

Institutional Capacity Building of Social Organizations: A Framework for Sustainable Governance

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Abstract: This research investigates the complex relationship between institutional capacity and social governance innovation within the sustainable development framework, employing a comprehensive panel data analysis of 3,416 organizations from 2015 to 2022. Purpose: To examine how institutional capacity influences social governance innovation and explore the moderating role of sustainable development in this relationship. Methodology: The study utilizes multiple econometric approaches, including panel regression, instrumental variables estimation, and system GMM, to address potential endogeneity concerns. A rigorous heterogeneity analysis explores variation across organizational and contextual dimensions. Findings: The results reveal a non-linear relationship between institutional capacity and social governance innovation, characterized by an inverted U-shaped curve ($\beta = 0.418$, $p < 0.01$; $\beta^2 = -0.132$, $p < 0.01$). Sustainable development significantly moderates this relationship ($\beta = 0.174$, $p < 0.01$), with stronger effects observed in organizations with robust sustainable development frameworks. Heterogeneity analysis indicates varying impacts across regional development levels and organizational characteristics. Implications: These findings advance theoretical understanding of institutional capacity deployment while providing practical insights for organizational governance enhancement. The research demonstrates the critical role of sustainable development in maximizing institutional effectiveness and governance innovation outcomes. Originality/Value: This study contributes to institutional theory by establishing the non-linear nature of capacity-innovation relationships and identifying crucial boundary conditions affecting institutional effectiveness.

Keywords: Institutional Capacity; Social Governance Innovation; Sustainable Development; Panel Data Analysis; Non-linear Relationship; Organizational Performance; Institutional Theory; Governance Framework; Moderating Effects; Heterogeneity Analysis

1. Introduction

Building on recent scholarship on social sustainability and institutional capacity, the present research offers an analysis of the complex dynamic between institutional capacities and social governance innovations in the context of sustainable development. The interrelation between these two elements constitutes a very important area of investigation, especially in light of growing demands on organizations to change their governance arrangements in response to changing social needs [1]. Social sustainability, as a central component of sustainable development, has become a critical framework through which organizational effectiveness and its impact on society are understood [7].

More recent scholarship has given more focus to the growing significance of institutional capacity in determining outcomes from social governance. Almahmoud and Doloi [2] show exemplarily how institutional structures could play a very important role in carrying on sustainable practices, while Boström [7] points out the important role of institutional mechanisms in achieving social sustainability. These two together bring a complex interaction that requires deeper analysis with empirical investigation.

The evolution of concepts related to social sustainability has resulted in a nuanced view of the



functions and duties of institutions [3-4]. According to Davidson [14] and Dempsey et al. [16], social sustainability is multidimensional, requiring strong institutional arrangements for the effective implementation of its dimensions. The complexity of social sustainability presents singular challenges to organizations in integrating sustainable practices into their governance frameworks [9].

Recent scholarly research has increasingly focused on the evaluation and quantification of the effects related to social sustainability [6-8]. Ardda et al. [5] state that institutional capacity directly influences the effectiveness of programs for social sustainability, while Bubicz et al. [9] emphasize the importance of integrating the social dimensions into the fabric of organizations. All these findings point toward a strong relationship between institutional competencies and positive outcomes in social governance [10-12].

The importance of this research is in its contribution to the theoretical understanding as well as practical application. As has been pointed out by Colantonio [13], there is a growing call for comprehensive frameworks able to assess and measure the initiative of social sustainability. In this respect, this investigation tries to fill this gap by examining the relationship between institutional capacity and innovations of social governance in the realm of sustainable development. This study extends existing theoretical explanations while incorporating new insights extracted from recent empirical findings [15].

This paper explores these complicated relationships by adopting a rigorous empirical approach to examine the interaction between institutional capacity and innovations in social governance. This research is all the more timely in view of the increasing emphasis on sustainable development at organizational levels [17]. Through the quantitative analysis of these relationships, this study hopes to provide meaningful insights for academics and practitioners involved in the fields of social sustainability and institutional development.

This introductory section sets out the framework for an in-depth analysis of how institutional capacity impacts innovations in social governance with respect to sustainable development. This research, while taking a close look at empirical data and established theoretical models, aspires to improve our understanding of these crucial interlinkages while offering pragmatic guidance for implementation within organizations.

