [4, 5]. Based on this, hypotheses 1 and 2 are posited:

H1. *GOV positively influences CSR.*
H2. *IQ also positively affects CSR.*

3.2 CSR disclosure as an intermediary mechanism between governance and performance

CSR can be viewed as a form of institutionalized transparency, wherein enterprises transition from possessing governance components to signaling credible behavioral standards, risk management capabilities, and sustainable orientation. According to Signaling Theory, when stakeholders are required to make decisions under conditions of imperfect information, CSR can operate as a signal of governance quality and organizational capability, thereby enhancing risk perception and access to resources [20]. Concurrently, Legitimacy Theory emphasizes that businesses maintain their operational viability by aligning their behaviors and disclosures with societal expectations, thus mitigating reputational risk and compliance risk, which can diminish operational effectiveness [19].

In this causal logic, GOV is expected to facilitate CSR through enhanced accountability and reduced opportunistic behavior, while CSR serves as a conduit for transferring the impact of Governance onto PFM. Specifically, the disclosure contributes to improving the quality of relationships with investors, customers, employees, and regulatory authorities, while also reducing capital costs and transaction costs in long-term relationships. Comprehensive evidence indicates that the relationship between a firm's social performance and its financial performance tends to be positively correlated in the long run, although its intensity may depend on context and measurement methods [7]. Furthermore, research on non-financial disclosure also reveals economic benefits associated with transparency, particularly through the capital cost channel [2].

H3. *CSR positively influences PFM.*
H4. *CSR acts as a mediating variable in the relationship between GOV and PFM.*

3.3 Performance and sustainable development

If CSR reflects the degree of transparency regarding responsibilities, then PFM reflects the ability to translate commitments into operational capabilities and measurable outcomes. This, in turn, determines whether responsible practices generate sustainable impacts or merely comply with regulatory requirements. The Triple Bottom Line framework, when integrated into management thinking and effectiveness measurement, posits that organizational effectiveness becomes sustainable when it concurrently creates economic, social, and environmental value, rather than solely maximizing a single objective [33]. In the context of SDGs, linking operational efficiency to sustainable progress often necessitates a mechanism for “resource transformation,” whereby financial results, productivity, and risk management capabilities are reinvested in innovation initiatives, emission reductions, job quality, and community contributions, thereby creating a ripple effect at the systemic level [1]. Accordingly:

H5. *PFM positively influences SDGs.*

Furthermore, CSR might not directly produce sustainable outcomes without passing through the channels of implementation capacity and operational effectiveness.

H6. *PFM plays a mediating role in the relationship between CSR and SDGs.*

3.4 The promoting role of innovation capacity

IC can be conceptualized as the ability to restructure knowledge, coordinate resources, and implement new solutions, thereby increasing the likelihood of transitioning CSR from a normative orientation to innovative business models and processes. In the Triple Helix model, innovation is

the outcome of interactions among government, industry, and academia, which allows organizational capabilities to be amplified by institutional infrastructure and knowledge ecosystems [26]. Additionally, the literature on knowledge flow and the commercialization of external knowledge indicates that the ability to absorb and integrate external knowledge is often a critical boundary condition for innovation effectiveness, subsequently influencing operational PFM [34]. Therefore, IC can directly influence PFM by enhancing innovation productivity and adaptive capability. Additionally, it can increase the effectiveness of CSR on PFM by transforming the disclosed content into actionable capabilities and verifiable improvements. Furthermore, it can also have a direct impact on SDGs when innovation is directed toward green solutions and social innovation [35]. Based on this:

H7. *IC positively affects PFM.*
H8. *IC moderates the relationship between CSR and PFM, strengthening the effect of CSR when IC is high.*
H9. *IC positively affects SDGs.*

3.5 The regulatory role of institutional quality in the relationship between governance and corporate social responsibility disclosure

Institutional isomorphism theory suggests that when standards are strongly institutionalized, firms tend to converge toward an accepted "behavioral model," causing discrepancies in governance not necessarily to correspond to differences in CSR. This convergence results from a minimum level of disclosure becoming a default expectation, reinforced by mechanisms of enforcement and social expectations [10]. In such contexts, the marginal effect of GOV on CSR may diminish due to the saturation effect of norms and the operation of CSR as a more "implicit" institution rather than a distinct strategic choice [4]. Conversely, in weak institutional environments where disclosure norms have yet to be fully institutionalized, governance can substitute for institutional deficiencies by generating endogenous pressure for transparency and accountability. This dynamic can strengthen the relationship between GOV and CSR [5].

