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Managing Private Enterprises Toward Sustainable Development: The Role of Institutional Governance and Adaptive Innovation

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ABSTRACT

In the context of increasingly institutionalized sustainability requirements, an important question remains whether policy environments and governance mechanisms automatically translate into firm-level sustainability outcomes. While institutional theory highlights the role of formal rules, prior studies suggest that their effects are conditional and depend on firms' internal capabilities and strategic adjustments. However, the mechanism linking institutional conditions to sustainable development outcomes and shaping firms' strategic adaptation processes remains underexplored, particularly in transitional economies. This study proposes that policy-oriented adaptive innovation (INNO) acts as a key mechanism connecting institutional conditions to Sustainable Development (SOSO). It examines the roles of state digital transformation policy (DIG), regulatory environment and public service quality (GOV), state support for resource access (RES), and sustainability regulatory compliance (SUSP). Using data from 265 private enterprises and Partial Least Squares Structural Equation Modeling, the results show that DIG, GOV, and RES positively influence adaptive innovation, which in turn enhances sustainable development. In addition, GOV, RES, and SUSP exert direct positive effects on sustainable development, whereas the effect of DIG is realized indirectly through adaptive innovation. The findings highlight that institutional effects are realized through firms' capacity to internalize policy signals and translate them into adaptive innovation and strategic restructuring, thereby helping private enterprises move toward sustainable development rather than merely supporting private enterprise development as a sectoral process.

1. INTRODUCTION

Sustainable development has become a global institutional norm that reshapes how firms are evaluated and governed. However, although governments are increasingly tightening environmental, social, and governance requirements, empirical evidence reveals a notable paradox: the expansion of regulation does not always lead to substantive improvements in firms' sustainable development outcomes [1, 2]. Many firms comply with legal requirements at a formal level but fail to transform institutional pressures into strategic change and core operational restructuring [3]. This raises a central question in governance and institutional research: why do firms operating within the same policy environment achieve different levels of sustainable development?

Traditional institutional theory emphasizes the role of formal rules and enforcement mechanisms in shaping organizational behavior [4, 5]. From this perspective, a transparent and stable regulatory environment can reduce uncertainty and encourage long-term investment. However, recent studies indicate that institutional effects are conditional and depend on organizational capabilities as well as the extent to which firms internalize external pressures [6, 7]. This approach suggests that policy does not automatically generate outcomes but must be translated through internal organizational mechanisms. Nevertheless, most prior studies continue to focus on the direct effects of regulation or governance environments on sustainability performance, while paying limited attention to the role of innovation as a structural mediating mechanism [8, 9], particularly in explaining how firms translate institutional pressures into sustainable outcomes through innovation. Accordingly, the key issue is not merely whether institutional conditions matter, but how private enterprises are guided and strategically reoriented toward sustainable development under institutional governance.

At the same time, the Triple Bottom Line framework [10] broadens the concept of firm performance to include economic, social, and environmental dimensions, yet it does not fully clarify how institutional requirements are integrated into corporate strategy and operations. Innovation theory, particularly Schumpeter's concept of creative destruction [11],

suggests that sustainable change occurs only when firms restructure production and governance models through new combinations. However, the relationship between institutional pressures and policy-oriented adaptive innovation has not been systematically examined in sustainable development research.

A critical research gap lies in clarifying the mediating mechanism between the institutional environment and sustainability outcomes, especially within the private sector, where tensions often arise between profitability and social and environmental responsibility, particularly in developing countries [12]. Much of the existing empirical evidence focuses on firms in developed economies where institutions are relatively stable and mature. In such contexts, consumers demonstrate high awareness of product origin, traceability, and environmental practices rather than focusing solely on price and functionality. Consequently, private enterprises have adjusted their strategies to align with these expectations [13]. In contrast, in developing countries where administrative reforms and support mechanisms are being strengthened to assist enterprises, particularly private firms, in overcoming the tradeoff between profit and responsibility, firms are gradually moving toward more substantive sustainability values. This context makes transition economies an important setting for examining how institutional governance shapes firms' strategic adaptation and sustainable development.

Building upon institutional theory, the Triple Bottom Line framework, and innovation theory, this study proposes that policy - oriented adaptive innovation serves as the central mechanism linking institutional factors, including state digital transformation policy (DIG), the regulatory environment and public service quality (GOV), support for resource access (RES), and compliance with sustainability regulations (SUSP), to firm-level sustainability outcomes (SOSO). In this study, institutional governance refers to the system of policy direction, regulatory quality, state-supported resource access, and compliance-oriented governance through which the state shapes firms' incentives, constraints, and strategic responses toward sustainable development. Accordingly, DIG, GOV, RES, and SUSP are conceptualized as complementary dimensions of institutional governance. However, these dimensions are modeled as separate constructs because they capture distinct institutional mechanisms rather than interchangeable manifestations of a single higher-order factor. Modeling them separately allows the study to identify their differentiated effects on adaptive innovation and firm-level sustainability outcomes. Rather than assuming a simple linear effect from policy to outcome, the study examines a more complex relational structure in which policy-oriented adaptive innovation (INNO) transforms institutional pressures into strategic adjustments and organizational improvements. By shifting the analytical focus from the level of compliance to the degree of internalization and strategic restructuring, the study clarifies the conditions under which institutions generate sustainable development.

This research contributes to three academic debates. First, it extends institutional theory by shifting attention from compliance toward internalization and strategic restructuring, thereby clarifying the conditions under which institutions create sustainable outcomes. Second, it enriches sustainable development theory by integrating the mediating role of adaptive innovation, demonstrating that sustainability is not an automatic consequence of regulation but the result of organizational transformation. Third, by focusing on private enterprises in the context of a transition economy, the study broadens the empirical scope of theories that have largely been tested in developed country settings. More specifically, the study contributes to the literature on managing private enterprises by explaining how institutional governance and adaptive innovation jointly shape firms' movement toward Sustainable Development.

The remainder of the paper is structured as follows. The next section presents the theoretical foundation and develops the research hypotheses. The research methodology and analytical model are then introduced. The results section reports the analysis of the measurement and structural models and discusses the main findings. The final section concludes with theoretical and practical implications and outlines directions for future research.

2. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

2.1 Theoretical background

Institutional Theory. Institutional theory is a key framework for analyzing the role of the state in promoting economic development, particularly within the private sector under sustainable development conditions. According to Douglass North [4], institutions are systems of rules, including laws, policies, norms, and enforcement mechanisms, that shape the behavior of economic actors and determine development outcomes. From this perspective, private sector development depends not only on capital, labor, or technology but also significantly on institutional quality [14, 15]. A transparent, stable, and predictable institutional framework reduces transaction costs, protects property rights, and encourages long-term investment and innovation, whereas weak or fragmented institutions may constrain development incentives and resource allocation efficiency [16]. Institutional theory thus highlights the role of the state as a developmental architect that establishes and refines governance frameworks to align private sector growth with economic, social, and environmental objectives [17].

New Public Management Theory (NPM). NPM theory emerged from public sector reforms in the late 20th century, emphasizing the application of private-sector management principles to improve efficiency and service quality in public administration [18]. Under this approach, the state shifts from a traditional administrative role to a results-oriented management model, focusing on performance outcomes rather than procedural inputs. Key mechanisms include decentralization, delegation, competition, outsourcing, and performance-based accountability. The private sector is viewed as an important partner in delivering public services and achieving policy objectives [19]. However, while NPM enhances efficiency, it may overlook issues of social equity and long-term sustainability if applied without appropriate adaptation [20]. Therefore, in the context of sustainable development, its application requires integration with broader governance frameworks that balance economic efficiency with social and environmental considerations.

Triple Bottom Line (TBL) Theory. TBL theory proposed by Elkington [10] extends traditional performance evaluation by incorporating economic, social, and environmental dimensions. The economic pillar emphasizes efficiency, productivity, and long-term competitiveness; the social pillar focuses on employment, equity, and community development;

and the environmental pillar addresses resource efficiency and ecological protection [10, 21]. These three dimensions are interdependent and must be balanced in development strategies. Overemphasis on economic growth without social and environmental considerations may undermine long-term sustainability [22]. TBL thus provides a comprehensive framework for aligning business activities with sustainable development objectives.

Green Growth Theory. Green Growth Theory emerged in response to the limitations of traditional growth models characterized by resource depletion and environmental degradation. It argues that economic growth and environmental protection can be pursued simultaneously through improved resource efficiency, technological innovation, and structural transformation toward low-carbon and environmentally friendly industries [23]. Policy instruments such as environmental taxation, emission standards, and incentives for green investment are used to internalize environmental costs and promote sustainable practices [24]. The state plays a central role in designing institutional frameworks and coordinating the transition toward green development, while the private sector acts as a key driver in implementing innovative and sustainable business models [25].

Innovation Theory. Innovation theory, developed by Schumpeter [11], explains economic growth through the process of "creative destruction," in which new combinations of products, processes, markets, and organizational forms replace outdated ones [26]. Innovation is not limited to technological change but encompasses broader transformations in economic activities. Entrepreneurs play a central role in initiating innovation and driving competitiveness [27]. The theory also highlights the importance of institutional support, including policies that protect intellectual property, promote research and development, and foster collaboration within innovation ecosystems. Through these mechanisms, innovation becomes a fundamental driver of sustainable and long-term economic growth.

2.2 Hypothesis development

DIG and INNO. Digital transformation is regarded as one of the key drivers reshaping governance models and operational practices within enterprises. The adoption of digital technologies contributes to process standardization, enhances information transparency, and improves data analytics capabilities, thereby creating a foundation for organizational and business innovation [28]. In this sense, digital technology functions not only as a technical tool but also as a strategic resource that enables firms to restructure their activities and adapt to the institutional environment. However, digital transformation does not automatically result in innovation. The implementation of digital technologies may remain at the level of formal digitalization if firms lack absorptive capacity, fail to transform managerial mindsets, or do not align digital initiatives with long-term strategic objectives [29]. Particularly in contexts where policy demands higher levels of transparency and compliance, firms may adopt technology primarily to satisfy regulatory requirements without generating substantive internal innovation. Nevertheless, when digital transformation is implemented comprehensively and integrated with strategic objectives, it can function as a mechanism that stimulates adaptive innovation in response to policy requirements. In such cases, firms are more likely to adjust processes, products, and governance practices in ways that align with regulatory expectations and sustainable development orientations [28, 30].

H1: State DIG positively influences policy-oriented adaptive innovation.

GOV and INNO. The regulatory environment and the quality of public services are regarded as core components of the institutional structure that shape organizational behavior. According to institutional theory [4, 5], the stability and transparency of the legal framework influence market expectations and generate compliance pressures for firms. When regulations are clear and consistently enforced, institutional uncertainty declines, enabling firms to allocate resources toward strategic adjustment activities rather than managing legal risks. From a transaction cost perspective, an effective regulatory system and high-quality public services reduce information and compliance costs, thereby allowing firms to concentrate on organizational improvement [20]. Prior research suggests that a well-governed institutional environment can stimulate innovation by enhancing predictability and reducing policy-related risks [4]. However, this relationship is not entirely linear. In contexts characterized by institutional voids [31], discrepancies between policy design and enforcement capacity may weaken the expected effects of the regulatory environment. This implies that the influence of the regulatory environment on innovation depends on the consistency and effectiveness of policy implementation.

H2: The GOV have a positive effect on policy-oriented adaptive innovation.

RES and INNO. State support in facilitating access to development resources such as financial capital, skilled human resources, market information, technology, and capacity-building programs plays a significant role in firms' innovation processes. When firms are able to access resources in a timely and appropriate manner, they are better positioned to invest in technological improvement, restructure operational processes, and adjust strategic orientations in line with policy objectives [32, 33]. In contexts where regulatory requirements are increasingly aligned with sustainable development goals, resources function not only as input factors but also as foundations that enable firms to undertake policy - oriented adaptive innovation in a proactive and long-term manner [19]. However, access to resources does not automatically translate into substantive innovation. If firms lack managerial capability, strategic clarity, or technological absorptive capacity, the supported resources may not be utilized effectively [15]. In addition, complex eligibility conditions or high access costs may weaken innovation incentives, particularly for small-scale enterprises. In such circumstances, innovation may remain at the level of formal adjustment aimed merely at complying with policy requirements. Despite these limitations, under supportive institutional conditions and transparent and stable mechanisms for resource allocation, state support is expected to promote firms' policy - oriented adaptive innovation [34].

H3: State RES has a positive effect on policy-oriented adaptive innovation.