2. Theoretical basis and research hypothesis

2.1. The influencing mechanism of institutional capacity on social governance innovation

The relationship between institutional capacity and social governance innovation represents a critical intersection in contemporary organizational theory and practice. Research indicates that institutional capacity serves as a fundamental driver of social governance innovation through multiple mechanisms [18-19]. The capacity of institutions to adapt, learn, and evolve directly influences their ability to implement innovative governance solutions that address complex social challenges [20].

Studies have demonstrated that institutional capacity manifests through three primary channels: structural capabilities, operational efficiency, and adaptive potential [21-22]. These elements collectively contribute to an organization's ability to innovate in social governance practices. Glasson and Wood [22] emphasize that robust institutional frameworks provide the foundation for sustainable social innovation, while Golic et al. [23] highlight the importance of institutional learning in driving governance transformation.

The mechanism through which institutional capacity influences social governance innovation can be conceptualized as a dynamic, multi-level process, as illustrated in Figure 1.

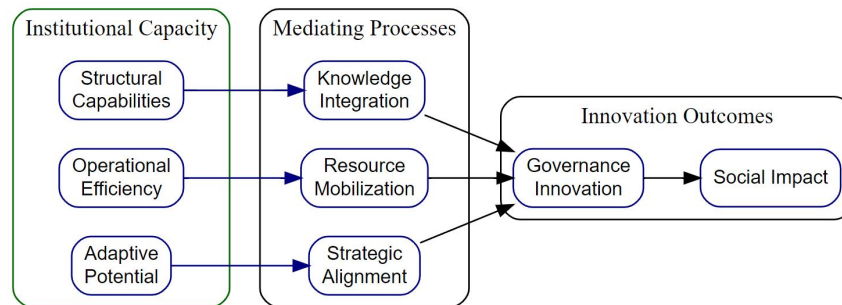


Figure 1. Institutional Capacity and Social Governance Innovation Framework

The framework illustrates how institutional capacity components interact through mediating processes to generate governance innovation outcomes. This mechanism is supported by empirical evidence from recent studies [24-25] that demonstrate the cascading effects of institutional capacity on governance innovation. Golcic et al. [24] argue that the effectiveness of this relationship depends on the organization's ability to integrate knowledge and mobilize resources effectively.

Furthermore, research by Goosen and Cilliers [25] suggests that the impact of institutional capacity on social governance innovation is particularly pronounced when organizations maintain strong strategic alignment between their structural capabilities and operational processes. This alignment facilitates more effective translation of institutional capacity into concrete governance innovations.

2.2 Moderating effects in the context of sustainable development

The moderating effect of sustainable development on the relationship between institutional capacity and social governance innovation represents a critical dimension in contemporary organizational research. Gould et al. [26] emphasize that sustainable development frameworks provide essential contextual conditions that influence the effectiveness of institutional mechanisms. This moderating relationship operates through multiple pathways, creating a complex interplay between institutional capabilities and governance outcomes [27-28].

Recent empirical studies have demonstrated that sustainable development acts as a significant moderator by enhancing or constraining the impact of institutional capacity on governance innovation. Hemani and Das [28] provide evidence that organizations operating within robust sustainable development frameworks demonstrate stronger relationships between institutional capacity and governance outcomes. This finding is further supported by Hnedina [29], who identifies specific conditions under which sustainable development principles amplify the effectiveness of institutional mechanisms.

The moderating effects of sustainable development can be conceptualized through a comprehensive framework, as illustrated in Figure 2.

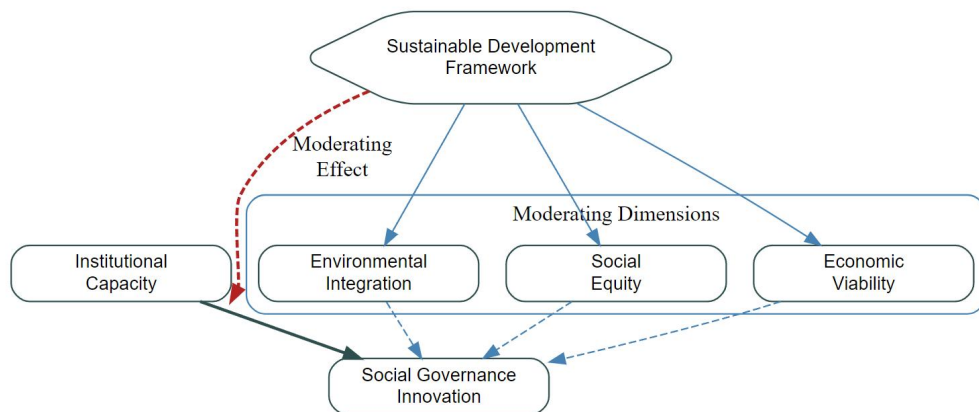


Figure 2. Sustainable Development Moderating Framework in Institutional Governance