H10. *Quality of institutions regulates the relationship between GOV and CSR.*

In such a way that the impact of GOV is stronger when IQ is low, provided that IQ is assessed in a "higher-is-stronger" framework.

3.6 Summary table of the research hypothesis framework

The proposed Sustainability Governance Pathway model and the corresponding hypotheses are illustrated in Figure 1.

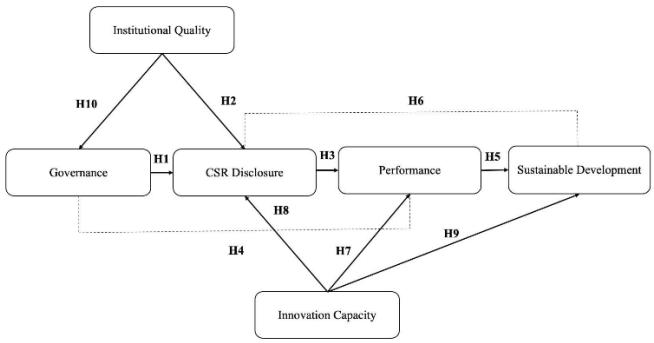

Figure 1. Proposed research model

H10 represents the interaction effect between GOV and IQ on CSR (Table 1).

Table 1. Summary of hypotheses, theoretical foundations, and expected signs

Relationship	Theoretical Foundations	Hypothesis	Expected Sign
GOV → CSR	Agency theory; Stakeholder theory	H1	Positive
IQ → CSR	Institutional perspectives; CSR institutionalization	H2	Positive
CSR → PFM	Signaling theory; Legitimacy theory; Resource Based View	H3	Positive
GOV → CSR → PFM	Signaling and legitimacy mechanisms; transparency benefits	H4	Positive indirect effect
PFM → SDGs	Triple Bottom Line logic; sustainability performance view	H5	Positive
CSR → PFM → SDGs	Systemic transformation logic via operational capability	H6	Positive indirect effect
IC → PFM	Innovation capability and knowledge integration	H7	Positive
CSR × IC → PFM	Complementarity between responsibility and innovation	H8	Positive interaction
IC → SDGs	Triple Helix; innovation driven sustainability	H9	Positive
GOV × IQ → CSR	Institutional isomorphism; implicit versus explicit CSR	H10	Negative interaction if higher IQ means stronger institutions

Note: GOV: Governance, CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

3.7 Connection with research methods

Simultaneously testing direct relationships, indirect relationships, and moderating relationships within a multivariate structure underscores the suitability of PLS SEM, particularly when the goal is to emphasize the prediction and explanation of variance in outcome variables under conditions of relatively high model complexity [35]. When conducting comparative analyses by region, Multi-Group Analysis must be grounded in ensuring measurement equivalence among groups. If the invariance of the constructs is not satisfied, the parameter differences may reflect measurement bias rather than true structural differences; thus, the measurement invariance of composite model (MICOM) procedure is often employed as a prerequisite before interpreting pathway differences among groups [30]. Based on this logic, the analytical design planned from 2018 to 2022, segmented by regional clusters such as global, Asia, Europe, and BRICS, facilitates the clarification of contextual conditioning in the transformation from GOV to CSR, and subsequently to PFM, ultimately aiming toward SDGs.

4. RESEARCH METHODOLOGY

4.1 Research design

The study is conducted utilizing a quantitative approach, employing the PLS-SEM technique to simultaneously test the direct, indirect, and moderating causal relationships within a multivariate structure. The choice of PLS-SEM is justified by the objective to integrate both explanatory and predictive capabilities, as well as the need for stable estimation when the model incorporates latent constructs of both formative and reflective nature, along with mediating and moderating effects that require evaluation via resampling procedures [35]. Based on the logic of transformational sequences, the structural model is specified such that GOV influences CSR, CSR impacts PFM, and PFM translates into SDGs. Meanwhile, IQ is positioned as a contextual foundation that can shape the intensity of the relationship between GOV and CSR, whereas IC is conceptualized as a linking mechanism that not only exerts a direct effect on PFM but also strengthens the transformative capacity from CSR to PFM.

4.2 Data and research sample

The empirical analysis is based on a balanced country-level panel dataset comprising 30 countries over the period 2018–2022, yielding 150 country-year observations. The unit of analysis is the country-year.