INNO and SOSO. Policy - oriented adaptive innovation reflects a firm's capability to reconfigure its strategy and organizational structure in response to changes in the institutional environment. According to dynamic capabilities

theory [35], the ability to reconfigure resources in order to adapt to external demands is a critical determinant of long-term competitive advantage. As environmental, labor, and social responsibility standards increasingly become formal evaluation criteria, policy-oriented adaptive innovation enables firms to integrate sustainability considerations into their core business models [36]. From the perspective of resource reconfiguration, innovation encompasses not only technological improvement but also process adjustments, value chain redesign, and changes in governance mechanisms. Prior research indicates that firms that proactively incorporate sustainability standards into their strategic orientation tend to achieve stronger long-term performance and reduce institutional risk [37]. However, innovation does not automatically ensure sustainable outcomes if it is merely reactive or disconnected from long-term strategic objectives. This suggests that the relationship between innovation and sustainable development depends on the extent to which environmental and social considerations are embedded within organizational structures.

H4: Policy-oriented adaptive innovation positively influences sustainable development.

RES and SOSO. According to institutional theory, the State shapes firm behavior not only through regulatory frameworks but also through mechanisms of resource allocation and support. When firms are provided with improved access to capital, technology, market information, and capacity building programs, they are better positioned to adjust production models and investment orientation toward long term objectives [33]. Appropriate access to resources enhances competitive capability and establishes a foundation for sustainable development strategies [32]. From the perspective of TBL theory, the simultaneous pursuit of economic, social, and environmental objectives often requires substantial investment and managerial capacity. This creates significant challenges for small and medium sized firms that face constraints in financial, technological, and human resources [38]. Therefore, state RES can reduce investment barriers and enable firms to integrate environmental and social considerations into their business strategies in a more substantive manner. However, the effectiveness of support mechanisms depends on policy design and implementation. In the absence of transparent monitoring and rigorous governance, allocated resources may be used inefficiently or diverted toward short term objectives [21]. In addition, limited absorptive capacity may weaken the expected positive effects. Consequently, support policies should be implemented in a coordinated and transparent manner and accompanied by clear evaluation mechanisms in order to prevent resource misallocation and ensure meaningful contributions to sustainable development objectives.

H5: State RES positively influences sustainable development.

SUSP and SOSO. SUSP represents an important institutional mechanism that guides firm behavior toward environmental and social standards. According to legitimacy theory [39], firms seek social acceptance and maintain legitimacy by adhering to formally established societal norms. When environmental, labor, and social responsibility regulations are implemented consistently, firms are more likely to adjust their strategies and operational processes in order to reduce legal risk and strengthen stakeholder trust [27]. Prior research indicates that regulatory compliance can enhance sustainable development by mitigating environmental risk and improving transparency [40, 41]. In many contexts, firms that meet higher regulatory standards tend to achieve stronger long-term performance through enhanced reputation and improved access to international markets. However, some studies suggest that compliance costs may impose financial burdens, particularly for small firms and in the short term [8]. When compliance is merely symbolic or primarily intended to avoid sanctions, the anticipated sustainability benefits may not be realized. This implies that the impact of compliance depends on the extent to which regulatory requirements are substantively integrated into corporate strategy.

H6: Sustainability regulatory compliance positively influences sustainable development.

GOV and SOSO. The GOV establish the institutional rules of the market and shape the incentive structure that guides firm behavior. According to institutional theory [4], formal rules and enforcement mechanisms create systems of rewards and sanctions that influence organizational strategic choices. When the regulatory framework sets clear standards regarding environmental protection, labor practices, and social responsibility and ensures consistent enforcement, firms are encouraged to integrate sustainability objectives into their business activities. From the perspective of legitimacy theory [39], firms seek social acceptance and institutional legitimacy. When sustainability standards become formal requirements, compliance not only reduces legal risk but also strengthens legitimacy and improves market access. Prior research suggests that high institutional quality can promote sustainable development by reducing uncertainty and enhancing stakeholder trust [40, 42]. However, this relationship depends on fairness and consistency in enforcement. If regulations are applied unevenly, compliant firms may incur higher costs than competitors that avoid regulatory obligations, thereby weakening incentives to pursue sustainability. Therefore, the impact of the regulatory environment on sustainable development derives not only from policy content but also from the transparency and effectiveness of enforcement mechanisms [1].

H7: GOV positively influence sustainable development.

The Mediating Role of INNO. Drawing on innovation theory, innovation functions as a mechanism that transforms resources and institutional pressures into long-term development outcomes. In the context of this study, DIG, GOV and RES do not directly guarantee sustainable development. Instead, their effects need to be translated into strategic adjustments and operational improvements within firms. First, digital transformation enhances process standardization, transparency, and information processing capacity, thereby creating conditions for innovation in governance and production. These innovations represent the direct drivers of improvements in sustainable development outcomes. Second, a stable and transparent regulatory environment generates institutional pressure and strategic orientation, yet it is the firm's adaptive innovation process that determines whether sustainability requirements are effectively integrated into actual operations. Third, RES provides critical input conditions; however, sustainable outcomes emerge only when firms utilize these resources effectively and implement innovation in a comprehensive manner. Therefore, policy - oriented adaptive innovation is expected to play a mediating role in the relationships between DIG, the GOV, state RES, and sustainable development.

H8: Policy-oriented adaptive innovation mediates the relationship between state DIG and sustainable development.

H9: Policy-oriented adaptive innovation mediates the relationship between the GOV and sustainable development.

H10: Policy-oriented adaptive innovation mediates the relationship between state RES and sustainable development.

3. RESEARCH METHOD

This study employs a quantitative research design and a cross sectional approach to examine the relationships between institutional conditions and sustainable development in private enterprises. Specifically, the research investigates the effects of DIG, GOV, RES, SUSP, INNO and SOSO. Guided by institutional theory and dynamic capabilities theory, the study assumes that institutional factors do not automatically generate sustainable outcomes. Instead, their effects are transmitted through adaptive innovation processes within firms. The proposed conceptual framework, presented in Figure 1, illustrates the hypothesized relationships among institutional conditions, policy-oriented adaptive innovation, and sustainable development.