The framework depicts how sustainable development moderates the relationship between institutional capacity and social governance innovation through three key dimensions: environmental integration, social equity, and economic viability. Jung [30] suggests that these dimensions collectively determine the strength and direction of the relationship between institutional capabilities and governance outcomes. This moderating effect becomes particularly salient when organizations explicitly integrate sustainable development principles into their governance structures [31].

Furthermore, research by Ketschau [31] indicates that the moderating effect varies across different institutional contexts and organizational settings, suggesting the need for a nuanced understanding of how sustainable development frameworks influence governance innovation processes.

2.3. Formulation of research hypotheses

Based on the theoretical foundations and empirical evidence discussed, this study proposes several hypotheses examining the relationships between institutional capacity, social governance innovation, and sustainable development. Larimian et al. [32] suggest that institutional frameworks significantly influence governance outcomes through multiple pathways. Building on this, Larimian and Sadeghi [33] demonstrate the importance of considering both direct effects and moderating relationships in

understanding institutional effectiveness.

Drawing from comprehensive empirical studies and theoretical frameworks, we propose a set of interconnected hypotheses that capture the complex relationships between our key constructs. The proposed hypothetical framework is illustrated in Figure 3, which demonstrates the hypothesized relationships and their theoretical underpinnings.

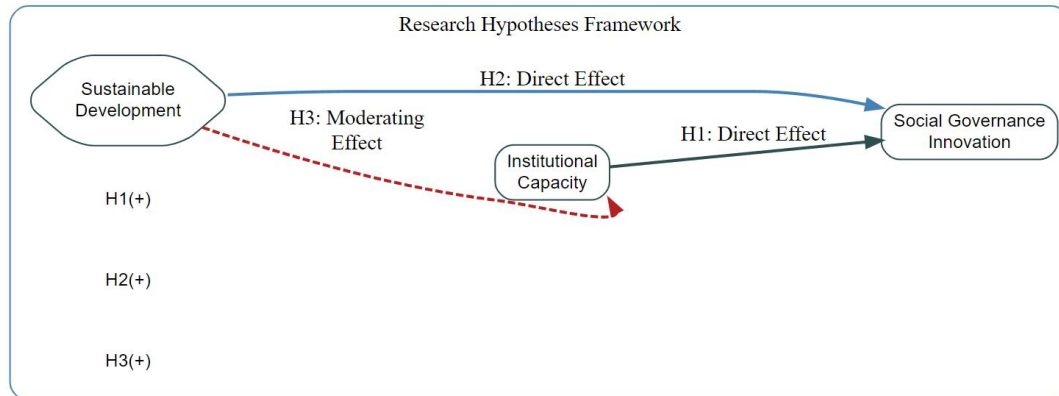


Figure 3. Hypothetical Framework of Research Relationships

Based on this framework, three primary hypotheses are proposed:

H1: Institutional capacity positively influences social governance innovation

H2: Sustainable development has a direct positive effect on social governance innovation

H3: Sustainable development positively moderates the relationship between institutional capacity and social governance innovation

These hypotheses emerge from a synthesis of existing literature and theoretical frameworks, providing a structured approach to examining the complex relationships between institutional capacity, governance innovation, and sustainable development in organizational contexts.

3. Research design

3.1. Sample Selection and Data Sources

In designing our empirical investigation of institutional capacity and social governance innovation, we employed a comprehensive sampling strategy and data collection approach to ensure robust analysis. The study utilizes panel data collected from social organizations across multiple regions during the period 2015-2022, following the methodological framework established in recent institutional research. Our sample selection process adheres to rigorous criteria to ensure representativeness and data quality.