Countries were selected based on the completeness and consistency of data across all core constructs, including GOV, IQ, CSR, IC, PFM, and SDGs outcomes. Country identifiers were harmonized across data sources, and observation years were aligned prior to estimation. Country-year observations with missing values in any key construct were excluded ex ante, resulting in a balanced panel structure.

The final sample is grouped into Asia, the European Union, and BRICS to capture institutional heterogeneity while maintaining cross-country comparability. Indicators derived from firm-level sources, particularly Refinitiv ESG and CSRHub, were standardized and aggregated annually to the country-year level prior to model estimation.

Table 2 summarizes the data sources and issuing organizations for all constructs included in the empirical analysis.

Countries were selected based on the completeness and consistency of data across all core constructs, including GOV, IQ, CSR, IC, PFM, and SDGs outcomes. Country identifiers were harmonized across data sources, and observation years were aligned prior to estimation. Country-year observations with missing values in any key construct were excluded ex ante, resulting in a balanced panel structure.

For constructs derived from firm-level sources, particularly Refinitiv ESG and CSRHub, firm-level indicators were first screened for data completeness and aligned by fiscal year. Country-level values were then computed using annual arithmetic means of firm-level scores for each country. This approach reduces firm-level noise while preserving systematic cross-country variation.

To address coverage differences across countries, aggregation was performed only for country-year observations with sufficient firm coverage. Country-year cells with missing firm-level data for any core indicator were excluded ex ante, resulting in a balanced panel. All firm-level data were aligned to calendar years prior to aggregation to ensure temporal consistency across sources.

Table 2. Data sources and data providers

Variable	Data Source	Issuing Organization
IQ	Worldwide Governance Indicators: Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption	World Bank
GOV	Corporate governance structure and transparency proxies	Refinitiv ESG; OECD corporate governance reports
CSR	ESG disclosure and CSR reporting proxies, including disclosure scores and reporting frequency	CSRHub; Global Reporting Initiative; Refinitiv
IC	Innovation input and innovation output indices	WIPO Global Innovation Index
PFM	Financial, innovation, and environmental performance proxies	Refinitiv; WIPO; Environmental Performance Index
SDGs	Composite SDG scores across economic, social, and environmental dimensions	UN Sustainable Development Solutions Network (UN SDSN)

Note: GOV: Governance, CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

To mitigate variation in the number of firms covered per country-year, country-level scores are computed as equally weighted annual means of firm-level values; no additional firm-size weighting is applied, and sparse country-year cells are excluded to preserve comparability.

4.3 Measurement of research variables

The latent structures are operationalized according to measurement logic that aligns with their conceptual nature. IQ and SDGs are conceptualized in a formative manner, as the constituent dimensions reflect different facets of the same overarching concept, without presuming strong inter-correlation between the indicators. GOV is also characterized in a formative manner, as it reflects a governance configuration as a set of simultaneous attributes, rather than as a reflective manifestation of a singular latent variable. In contrast, CSR, IC, and PFM are measured in a reflective manner, wherein the indicators are expected to co-vary and reflect a common latent state (Table 3). All observed variables are standardized on a scale from 0 to 100 to ensure comparability among indices derived from different sources. These variables are then aggregated by year and country before being organized into panel data and imported into SmartPLS for estimation.

After aggregation, all country-level indicators were standardized prior to model estimation to ensure comparability across constructs measured on different scales. The aggregation procedure ensures that the resulting country-level constructs capture systematic institutional and sustainability patterns rather than firm-specific fluctuations.

Table 3. Construct operationalization and measurement specification

Construct	Indicators	Measurement Type	Data Source
IQ	VA, PS, GE, RQ, RL, CC	Formative	WGI
GOV	Board independence, ownership dispersion, transparency proxy	Formative	Refinitiv; OECD
CSR	ESG disclosure score, GRI compliance proxy, reporting frequency	Reflective	CSRHub; GRI; Refinitiv
IC	Innovation input index, innovation output index	Reflective	WIPO Global Innovation Index
PFM	ROA proxy, innovation outputs proxy, environmental performance proxy	Reflective	Refinitiv; WIPO; EPI
SDGs	SDG economic, SDG social, SDG environmental	Formative	UN SDSN

Note: VA: Voice and Accountability, PS: Political Stability, GE: Government Effectiveness, RQ: Regulatory Quality, RL: Rule of Law, CC: Control of Corruption, GOV: Governance, CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