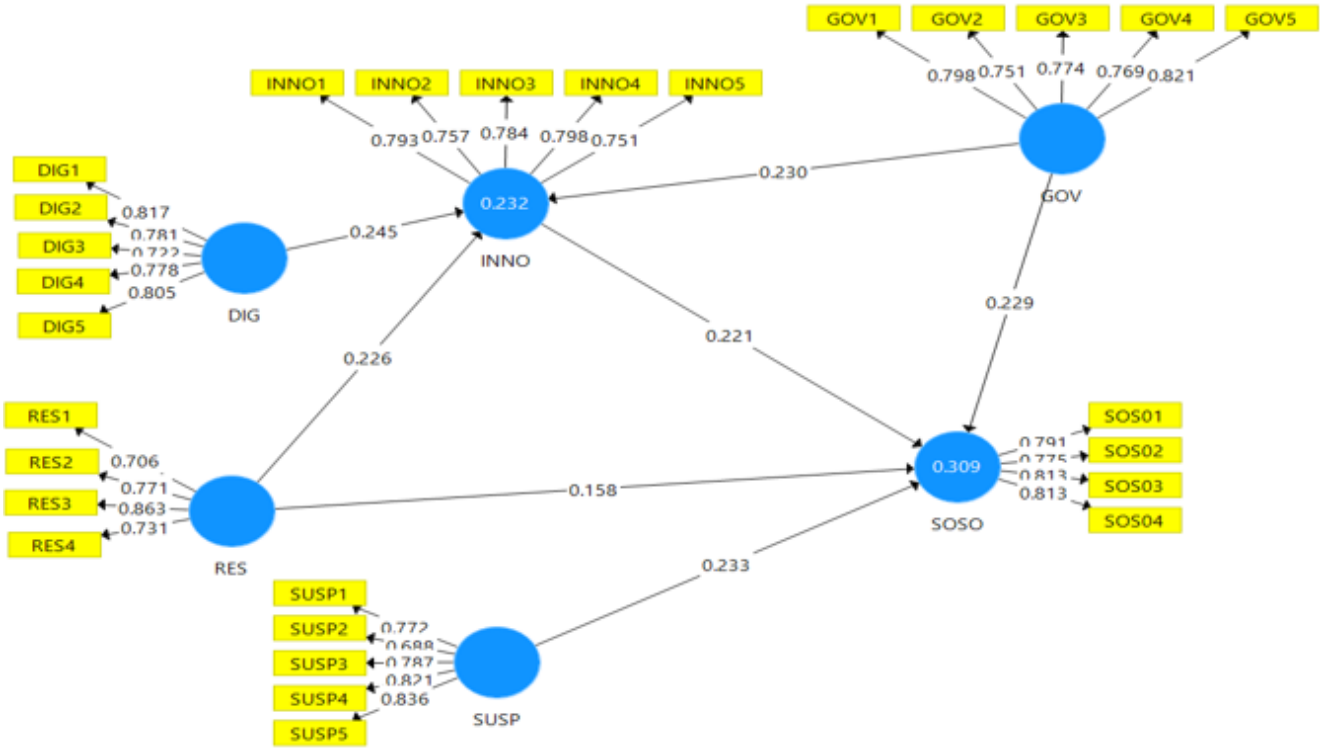

Figure 1. Conceptual framework

3.1 Sample and data collection

The data collection process was conducted from October 2025 to December 2025 using a structured questionnaire. The survey targeted private enterprises located in Hai Phong, Vietnam, in order to capture diverse contexts of policy implementation and varying levels of firm adaptation within the current institutional environment. The duration of the survey period was sufficient to record differences in firms' perceptions and behaviors under policy influence.

The study employed a nonprobability sampling approach, combining purposive sampling and snowball sampling techniques. Initially, firms were contacted through professional networks, business associations, and the research team's professional connections. Subsequently, participating firms were asked to introduce other enterprises that met the research criteria. This approach is particularly useful in studies involving private enterprises, where direct access to senior managers is often limited.

The questionnaire collected information at the firm level, including items related to state DIG, GOV, state RES, policy-oriented adaptive innovation, sustainability regulatory compliance, and sustainable development outcomes. To ensure data reliability, respondents were required to be business owners, chief executive officers, or senior managers with adequate knowledge of the firm's strategy and compliance practices.

Prior to full deployment, the questionnaire was reviewed by experts in management and public policy to ensure clarity and content validity. A pilot test was also conducted with a small group of firms in order to refine the measurement items and improve scale reliability.

Participation in the survey was entirely voluntary and anonymous. At the beginning of the questionnaire, participants were informed about the research objectives, data confidentiality commitments, and their right to decline or withdraw at any time. The study did not collect personal identification information or sensitive data; therefore, the level of risk to participants was considered minimal and consistent with ethical principles in social science research.

A total of 300 responses were collected, of which 265 were deemed valid after data screening. This sample size exceeds the minimum threshold recommended for the partial least squares structural equation modeling (PLS-SEM) analysis [43], ensuring adequate statistical power for model testing. To reduce potential bias associated with snowball sampling, the study diversified the initial group of firms across industries and firm sizes. The characteristics of the sample, including firm size, industry sector, and years of operation, are presented in Table 1.

Table 1. Demographic of participants (N = 265)

Criteria	Category	Frequency	Percentage (%)
Gender	Male	168	63.4
	Female	97	36.6
Age	Under 30	32	12.1
	30-39	94	35.5
	40-49	86	32.5
	50 and above	53	20
Education level	College / Vocational diploma	41	15.5
	Bachelor's degree	162	61.1
	Postgraduate degree	62	23.4
Position	Business owner	82	30.9
	Director / Deputy director	109	41.1
	Department head / Middle manager	74	27.9
Firm size	Fewer than 50 employees	118	44.5
	50-199 employees	96	36.2
	200 employees and above	51	19.3
Years of operation	Less than 5 years	47	17.7
	5-10 years	88	33.2
	More than 10 years	130	49.1
Industry sector	Manufacturing	91	34.3
	Trade	56	21.1
	Services	63	23.8
	Logistics / Transportation	38	14.3
	Technology / Others	17	6.4

3.2 Research model

In this study, structural equation modeling was employed to test the proposed research hypotheses. Previous studies indicate that structural equation modeling is particularly suitable for analyzing survey data, especially in research contexts that examine mediating and moderating relationships. This method allows explicit treatment of measurement error and accurate estimation of mediating effects, thereby enhancing the reliability of analytical results [44].

Among the various structural equation modeling approaches, PLS-SEM is considered especially flexible in handling both simple and complex research models, particularly when the research objective emphasizes explanatory and predictive capability [44]. Due to these advantages, this approach has been widely applied in social science research to assess measurement reliability and validity and to test hypothesized relationships in empirical analysis [45].

In addition, the use of PLS-SEM in this study is consistent with the characteristics of the proposed measurement instruments, which were developed based on theoretical synthesis and prior literature review. This approach aligns with previous studies that have applied this method in comparable research contexts to test theoretically complex models and measurement scales that were developed or adapted for specific settings [46].