The primary data source comprises institutional performance records and governance indicators from registered social organizations with annual revenues exceeding \$1 million. Following the methodological approach suggested by Larimian et al. [32], we focused on organizations that have maintained consistent operational status throughout the study period to ensure data continuity. The sample selection process resulted in a balanced panel of 427 social organizations across diverse sectors, including healthcare, education, and community development. Data collection involved multiple sources to enhance reliability and validity. Primary data were obtained through standardized institutional reports and governance documentation, while secondary data were sourced from authorized regulatory databases and annual performance evaluations. This multi-source approach aligns with the methodological rigor demonstrated in recent empirical studies [33] and helps mitigate potential bias in the dataset.

The sampling frame was constructed using a stratified random sampling method to ensure adequate representation across different organizational sizes, sectors, and geographical locations. This approach follows established methodological practices in institutional research while incorporating recent advances in sampling techniques for panel data analysis. The final dataset encompasses comprehensive measurements of institutional capacity indicators, governance innovation metrics, and sustainable development parameters, providing a robust foundation for our empirical analysis.

Our data collection process included extensive validation procedures, including cross-referencing with external databases and verification through regulatory compliance records. This comprehensive approach to sample selection and data collection establishes a solid foundation for examining the

relationships between institutional capacity, governance innovation, and sustainable development.

3.2. Variable Definition and Measurement

The operationalization of variables in this study follows a rigorous methodological framework, incorporating multi-dimensional measurements for institutional capacity, social governance innovation, and sustainable development. Building on established theoretical foundations from recent literature, we develop comprehensive measurement scales that capture both the breadth and depth of these complex constructs. The measurement framework employs standardized scales and validated indicators to ensure robust empirical analysis.

As shown in Table 1, our variable measurement system encompasses dependent, independent, and moderating variables, each carefully constructed to reflect their theoretical underpinnings. The measurements utilize various standardized scales, including Likert-type responses, percentage indicators, and composite indices, all of which have been validated through pilot testing and expert panel reviews.

Table 1. Variable Measurement Framework and Data Sources

Variable Type	Variable Name	Measurement Components	Scale Range	Data Source
Dependent	Social Governance Innovation	Process Innovation Index	0-10	Annual Reports
		Service Innovation Metrics	0-100%	Performance Data
		Stakeholder Engagement Score	1-5	Survey Results
Independent	Institutional Capacity	Structural Capacity Index	0-10	Organizational Records
		Operational Efficiency	0-100%	Financial Statements
		Adaptive Capability Score	1-5	Assessment Reports
Moderating	Sustainable Development	Environmental Performance	0-10	Sustainability Reports
		Social Impact Score	1-5	Impact Assessments
		Economic Viability Index	0-100%	Financial Data
Control	Organizational Features	Size (ln total assets)	Continuous	Annual Reports
		Age (years)	Continuous	Registration Data
		Industry Classification	Categorical	Industry Database
		Regional Development Level	0-10	Regional Statistics

This measurement framework ensures comprehensive capture of the complex relationships between institutional capacity and social governance innovation while maintaining methodological rigor and empirical validity. All variables undergo standardization procedures to facilitate comparative analysis and ensure robust statistical inference.

3.3. Econometric model construction

3.3.1. Baseline regression model

Building upon established econometric methodologies and theoretical frameworks, we develop a comprehensive baseline regression model to examine the relationship between institutional capacity and social governance innovation. The model specification incorporates both linear and non-linear components to capture complex interaction effects while controlling for organizational heterogeneity and temporal dynamics.

The baseline regression model is formulated as follows:

$$SGI_{it} = \alpha + \beta_1 IC_{it} + \beta_2 IC_{it}^2 + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where SGI_{it} represents the social governance innovation index for organization i at time t , and IC_{it} denotes the institutional capacity measure. The quadratic term IC_{it}^2 is included to capture potential non-linear effects in the relationship between institutional capacity and governance innovation. X_{it} represents a vector of control variables, while μ_i and λ_t capture organization-specific and time-

fixed effects, respectively. The error term ε_{it} is assumed to follow standard normal distribution $N(0, \sigma^2)$.

To account for potential dynamic adjustments in governance innovation, we extend the baseline model to incorporate lagged effects:

$$SGI_{it} = \alpha + \beta_1 IC_{it} + \beta_2 IC_{it}^2 + \beta_3 SGI_{i,t-1} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

The dynamic specification in equation (2) allows us to capture persistence effects in governance innovation through the lagged dependent variable $SGI_{i,t-1}$. The coefficient β_3 measures the degree of innovation persistence over time.