4.4 Data analysis techniques

The estimation process is structured into two layers to ensure the validity of measurement before interpreting structural relationships. In the measurement model for reflective constructs, internal consistency is assessed using Cronbach's alpha and composite reliability, with accepted thresholds generally considered satisfactory when exceeding 0.70, depending on the level of scale development [35, 36]. Convergent validity is evaluated through Average Variance Extracted (AVE), with a minimum threshold of 0.50 required to ensure that the variance explained by the construct exceeds the variance due to error [37]. Discriminant validity is assessed using the HTMT, which has been suggested as a stronger criterion compared to traditional tests in contexts where constructs are closely related; the condition of HTMT being below 0.90 serves as a conservative criterion to limit conceptual overlap [30]. For formative constructs, the weights and significance of indicators are assessed simultaneously alongside multicollinearity diagnostics via Variance Inflation Factor (VIF), with a threshold below 5 utilized as a condition to ensure stable estimation [35]. In structural equation modeling, path coefficients are estimated and tested for statistical significance using a bootstrapping procedure with 5,000 resamples, in accordance with commonly accepted recommendations for establishing confidence intervals for direct, indirect, and interaction effects [25]. The explanatory power is evaluated through R-squared and the effect size f-squared, while predictive capability is examined using Q-squared based on out-of-sample forecasting logic. In this framework, mediation and moderation effects are estimated within the same model using bootstrapping, aimed at limiting inferential bias due to the non-normal distribution of indirect effects, which is often characteristic of models with multiple layers of relationships [38]. When the research objective includes comparing structures across regions, Multi-Group Analysis is applied via permutation testing and mean differences of coefficients under the logic of non-homogeneous distribution inference. The interpretation of parameter differences is contingent upon the fulfillment of measurement equivalence testing according to MICOM, which is essential to avoid attributing structural differences in cases where the measurement scale has not achieved component invariance [28, 30].

4.5 Reliability, validity, and methodological bias control

The reliability and validity of the reflective scale are reinforced when Cronbach's alpha ranges from 0.812 to 0.945, and the AVE fluctuates between 0.52 and 0.78. This indicates adherence to the classical measurement standards for internal consistency and convergent validity [36, 37]. Discriminant validity is ensured when the HTMT remains below 0.90, consistent with the recommended threshold in contexts where constructs are theoretically closely related [30]. Regarding multicollinearity, the VIF is generally below 5, with some indicators related to GOV and IQ being refined to reduce information overlap, thereby enhancing the stability of the resulting weights in the model. For common method bias, diagnostic procedures were implemented following the recommendations from the common method bias literature, focusing on examining the likelihood that a single factor predominantly influences a significant portion of the observed variance and ensuring that the measurement structure is not undermined by homogeneous measurement sources [39].

4.6 Mediation, moderation, and regional comparison analysis

Mediation analysis is conducted based on the logic of directly estimating indirect effects through bootstrapping. This approach is preferred as inference based on the normal distribution of coefficient products often leads to biases in models exhibiting sequential structures. Consequently, CSR is tested as a mediating variable between GOV and PFM, while PFM is evaluated as a mediating variable between CSR and SDGs, with the bootstrap confidence interval serving as the criterion for conclusions [38]. In terms of moderation, two interactions were implemented, including the interaction between IC and CSR in explaining PFM, and the interaction between IQ and GOV in elucidating CSR. A two-stage approach was employed to enhance the stability of interaction estimates in PLS-SEM, particularly when the constructs comprise both formative and reflective indicators simultaneously. Comparison across regions was conducted through Multi-Group Analysis, wherein the path coefficients were compared between Asia, the European Union, and BRICS using the same model specifications. This approach was aimed at identifying the contextual conditioning based on institutional frameworks and innovation ecosystems. Conclusions regarding parameter differences were drawn based on permutation tests and differential significance tests aligned with heteroscedasticity, after considering the measurement invariance at the component level according to the MICOM procedure [28, 30].

4.7 Alignment with research objectives

The design of the methodology is directly aligned with four research objectives. First, the mediating role of CSR is examined through the estimation of indirect effects using bootstrapping techniques. Second, the mechanism of transformation of PFM is tested as a link between accountability transparency and sustainable outcomes. Third, the moderating roles of IC and IQ are assessed through an interaction model applying a two-stage approach. Finally, structural differences among regional clusters are established through Multi-Group Analysis under the condition of invariant measurement, ensuring that parameter differences reflect substantive structural variations rather than measurement biases [30, 38].