3.3 Measurement

The research questionnaire was developed based on a systematic review of the theoretical framework, prior studies, and the specific research context. The construction of measurement scales followed established principles to ensure that observed variables accurately represented the underlying constructs [47, 48].

The questionnaire was designed in Vietnamese to ensure suitability for respondents. It was reviewed by experts and pilot tested with a small sample to evaluate clarity, comprehensibility, and contextual relevance. Feedback from this stage was used to refine wording and improve the quality of the instrument [49].

All constructs were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The questionnaire included two sections: the first collected demographic and firm-related information, while the second measured the research constructs.

Although the scales were self-developed, their reliability and validity were empirically assessed using PLS-SEM approach. Composite reliability (CR), convergent validity, and discriminant validity were evaluated following established methodological guidelines [50, 51], ensuring that the measurement instruments met required standards while remaining appropriate for the research context.

4. RESULTS

4.1 Common method bias

Because the data were collected using a self-administered questionnaire, the potential presence of common method bias was carefully considered. Several procedural remedies were applied at the questionnaire design stage, including expert review, pilot testing, clear item wording, and voluntary and anonymous participation, in order to reduce ambiguity and minimize the risk of common method bias. Harman's single-factor test was then conducted by entering all observed variables into an exploratory factor analysis with a single-factor extraction to determine the proportion of variance attributable to a common method source [52].

The results indicate that the single factor accounts for 42.574 percent of the total variance, which is below the recommended threshold of 50 percent suggested in prior methodological studies [50, 53]. This finding suggests that common method bias is unlikely to pose a serious concern.

In addition, following Kock [54], a comprehensive collinearity assessment was conducted using variance inflation factor (VIF) values. In the context of PLS-SEM, VIF values exceeding 3.3 may indicate potential collinearity issues and the possible presence of common method bias. As shown in Table 2, all VIF values are below the recommended threshold. Therefore, the results of the comprehensive collinearity assessment do not indicate any serious concern regarding common method bias.

Table 2. Collinearity statistic (VIF) with inner model

Factors	DIG	GOV	INNO	RES	SOSO	SUSP
DIG			1.079			
GOV			1.109		1.191	
INNO					1.228	
RES			1.060		1.128	
SOSO						
SUSP					1.081	

To further strengthen the assessment of common method bias, this study followed the single unmeasured method factor approach suggested by Liang et al. [55]. A common method factor was created using all indicators of the substantive constructs and incorporated into the PLS model. The substantive factor loadings and method factor loadings were then compared at the indicator level.

Table 3. Common method bias analysis

Items	Substantive Factor Loading (R1)	$R1^2$	Method Factor Loading (R2)	$R2^2$
DIG1	0.817	0.667	0.052	0.002
DIG2	0.781	0.609	-0.061	0.003
DIG3	0.722	0.521	0.084	0.007
DIG4	0.778	0.605	-0.047	0.002
DIG5	0.805	0.648	0.073	0.005
GOV1	0.798	0.636	-0.068	0.004
GOV2	0.751	0.564	0.058	0.003
GOV3	0.774	0.599	0.092	0.008
GOV4	0.769	0.591	-0.055	0.003
GOV5	0.821	0.674	0.041	0.001
INNO1	0.793	0.628	0.079	0.006
INNO2	0.757	0.573	-0.063	0.003
INNO3	0.784	0.614	0.086	0.007
INNO4	0.751	0.564	-0.052	0.002
INNO5	0.706	0.498	0.067	0.004
RES1	0.771	0.594	0.111	0.012
RES2	0.863	0.744	-0.074	0.005
RES3	0.731	0.534	0.049	0.002
RES4	0.791	0.625	-0.088	0.007
SOSO1	0.775	0.600	0.095	0.009
SOSO2	0.813	0.660	-0.057	0.003
SOSO3	0.813	0.660	0.066	0.004
SOSO4	0.772	0.595	-0.071	0.005
SUSP1	0.788	0.620	0.082	0.006
SUSP2	0.787	0.619	-0.045	0.002
SUSP3	0.821	0.674	0.076	0.005
SUSP4	0.836	0.698	-0.059	0.003
SUSP5	0.835	0.697	0.064	0.004
Average	**0.785**	**0.618**	**0.015**	**0.004**

As shown in Table 3, the average substantive factor loading was 0.785, whereas the average method factor loading was only 0.015. The average variance explained by the substantive constructs was 0.618, substantially higher than the average variance explained by the common method factor of 0.004. These results indicate that the indicators were mainly explained by their theoretical constructs rather than by a common method factor. Therefore, common method variance is unlikely to substantially bias the empirical results.

4.2 Measurement model assessment

In this study, SmartPLS version 3.2.9 was employed to estimate the partial least squares structural equation model. The PLS SEM approach was selected due to its advantages in handling complex research models and its ability to estimate and test latent constructs within a theoretically grounded framework. This method is particularly suitable for exploratory research that seeks to develop and refine theoretical constructs based on empirical data [56], thereby clarifying the relationships among variables in the proposed model.

The analysis began with an assessment of the measurement model. Scale reliability and convergent validity were evaluated using several established indicators. Specifically, outer loadings were used to assess the reliability of individual items, with values of 0.70 or higher considered acceptable. Cronbach's alpha and CR were employed to assess internal consistency reliability, with threshold values of 0.70 or above. Average variance extracted (AVE) was used to examine convergent validity, with a minimum recommended value of 0.50 [57, 58]. The results show that all constructs and indicators met these recommended thresholds, confirming adequate reliability and convergent validity of the measurement model. Detailed results are reported in Table 4.