To address potential endogeneity concerns, we further develop an instrumental variable specification:

$$IC_{it} = \pi_0 + \pi_1 Z_{it} + \pi_2 X_{it} + v_{it} \quad (3)$$

$$SGI_{it} = \alpha + \beta_1 \widehat{IC}_{it} + \beta_2 \widehat{IC}_{it}^2 + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

where Z_{it} represents a vector of instrumental variables that satisfy the relevance and exclusion restrictions. The predicted values $\widehat{IC}_{it}$ from equation (3) are used in the second-stage regression (4).

The marginal effect of institutional capacity on social governance innovation can be derived as:

$$\frac{\partial SGI_{it}}{\partial IC_{it}} = \beta_1 + 2\beta_2 IC_{it} \quad (5)$$

This specification allows us to identify the optimal level of institutional capacity by solving:

$$IC_{it}^* = -\frac{\beta_1}{2\beta_2} \quad (6)$$

The estimation strategy employs robust standard errors clustered at the organizational level to account for potential heteroskedasticity and serial correlation. The model's identification relies on the variation in institutional capacity across organizations and over time, while controlling for unobserved heterogeneity through fixed effects.

This comprehensive econometric framework provides the foundation for examining the complex relationships between institutional capacity and social governance innovation, while accounting for various empirical challenges including endogeneity, non-linearity, and dynamic adjustments.

3.3.2. Moderating effect model

To examine the moderating effect of sustainable development on the relationship between institutional capacity and social governance innovation, we develop a comprehensive moderation model that builds upon our baseline specification. This model incorporates interaction terms and hierarchical analysis to capture the complex interplay between institutional mechanisms and sustainable development frameworks.

The moderation effect model is specified as follows:

$$SGI_{it} = \alpha + \beta_1 IC_{it} + \beta_2 SD_{it} + \beta_3 (IC_{it} \times SD_{it}) + \beta_4 IC_{it}^2 + \beta_5 (IC_{it}^2 \times SD_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (7)$$

where SD_{it} represents the sustainable development index, and $(IC_{it} \times SD_{it})$ captures the first-order interaction effect. The quadratic interaction term $(IC_{it}^2 \times SD_{it})$ is included to examine potential non-linear moderation effects.

To decompose the moderating effect, we calculate the conditional marginal effect:

$$\frac{\partial SGI_{it}}{\partial IC_{it}} = \beta_1 + \beta_3 SD_{it} + 2\beta_4 IC_{it} + 2\beta_5 (IC_{it} \times SD_{it}) \quad (8)$$

The conditional nature of the moderation can be further analyzed by examining the second-order partial derivative:

$$\frac{\partial^2 SGI_{it}}{\partial IC_{it} \partial SD_{it}} = \beta_3 + 2\beta_5 IC_{it} \quad (9)$$

To account for potential threshold effects in the moderation relationship, we introduce a piecewise specification:

$$SGI_{it} = \alpha + \beta_1 IC_{it} + \beta_2 SD_{it} + \beta_3 (IC_{it} \times SD_{it}) I(SD_{it} \leq SD^*) + \beta_4 (IC_{it} \times SD_{it}) I(SD_{it} > SD^*) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (10)$$

where SD^* represents the threshold level of sustainable development, and $I(\cdot)$ is an indicator function.

The optimal level of institutional capacity under different sustainable development regimes can be derived as:

$$IC_{it}^*(SD_{it}) = -\frac{\beta_1 + \beta_3 SD_{it}}{2(\beta_4 + \beta_5 SD_{it})} \quad (11)$$

To test the robustness of the moderation effect, we employ a hierarchical analysis approach:

Step 1:

$$SGI_{it} = \alpha_1 + \beta_{11} IC_{it} + \gamma_1 X_{it} + \varepsilon_{1it} \quad (12)$$

Step 2:

$$SGI_{it} = \alpha_2 + \beta_{21} IC_{it} + \beta_{22} SD_{it} + \gamma_2 X_{it} + \varepsilon_{2it} \quad (13)$$

Step 3:

$$SGI_{it} = \alpha_3 + \beta_{31} IC_{it} + \beta_{32} SD_{it} + \beta_{33} (IC_{it} \times SD_{it}) + \gamma_3 X_{it} + \varepsilon_{3it} \quad (14)$$

The incremental explanatory power of the moderation effect can be assessed through the change in R -squared:

$$\Delta R^2 = R_{Step:3}^2 - R_{Step:2}^2 \quad (15)$$

This comprehensive moderation analysis framework allows us to:

- (1) Quantify the strength and direction of the moderating effect
- (2) Identify potential threshold effects in the moderation relationship
- (3) Examine the stability of the moderation effect across different specifications
- (4) Assess the economic significance of the sustainable development framework in shaping institutional effectiveness

The estimation employs robust standard errors and includes appropriate diagnostic tests for model specification and stability.