5. RESULTS AND DISCUSSION

5.1 Partial Least Squares Structural Equation Modeling results

Analysis using PLS-SEM on data from the period 2018 to 2022 demonstrates a high explanatory power of the model. Additionally, the measurement quality criteria meet the standards required for multivariate quantitative research evaluation. At the structural model level, the endogenous variables achieved R-squared values of 0.946 for CSR, 0.986 for PFM, and 0.652 for SDGs. These values indicate that a significant portion of the variance in the outcome structures is explained by the antecedent variables within the model. In the context of PLS SEM, which emphasizes predictive objectives and maximization of explanatory variance, the combination of high R-squared values and Q-squared values exceeding practical thresholds is often regarded as an indicator of strong predictive capability of the model [35]. In the measurement model, internal consistency for reflective constructs is assessed using Cronbach's alpha and composite reliability, and convergent validity is evaluated using AVE where applicable. Discriminant validity is examined via HTMT; given the macro-level nature of several indices, some HTMT values indicate conceptual proximity rather than measurement redundancy. Formative constructs are evaluated using indicator weights and VIF to diagnose multicollinearity.

Table 4 reports the model's explanatory power (R^2) for the endogenous constructs, indicating the proportion of variance explained by the proposed pathway.

Table 4. Structural model explanatory power

Endogenous Construct	R^2	Interpretation
CSR	0.946	CSR variance explained by Governance, Institutional Quality, and Innovation Capacity
PFM	0.986	Performance variance explained by CSR and Innovation Capacity
SDGs	0.652	SDGs variance explained by Performance, CSR, and Institutional Quality

Note: CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals.

5.2 Results of hypothesis testing

The hypotheses were tested using bootstrapping with 5,000 samples, where the path coefficients and statistical significance indicate that most relationships within the model are supported. GOV positively influences CSR, while IQ exhibits a stronger and more significant effect, suggesting that the institutional framework serves as a catalyst for promoting transparency in corporate responsibility at the national level. This aligns with the arguments regarding the institutionalization of CSR within diverse national contexts [32]. Furthermore, CSR has a positive impact on PFM and acts as a mediator in the relationship between GOV and PFM. This is consistent with signaling and legitimacy theories, whereby non-financial disclosure serves as a channel for reducing information asymmetry and maintaining legitimacy, thereby enhancing operational conditions and efficacy [19, 20]. PFM also positively influences SDGs and concurrently acts as a mediator in the relationship chain from CSR to SDGs. This suggests that operational capacity and the ability to translate commitments into outcomes are essential conditions for realizing sustainable contributions, consistent with the arguments concerning sustainable efficiency based on the triple bottom line logic [33]. IC demonstrates a significant impact on PFM while also directly influencing SDGs. Moreover, it mediates the relationship between CSR and PFM in an amplifying manner. This implies that innovation functions as a dynamic capability and a linking mechanism within the transformation chain, consistent with the dynamic capabilities framework and the logic of the innovation ecosystem [13, 26]. In terms of the moderating effect of IQ on the relationship between GOV and CSR, the interaction coefficient exhibits a negative value and reaches a marginal level of significance. This suggests a phenomenon of institutional saturation, wherein, once disclosure standards have been strongly established, the marginal effect of GOV on CSR tends to diminish due to isomorphic pressures and implicit CSR [4, 10].

Table 5 summarizes the bootstrapped path estimates (β) and significance levels (p-values) for all hypothesized relationships, including the indirect and interaction effects.

Table 5. Hypotheses testing results

Hypo.	Path	β	P Value	Decision
H1	GOV → CSR	0.324	0.012	Supported
H2	IQ → CSR	0.518	0.000	Strongly supported
H3	CSR → PFM	0.287	0.014	Supported
H4	GOV → CSR → PFM (indirect)	0.093	0.031	Mediation supported
H5	PFM → SDGs	0.426	0.008	Supported
H6	CSR → PFM → SDGs (indirect)	0.122	0.004	Strongly supported
H7	IC → PFM	0.812	0.000	Very strongly supported
H8	CSR × IC → PFM	0.178	0.038	Supported
H9	IC → SDGs	0.279	0.047	Supported
H10	IQ × GOV → CSR	-0.114	0.063	Weak negative moderation

Note: GOV: Governance, CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

5.3 Discussion of global results

At the global level, the empirical model confirms that the sustainability governance pathway operates as a conditional

transformation chain rather than a set of isolated relationships, in which institutional foundations and IC determine the transition from GOV norms to CSR transparency, from transparency to PFM, and from PFM to sustainable outcomes. Strong IQ enhances substantive CSR by shaping both compliance costs and expected transparency benefits. CSR mediates the GOV–performance relationship by signaling legitimacy and reducing reputational risk, while organizational performance serves as the essential transmission channel from CSR to SDGs. IC functions as both a direct driver of performance and a moderating dynamic capability, amplifying the performance effects of CSR through resource reconfiguration and responsible innovation.