Table 4. Reliability and convergent validity

Items	Outer Loading	VIF	Cronbach's α	CR	AVE
DIG1	0.817	2.945	0.842	0.886	0.610
DIG2	0.781	2.725			
DIG3	0.722	2.602			
DIG4	0.778	2.798			
DIG5	0.805	1.733			
GOV1	0.798	1.777	0.843	0.888	0.613
GOV2	0.751	1.613			
GOV3	0.774	2.435			
GOV4	0.769	1.647			
GOV5	0.821	2.748			
INNO1	0.793	2.180	0.836	0.884	0.603
INNO2	0.757	2.011			
INNO3	0.784	2.364			
INNO4	0.798	2.487			
INNO5	0.751	1.617			
RES1	0.706	1.500	0.774	0.853	0.593
RES2	0.771	1.516			
RES3	0.863	1.799			
RES4	0.731	1.360			
SOSO1	0.791	1.596	0.811	0.875	0.637
SOSO2	0.775	1.619			
SOSO3	0.813	2.453			
SOSO4	0.813	2.042			
SUSP1	0.772	2.042	0.843	0.887	0.612
SUSP2	0.788	1.576			
SUSP3	0.787	1.901			
SUSP4	0.821	2.788			
SUSP5	0.836	2.871			

Table 5. Fornell-Larcker criterion

Factors	DIG	GOV	INNO	RES	SOSO	SUSP
DIG	0.781					
GOV	0.255	0.783				
INNO	0.337	0.342	0.777			
RES	0.147	0.219	0.312	0.770		
SOSO	0.356	0.396	0.395	0.307	0.798	
SUSP	0.061	0.242	0.195	0.126	0.352	0.783

Table 6. Heterotrait-Monotrait (HTMT) ratio

Factors	DIG	GOV	INNO	RES	SOSO	SUSP
DIG						
GOV	0.298					
INNO	0.387	0.397				
RES	0.175	0.261	0.376			
SOSO	0.417	0.471	0.475	0.360		
SUSP	0.095	0.286	0.236	0.165	0.409	

Discriminant validity was examined using the Fornell and Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio of correlations [51, 59, 60]. According to the Fornell and

Larcker criterion, the square root of the AVF for each latent construct should exceed its correlations with other constructs in the model [59]. In addition, as recommended by Henseler et al. [51] and Hair et al. [60], Heterotrait-Monotrait (HTMT) values should be below 0.85, or below 0.90 in cases where constructs are conceptually related, to establish discriminant validity. The results show that all values satisfy these recommended thresholds, confirming that the constructs in this study exhibit adequate discriminant validity. Detailed results are reported in Tables 5 and 6.

4.3 Structural model assessment and hypothesis testing

After the measurement model satisfied the required criteria, the structural model was evaluated. To assess overall model quality, the study examined both model fit and predictive relevance. Stone Geisser's Q square values were calculated using the blindfolding procedure. The results indicate that all Q square values are greater than zero, with 0.131 for policy - oriented adaptive innovation and 0.184 for sustainable development, confirming the model's predictive relevance for the endogenous constructs [43].

The coefficient of determination R-squared was used to evaluate the explanatory power of the model. According to Henseler et al. [61] and Hair et al. [50], values of 0.75, 0.50, and 0.25 can be considered substantial, moderate, and weak, respectively, although acceptable levels may vary depending on the research context [62]. The results show that the model explains 23.2 percent of the variance in policy - oriented adaptive innovation and 30.9 percent of the variance in sustainable development. These values indicate a low to moderate level of explanatory power, which is consistent with expectations in social science research. Effect size f-squared values range from 0.032 to 0.073, suggesting small effect sizes, although each predictor still contributes meaningfully to the dependent constructs.

In addition, the standardized root mean square residual value is 0.067, which is below the recommended threshold of 0.08, indicating an acceptable level of model fit [44]. The root mean square theta value was also examined to assess model specification. The obtained value of 0.155 suggests that model specification could be further improved. However, considering the overall set of evaluation criteria, the structural model can be regarded as acceptable for the purposes of this study.

Table 7. Direct path coefficients and effect sizes

Hypothesis	Relationship	β	SE	Effect Size (f^2)	Bootstrapped 95% Confidence Interval		Decision
					2.5%	97.5%	
H1	DIG → INNO	0.245***	0.055	0.072	0.144	0.363	Supported
H2	GOV → INNO	0.230***	0.061	0.062	0.106	0.351	Supported
H3	RES → INNO	0.226***	0.061	0.063	0.102	0.349	Supported
H4	INNO → SOSO	0.221***	0.067	0.058	0.087	0.347	Supported
H5	RES → SOSO	0.158***	0.060	0.032	0.040	0.273	Supported
H6	SUSP → SOSO	0.233***	0.057	0.073	0.119	0.342	Supported
H7	GOV → SOSO	0.229***	0.062	0.064	0.103	0.347	Supported

Note: β = standardized path coefficient; SE = standard error, *p < 0.05; **p < 0.01; ***p < 0.001.

Table 8. Specific indirect effects and mediation analysis

Hypothesis	Relationship	β	SE	Bootstrapped 95% Confidence Interval		Mediation Type	Decision
				2.5%	97.5%		
H8	DIG → INNO → SOSO	0.054**	0.015	0.022	0.080	Indirect-only mediation	Supported
H9	GOV → INNO → SOSO	0.051**	0.019	0.016	0.092	Partial mediation	Supported
H10	RES → INNO → SOSO	0.050**	0.021	0.014	0.098	Partial mediation	Supported

Note: β = standardized path coefficient; SE = standard error, *p < 0.05; **p < 0.01; ***p < 0.001.

Finally, the research hypotheses were tested using the bootstrapping procedure with 1,000 resamples to assess the statistical significance of the path coefficients [43, 59, 63] (Table 7). This analytical approach enhances the robustness and reliability of the findings and provides a sound basis for interpreting the relationships among the constructs in the proposed model [64].

This study advances the understanding of how institutional environments influence sustainable development by clarifying the mechanism through which institutional pressures are translated into organizational outcomes. Rather than assuming a direct institutional effect, the findings indicate that sustainability performance depends on firms' capacity to internalize policy signals and transform them into strategic and structural adjustments. This highlights the importance of organizational agency and challenges the conventional view that regulatory improvement alone is sufficient to generate sustainable outcomes [65].

The results confirm that DIG has a positive and statistically significant effect on INNO. This suggests that digital transformation at the policy level goes beyond administrative modernization and functions as a governance mechanism that enhances transparency and information traceability. In doing so, it increases institutional pressure on firms to align their behavior with regulatory expectations. Consistent with prior studies [8, 66], digital transformation facilitates organizational innovation by reconfiguring processes and improving decision-making. However, the present findings further indicate that this effect depends on firms' ability to internalize policy demands. Without sufficient managerial capacity and absorptive capability, digital transformation may remain limited to compliance-based reporting. Thus, digital transformation should be understood as a catalyst for adaptive innovation rather than merely a technological upgrade [67, 68].