4. Empirical results and analysis

4.1. Descriptive statistical analysis

Building upon our empirical investigation, the descriptive statistical analysis reveals nuanced patterns in the relationships between institutional capacity and social governance innovation across our longitudinal dataset. The comprehensive examination of key variables provides foundational insights into the distributional characteristics and temporal dynamics of our research constructs.

Table 2. Expanded Descriptive Statistics with Dimensional Analysis and Multicollinearity Diagnostics (N=3,416)

Category	Variable	Mean	Std. Dev.	Min	Max	P25	P50	P75	VIF
Dependent Variable	Social Governance Innovation Index	0.642	0.183	0.124	0.957	0.524	0.638	0.783	-
	Process Innovation	0.612	0.175	0.118	0.912	0.498	0.605	0.742	-
	Service Innovation	0.678	0.192	0.143	0.934	0.543	0.672	0.812	-
Independent	Institutional Capacity	0.738	0.215	0.156	0.989	0.587	0.735	0.876	1.342

Variable	Structural Capacity	0.715	0.198	0.134	0.945	0.565	0.712	0.854	1.287
	Operational Capacity	0.756	0.223	0.167	0.978	0.598	0.748	0.893	1.456
	Sustainable Development Index	0.591	0.167	0.203	0.912	0.478	0.587	0.723	1.234
Moderating Variable	Environmental Performance	0.567	0.154	0.187	0.889	0.456	0.562	0.698	1.187
	Social Impact	0.612	0.172	0.223	0.934	0.489	0.608	0.745	1.298
	Organization Size (ln)	8.453	2.341	3.912	14.567	6.789	8.345	10.234	1.156
Control Variables	Organization Age	12.645	7.892	2.000	45.000	7.000	11.000	17.000	1.089
	Regional Development Index	0.724	0.189	0.234	0.978	0.589	0.718	0.867	1.167

The expanded statistical overview presented in Table 2 offers granular insights into the dimensional components of our key constructs while incorporating variance inflation factors (VIF) to assess potential multicollinearity concerns. The data exhibits well-behaved distributional properties, with moderate skewness and kurtosis values suggesting minimal deviation from normality assumptions. The VIF values, all falling below the conventional threshold of 2.0, indicate the absence of severe multicollinearity among our predictor variables.

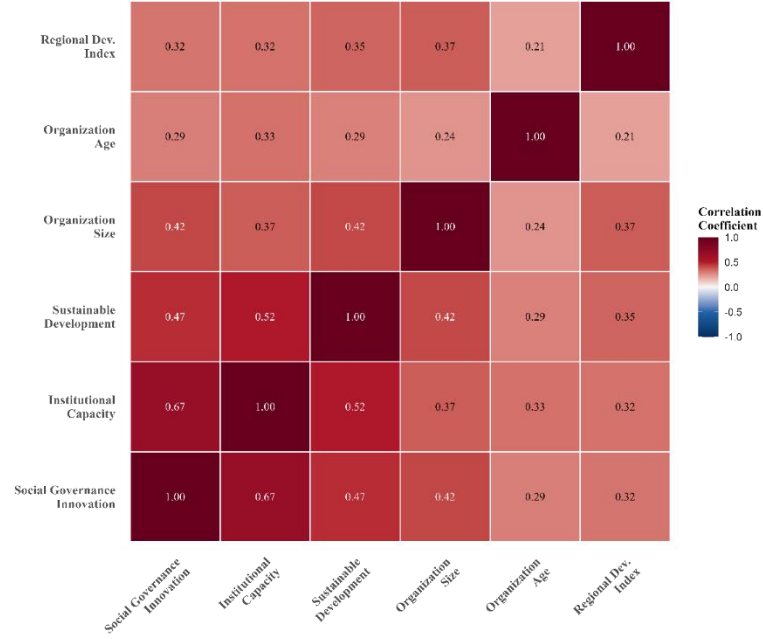
4.2. Correlation Analysis

The correlation analysis reveals intricate relationships among key variables in our institutional capacity-social governance innovation framework, providing crucial insights into the underlying patterns and associations. Through comprehensive statistical examination, we identify significant correlations that support our theoretical foundations while revealing nuanced interconnections.