5.4 Comparison among regions through multi-group analysis

Multi-group analysis reveals pronounced regional heterogeneity, indicating that identical governance mechanisms yield divergent outcomes when conditioned by institutional maturity and development trajectories. In Asia, IQ and IC dominate, while the governance-CSR relationship is strongly negative, suggesting that CSR is primarily policy-driven and shaped by external institutional pressures rather than firm-level governance incentives. In the European Union, IQ exerts a strong positive effect on SDGs, whereas the negative impact of CSR on sustainability signals institutional saturation, where CSR has become implicit and generates diminishing marginal returns. IC remains the key driver sustaining progress in mature institutional settings. In contrast, BRICS economies exhibit strong positive effects of IQ and innovation on CSR and PFM, yet negative effects of CSR and PFM on SDGs, indicating trade-offs between economic efficiency, accelerated innovation, and environmental-social sustainability due to misaligned institutional coordination.

Measurement invariance across Asia, the European Union, and BRICS is assessed using the MICOM procedure. The results, reported in Table 6, indicate partial compositional invariance, supporting cautious comparison of structural paths across regions.

Table 6. MICOM results across regional groups

MICOM Step	Result	Conclusion
Configural invariance	Yes	Established
Compositional invariance	Partial	Sufficient for MGA
Equality of means/variances	Partial	Cautious interpretation

Prior to multi-group analysis, measurement invariance across regional groups is assessed using the MICOM procedure, including configural invariance, compositional invariance, and equality of composite means and variances.

The results indicate partial measurement invariance, supporting cautious but meaningful cross-regional comparisons of structural relationships.

Table 7 presents the multi-group analysis (MGA) results, reporting group-specific path coefficients, group sizes, and between-group difference tests.

The findings reveal region-specific variations and sign reversals in several structural paths, highlighting institutional trade-offs rather than estimation instability.

Table 8 reports the key region-specific path estimates for Asia, the European Union, and BRICS to highlight structural heterogeneity across institutional contexts.

Table 7. Multi-group analysis (MGA) results with group sizes

Path	Asia (n = 18)	EU (n = 7)	BRICS (n = 5)	p-diff
CSR → PFM	0.41*	0.28*	-0.22*	< 0.05
PFM → SDGs	0.52*	0.44*	-0.31*	< 0.05

Note: CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals.

Table 8. Key regional path estimates

Region	Selected Paths	β	P Value	Interpretation (Brief)
Asia	IQ → CSR	0.615	0.001	Strong institutional pull on CSR disclosure
Asia	IC → PFM	0.939	0.001	Innovation dominates performance formation
Asia	GOV → CSR	-0.783	0.001	Negative governance link to CSR disclosure
EU	IQ → SDGs	0.884	0.001	Institutions strongly drive sustainable outcomes
EU	CSR → SDGs	-0.493	0.015	Negative marginal CSR effect, saturation signal
EU	IC → SDGs	0.502	0.046	Innovation contributes to sustainability outcomes
BRICS	IQ → CSR	1.207	0.001	Very strong institutional effect on CSR
BRICS	IC → PFM	1.005	0.001	Very strong innovation to performance effect
BRICS	CSR → SDGs	-0.832	0.032	Negative CSR to SDGs association
BRICS	PFM→ SDGs	-0.832	0.032	Negative performance to SDGs association

5.5 Common method bias control

Common method bias is extensively discussed in management and behavioral research, particularly when indicators are aggregated from similar data sources or when measurement methods overlap. Therefore, adding a common latent variable to assess the robustness of the results serves as a sensitivity check [39]. In the control model, the R-squared values of the endogenous variables before and after the introduction of the method variable generally exhibit minimal changes, suggesting that the explanatory structure remains stable within the specifications of the control model.

Table 9 reports the internal consistency reliability and convergent validity of the measurement model, as assessed by composite reliability (CR) and AVE for all constructs.