Similarly, GOV is found to positively influence INNO. A

stable and transparent regulatory framework reduces uncertainty and encourages firms to adopt proactive strategies instead of defensive responses [32, 38]. However, the magnitude of this effect suggests that regulatory improvement alone is not sufficient to stimulate innovation without complementary mechanisms. Compared to digital transformation, which directly alters information structures, the regulatory environment primarily shapes expectations and reduces institutional risk. This finding is consistent with the concept of institutional voids, where inconsistent enforcement may lead firms to prioritize short-term adaptation over long-term innovation [65, 69]. Therefore, institutional quality functions not only as a foundation but also as directional pressure guiding innovative behavior, contingent on enforcement consistency.

In addition, GOV has a direct and statistically significant effect on SOSO. This indicates that institutional quality not only facilitates innovation but also directly shapes market behavior by standardizing environmental and social expectations. When regulatory enforcement is consistent, sustainable practices become a condition for market participation rather than a voluntary choice [1, 3]. This aligns with legitimacy theory, suggesting that firms adjust their behavior to maintain social acceptance and competitive positioning [41]. Consequently, institutional quality can directly influence long-term market dynamics beyond its indirect role through innovation.

The findings also show that RES positively affects INNO. Access to financial, technological, and informational resources enables firms to overcome constraints and engage in innovation activities [7, 38]. However, this effect is conditional. If allocation mechanisms lack transparency or firms lack absorptive capacity, support programs may fail to generate substantive innovation. Furthermore, the absence of effective monitoring may lead to inefficiencies or resource misallocation. Thus, the effectiveness of support policies depends on both program design and firms' internal capabilities [70].

RES also has a direct and significant effect on SOSO, supporting H5. This suggests that resource support not only provides inputs but also signals strategic priorities, guiding firms toward sustainability-oriented investments [33, 71]. By directing resources toward environmentally and socially responsible activities, the state can reshape competitive dynamics and promote long-term development. Nevertheless, poorly designed support mechanisms may distort market signals and foster dependency, highlighting the importance of transparent and performance-based allocation systems.

INNO is found to significantly enhance SOSO. This confirms that innovation is not merely a technical response to institutional requirements but a central mechanism through which firms convert institutional pressure into long-term value. In the context of increasing Environmental, Social, and Governance (ESG) and sustainability standards, firms must go beyond compliance and integrate sustainability into governance structures and strategic planning [15, 21]. However, not all forms of innovation contribute equally to sustainability outcomes. Only innovation aligned with long-term restructuring and strategic orientation can generate sustainable value, emphasizing the importance of innovation quality.

SUSP also shows a positive and significant effect on SOSO. This finding suggests that compliance enhances legitimacy, reduces risk, and strengthens competitive positioning. While compliance may impose short-term costs, it has become a prerequisite for participation in global markets where ESG standards are increasingly enforced [25, 72]. Firms that fail to comply risk exclusion from supply chains and reputational damage, whereas compliant firms benefit from improved transparency and credibility.

Importantly, the mediation analysis confirms that INNO transmits the effects of institutional factors to sustainable development outcomes. As shown in Table 8, the indirect effects of DIG, GOV, and RES on SOSO through INNO are positive and statistically significant because their bootstrapped confidence intervals do not include zero. Since the final model does not include a direct path from DIG to SOSO, the DIG-SOSO relationship indicates indirect-only mediation. By contrast, GOV and RES have both significant direct effects on SOSO and significant indirect effects through INNO; therefore, their mediation effects are classified as partial mediation.

Overall, the findings indicate that the relationship between institutional environments and sustainable development is conditional and non-linear. Digital transformation policies, regulatory quality, and resource support establish institutional frameworks and directional signals, but they do not automatically generate sustainable value. Sustainable development should therefore be understood as a dynamic transformation process in which adaptive innovation serves as the central mechanism linking institutional pressures with long-term competitive capability.

4.4 Predictive assessment

This study employed the PLS predict procedure with 10 folds and one repetition to simulate how the PLS SEM model would be applied in practice to predict new observations, rather than relying on the average estimates derived from multiple model estimations.

The predictive analysis focused on the indicators of the endogenous constructs, namely INNO and SOSO. In addition, predictive performance metrics for all indicators associated with the endogenous constructs were reported at the indicator level.

Table 9. Indicator-level predictive performance

Items	PLS-SEM		LM	$RMSE_{PLS}$ - $RMSE_{LM}$
	RMSE	$Q^2_{predict}$	RMSE	
INNO1	0.450	0.180	0.465	-0.015
INNO2	0.465	0.116	0.491	-0.026
INNO3	0.444	0.151	0.462	-0.018
INNO4	0.453	0.073	0.472	-0.019
INNO5	0.462	0.080	0.482	-0.020
SOSO1	0.440	0.223	0.445	-0.005
SOSO2	0.469	0.152	0.472	-0.003
SOSO3	0.504	0.145	0.511	-0.007
SOSO4	0.509	0.147	0.517	-0.008

This study applied the PLS predict procedure with 10 folds and one repetition to simulate how the PLS SEM model performs in predicting new observations in practice, rather than relying on average estimates obtained from repeated model estimations. The predictive assessment focused on the indicators of the endogenous constructs, INNO and SOSO. Predictive performance metrics were reported at the indicator level for all indicators associated with the endogenous

constructs.

First, the results presented in Table 9 show that all indicators of the endogenous constructs have Q-square predict values greater than zero, ranging from 0.073 to 0.223. According to Shmueli et al. [64], positive Q-square predicted values indicate that the model has superior out-of-sample predictive power compared with a naive benchmark model that relies solely on the mean values of the dependent variable. These findings confirm that the proposed model demonstrates predictive relevance for all endogenous constructs under consideration.

Next, in evaluating out-of-sample predictive performance, root mean square error (RMSE) was used as the primary metric of prediction error, consistent with recommendations for PLS predict analysis. The results indicate that RMSE values of the PLS SEM model range from 0.440 to 0.509, reflecting an acceptable level of prediction error relative to the measurement scale of the indicators. A comparison of prediction errors between the PLS SEM model and a linear benchmark model shows that RMSE values of PLS SEM are consistently lower than those of the linear model for all indicators, with differences ranging from negative 0.002 to negative 0.018. This suggests that the PLS-SEM model outperforms the linear benchmark model in out-of-sample prediction.

The findings further indicate that under conditions of an effective regulatory environment and appropriate support mechanisms, private enterprises tend to increase innovation in their business operations. Innovation functions not merely as a reactive response to regulatory requirements but also as a critical mediating mechanism that contributes to improved sustainable development outcomes [38]. When the regulatory environment is transparent, resource access is facilitated, and technological adoption is encouraged, private enterprises have stronger incentives and more favorable conditions to innovate. This process enhances compliance with regulatory requirements and ultimately improves sustainable development outcomes, generating long-term economic and social value [65].