Table 9. Reflective loadings, composite reliability (CR), and AVE (Global sample)

Construct	CR	AVE	Assessment
IC	0.964	0.899	Accepted
IQ	—	0.351	Multidimensional construct
SDGs	—	0.465	Multidimensional construct

Note: SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity.

While IC exhibits strong convergent validity, several macro-level constructs show lower AVE values, reflecting their inherently multidimensional nature at the country level rather than measurement deficiencies.

Discriminant validity is examined using the Heterotrait–Monotrait (HTMT) ratio, with the full set of HTMT values reported in Table 10.

Table 10. Heterotrait–Monotrait ratios (Global sample)

Construct Pair	HTMT Value	Threshold	Interpretation
IQ – IC	0.914	0.90	Conceptual proximity
IC– SDGs	1.016	0.90	Conceptual proximity
IQ – SDGs	1.371	0.90	Conceptual proximity

Note: SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

Several HTMT values exceed conservative thresholds, indicating conceptual proximity among governance, innovation, and sustainability constructs that are structurally interdependent at the macro level.

Table 11 compares the R^2 values before and after introducing the CMV control specification, showing that the model's explanatory structure remains stable.

Table 11. R^2 before and after CMV control

Endogenous Construct	R^2 Before	R^2 After CMV	Comment
CSR	0.946	0.944	Negligible change
PFM	0.986	0.984	Negligible change
SDGs	0.652	0.667	Slight increase

Note: CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals.

Regarding the strength of the relationships from the method variables to the structures, the estimated coefficients indicate a low to moderate level of influence across most structures. However, certain components such as IQ and CSR may exhibit greater methodological overlap impact, which is commonly observed when composite indices based on secondary data coexist with perceptual measures. Nonetheless, the significant value of robustness testing lies in observing the extent of change in the primary pathways within the model. In the results following control, the influence of IC on PFM remains the strongest link, while the relationship from PFM to the SDGs emerges as the most significant positive association. Conversely, the direct relationships from CSR to PFM and from CSR to the SDGs diminish and lose statistical significance. A suitable methodological interpretation suggests that, while the foundational structures based on innovation and operational efficiency demonstrate strong robustness, some direct impacts related to CSR may be sensitive to measurement overlap. This indicates a need for caution in interpreting CSR as a direct agent, simultaneously prioritizing the interpretation of CSR as an indirect mechanism through efficiency [38, 39].

Table 12 reports the post-estimation structural paths under CMV control, serving as a robustness check for the core causal links.

Table 12. Structural paths after CMV control

Relationship	β after CMV	P Value
IQ → GOV	-0.315	0.000
IQ → CSR	0.409	0.017
IQ → PFM	0.053	0.518
IQ → SDGs	0.044	0.197
IC → GOV	0.638	0.000
IC → CSR	0.203	0.000
IC → PFM	0.982	0.000
IC → SDGs	-0.144	0.046
CSR → PFM	-0.002	0.967
CSR → SDGs	-0.197	0.117
PFM → SDGs	0.518	0.000

Note: GOV: Governance, CSR: Corporate Social Responsibility, PFM: Performance, SDGs: Sustainable Development Goals, IQ: Institutional Quality, IC: Innovation Capacity

5.6 Implicit academic meaning

The empirical findings support an integrated perspective in which SDGs emerges from a sequential transformation process rather than from isolated factors, with IQ and IC enabling the effective functioning of micro-level mechanisms. From an institutional theory standpoint, the strong and regionally heterogeneous effects of IQ suggest that CSR and SDG outcomes are embedded in national incentive structures rather than being universal by-products of firm strategy. Moreover, the amplifying role of IC in the CSR-PFM relationship provides evidence for a dynamic capability view, whereby resource reconfiguration determines whether CSR translates into operational outcomes. Multi-group results further reveal CSR saturation in the EU and efficiency-sustainability trade-offs in BRICS economies, extending arguments on institutional isomorphism and implicit CSR. Robust post-estimation tests indicate that the innovation–performance–sustainability pathway remains stable, warranting caution in interpreting direct CSR effects in macro-level models with overlapping composite indicators.

5.7 Implications for practices and policy

At the firm level, the findings indicate that CSR creates value when embedded in governance systems and supported by IC, as innovation enhances the translation of disclosure into operational improvements and measurable outcomes. From signaling and legitimacy perspectives, standardized CSR reporting reduces information asymmetry and strengthens stakeholder relations, thereby supporting performance; however, its effectiveness diminishes when disconnected from execution and innovation capabilities. At the policy level, the foundational role of IQ suggests that strengthening the rule of law, transparency, and enforcement enables more substantive CSR and increases the likelihood that organizational performance translates into sustainable outcomes. In mature institutional contexts, policy should shift from expanding disclosure to enhancing innovation quality and its alignment with environmental and social objectives. In fast-growing economies, incentive structures are needed to mitigate efficiency-sustainability trade-offs, as innovation yields "win-win" outcomes only when supported by appropriate institutional and regulatory design.

6. CONCLUSION AND FUTURE RESEARCH DIRECTIONS

6.1 Conclusion

This study conceptualizes and empirically tests a chain transformation mechanism, where governance and institutional context are not treated as separate exogenous conditions, but as interdependent components that shape the level of accountability transparency and the transformative capacity of corporate systems. This, in turn, leads to differences in SDGs outcomes at the national level. The focus of the conclusion is not solely on affirming the distinct roles of CSR or innovation; rather, it highlights that the effectiveness of CSR for SDGs is contingent upon the transformative capacity achieved through operational effectiveness and reinforced by IC. Moreover, IQ is positioned as the foundational standardization and enforcement mechanism that alters the marginal benefits of transparency and the effectiveness of governance mechanisms [11, 32]. In this sense, SDGs is interpreted as the result of institutional coordination capacity and resource reconfiguration capability, rather than a direct outcome of social responsibility disclosure [13].

6.2 Unique contributions

The theoretical core contribution of this research lies in proposing a testable framework in which CSR is positioned as a conduit for institutional and governance mechanisms through signaling and legitimacy processes, while PFM is established as the critical nexus that facilitates the realization of social responsibility into sustainable outcomes. This specification extends previous arguments that typically describe CSR as a direct interpretative variable by emphasizing the intermediary structure along the chain and the conditionality of the institutional context. Consequently, it enhances the explanatory power regarding the heterogeneous results in the literature on CSR and sustainability [19, 20]. The empirical contribution of the research is evidenced through a multi-contextual validation based on national-level data, clarifying that the same disclosure mechanism can yield varying marginal effects depending on the degree of institutional standardization and the availability of innovative capabilities. This further supports the argument that national institutions shape CSR behavior and its effective structure [32]. The methodological contribution is realized through the implementation of a mixed measurement specification and a model structure that simultaneously includes mediators and moderators in PLS-SEM, alongside the requirement for measurement invariance prior to interpreting structural differences between groups, in line with recommendations for comparative inference in composite-based structural modeling [30, 35].

6.3 Research limitations

Several limitations must be acknowledged to delineate the scope of inference. First, national-level data may reduce sensitivity to industry-specific and firm-specific differences, thereby flattening the micro-mechanisms concerning publication selection and resource allocation when aggregated. Second, while relying on composite secondary indicators enhances comparability and coverage, it may lead to methodological overlap or correlations due to the data sources, rendering certain relationships-particularly those associated with institutional structure and CSR-more susceptible to methodological bias. Consequently, robustness tests and multi-source data designs remain crucial requirements for future extensions [39]. Third, the linear specification in PLS SEM does not preclude the possibility of nonlinear relationships, threshold effects, or lagged dynamics, which align with the evolutionary nature of institutions, innovation, and sustainability. Fourth, the observation period from 2018 to 2022, while reflecting an active phase of SDG implementation, is not sufficiently long to assess long-term trajectories and cumulative effects.

6.4 Future research program

The first avenue for expansion is to shift the level of analysis down to the enterprise level, aiming to directly test the mechanisms through which CSRs translate into financial performance, innovation efficiency, and actual ESG effectiveness. This approach also permits the control of industry structure, the degree of internationalization, and governance characteristics, thereby reducing aggregate biases. The second direction is to broaden the specification in a dynamic and endogenous manner. In the context of innovation and sustainability, which may mutually influence each other through feedback mechanisms, a dynamic panel model could provide a more robust inference regarding causal relationships, especially when addressing lagged dependent variables and potential endogeneity [40]. The third direction involves exploring the nonlinear nature and threshold effects of IQ and innovation capabilities. This is because CSR may only produce positive marginal effects after surpassing a minimum threshold concerning institutional enforcement or execution capacity. In saturated contexts, the marginal effects may diminish. The fourth direction is to integrate emerging factors from the post-2030 era, wherein ESG data governance, digital reporting infrastructure, and AI-based analytical capabilities may operate as new regulatory variables, altering the costs of transparency and the ability to transition from disclosure to effectiveness.

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