These results imply that public governance plays not only a regulatory role but also a strategic and enabling function by stimulating innovation as a mechanism through which policy effects are translated into sustainable development outcomes at the firm level. This reinforces the argument that sustainable development in the private sector is closely linked to the state's role in creating a stable, transparent, and innovation supportive institutional environment [73, 74].

5. CONCLUSION

This study examines the impact of institutional factors, including DIG, GOV, RES, and SUSP, on SOSO. It also tests the mediating role of INNO. The empirical findings show that DIG, GOV, and RES have positive and statistically significant effects on INNO, which in turn positively affects sustainable development. In addition to the direct effects of GOV, RES, and SUSP on SOSO, policy-oriented adaptive innovation plays a central mediating role by channeling the influence of DIG, GOV, and RES into sustainable development outcomes.

From a theoretical perspective, the study clarifies the operational mechanism linking the institutional environment to sustainable development outcomes in private enterprises within a transition economy. Rather than treating institutional factors such as DIG, regulatory quality, resource support, or compliance requirements as direct determinants of sustainability performance, the findings demonstrate that institutional effectiveness depends on the extent to which firms internalize and transform policy pressures and support into strategic adjustments and organizational improvements. The mediating role of adaptive innovation confirms that innovation is not merely a tool for enhancing competitiveness but also a mechanism that connects institutional demands with sustainable development performance. In this regard, the study extends the Triple Bottom Line perspective by emphasizing that sustainable development is not an automatic outcome of regulatory enforcement or policy support but rather the result of internal organizational restructuring processes.

From a practical standpoint, the study offers important implications for managing private enterprises toward sustainable development in a context where sustainability requirements increasingly constitute institutional norms. The findings suggest that public policy should not be limited to strengthening compliance requirements or refining legal frameworks but should be designed to stimulate internal innovation within firms. Efforts to promote digital transformation, improve the regulatory environment, streamline administrative procedures, enhance public service quality, and expand access to resources will only be effective if accompanied by mechanisms that encourage firms to restructure strategically and strengthen their innovation capabilities. For private enterprises, sustainable development should not be viewed as a short-term response to regulatory pressure but rather as a long-term strategic orientation involving governance restructuring, resource optimization, and the integration of environmental and social standards into the value chain. Only when innovation is implemented as a comprehensive organizational strategy can state governance policies be effectively translated into enduring economic, social, and environmental value.

Despite its empirical contributions, the study has several limitations. First, the use of cross-sectional data does not capture dynamic changes over time in innovation processes and sustainable development. Second, the sample is limited to private enterprises within a specific locality, which calls for caution in generalizing the findings. Third, the variables are measured based on respondents' perceptions, which may involve subjective bias.

Future research may expand the scope of investigation across multiple regions or countries to examine the robustness of the proposed model under different institutional contexts. Longitudinal research designs would help clarify the dynamic transformation from policy compliance and institutional support to innovation and sustainability outcomes. Furthermore, examining moderating factors such as firm size, industry characteristics, or the degree of participation in global value chains could provide deeper insights into the conditions under which compliance and innovation exert the strongest effects.

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APPENDIX

Code	Contens
	Regulatory Environment and Public Service Quality
GOV1	Regulations and policies issued by local authorities related to private enterprises are clear and easy to understand.
GOV2	Administrative procedures for private enterprises are implemented in a transparent and consistent manner.
GOV3	Local authorities provide effective online public services that help reduce the time and costs required for private enterprises to complete administrative procedures.
GOV4	Local authorities create favorable conditions for private enterprises to adopt technology in order to enhance business performance.
GOV5	Local authorities ensure access to information, policies, and support programs for private enterprises.
	State Support for Resource Access
RES1	State policies create favorable conditions for private enterprises to access financial resources for investment and innovation.
RES2	Local authorities implement measures to support private enterprises in accessing and developing appropriate human resources.
RES3	The State supports private enterprises in accessing market information and technology for innovation activities.
RES4	State support programs contribute to improving private enterprises' access to resources for innovation and improvement activities.
	Policy - oriented Adaptive Innovation
INNO1	Private enterprises innovate and improve their operations in response to state policy orientations by enhancing resource efficiency and reducing negative environmental impacts.
INNO2	State policies and support programs encourage private enterprises to improve their production and business processes in alignment with sustainable development requirements.
INNO3	Under the influence of state regulation, private enterprises innovate their products or services in ways that are more environmentally and socially responsible.
INNO4	The guiding role of the State encourages private enterprises to adopt more sustainable management practices and production systems.
INNO5	State requirements and policy orientations regarding sustainable development motivate private enterprises to invest in long term innovation and improvement.
	State Digital Transformation Policy

DIG1	State digital transformation policies encourage private enterprises to standardize their processes and operations, thereby saving time and effort.
DIG2	Under the management and support of the State, digital transformation helps private enterprises enhance transparency in their operations.
DIG3	Local authorities encourage private enterprises to adopt digital technologies to strengthen monitoring and control of their operations.
DIG4	State digital transformation policies create conditions that enable private enterprises to use data and technology in decision making.
DIG5	The role of the State in digital transformation helps private enterprises enhance their capacity to meet regulatory requirements in the long term.
	Sustainability Regulatory Compliance
SUSP1	Private enterprises implement environmental protection measures in accordance with state regulations and requirements.
SUSP2	Private enterprises comply with state requirements regarding occupational safety, health, and working conditions for employees.
SUSP3	Private enterprises engage in corporate social responsibility activities in line with state orientations and incentives.
SUSP4	Sustainable development objectives are integrated into the production and business activities of private enterprises in accordance with the state legal framework.
SUSP5	Private enterprises diligently prepare and submit reports on environmental and labor related matters to enable state monitoring and evaluation.
	Sustainable Development
SOSO1	State requirements and policy orientations regarding sustainable development lead private enterprises to allocate more resources to environmental protection, employees, and the community.
SOSO2	Compliance with state requirements on sustainable development requires private enterprises to accept certain trade offs in short term business objectives in order to pursue long term sustainability.
SOSO3	State regulations on sustainable development change the way private enterprises make decisions by placing greater emphasis on social and environmental responsibility.
SOSO4	Private enterprises' implementation of sustainable development activities within the state governance framework contributes to generating positive social value in the long term.