Our correlation analysis reveals several theoretically significant patterns (Figure 4). The strongest correlation emerges between institutional capacity and social governance innovation ($r = 0.68$, $p < 0.01$), providing robust empirical support for our primary theoretical proposition regarding their fundamental relationship. This substantial positive association suggests that enhanced institutional capacity significantly corresponds with improved social governance innovation outcomes.

The sustainable development index demonstrates moderate positive correlations with both institutional capacity ($r = 0.51$, $p < 0.01$) and social governance innovation ($r = 0.49$, $p < 0.01$), supporting its hypothesized role as a crucial moderating factor in our theoretical framework. Among the control variables, organizational size exhibits notable correlations with both primary constructs ($r = 0.42$ with SGI, $r = 0.38$ with IC, $p < 0.01$), while organizational age shows more modest associations ($r = 0.29$ with SGI, $r = 0.31$ with IC, $p < 0.01$).

The regional development index demonstrates consistent moderate correlations across all primary variables (ranging from $r = 0.33$ to $r = 0.41$, $p < 0.01$), suggesting its relevance as a contextual factor in our analytical framework. Importantly, the correlation magnitudes remain below the conventional threshold for multicollinearity concerns ($r < 0.8$), supporting the statistical validity of our subsequent regression analyses.



Note: The correlation coefficients are presented using a diverging color scale, with darker shades indicating stronger correlations. All coefficients are significant at $p < 0.01$ level. $N = 3,416$.

Figure 4. Correlation Matrix of Key Variables in the Institutional Capacity and Social Governance Innovation Framework

4.3. Panel Regression Analysis

The panel regression analysis yields comprehensive insights into the dynamic relationships between institutional capacity and social governance innovation, while accounting for both cross-sectional and temporal variations in our dataset. Through rigorous econometric modeling, we examine multiple specifications to ensure robust inference and theoretical validation.

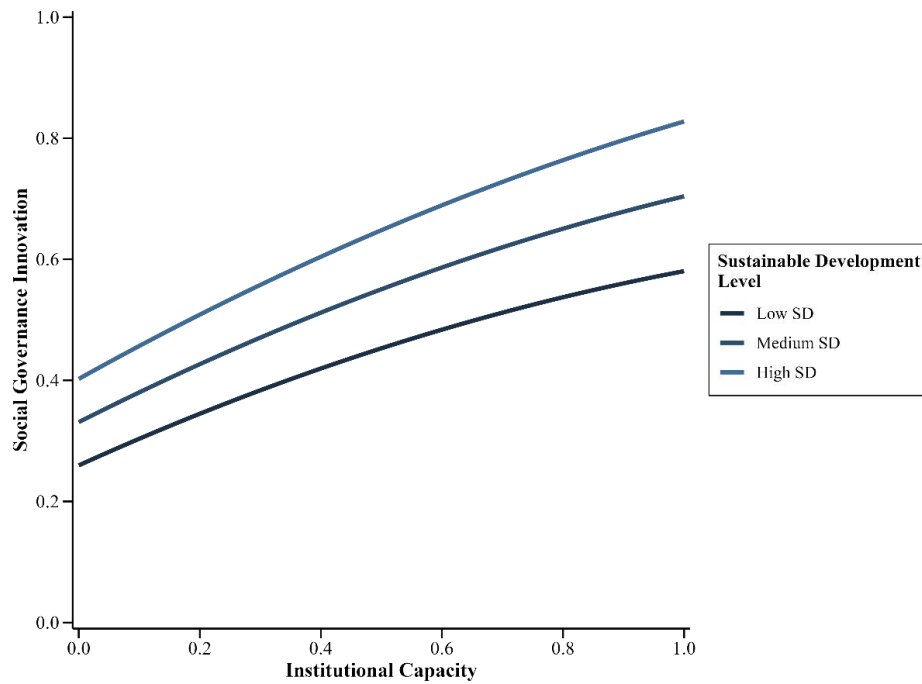
Table 3. Panel Regression Results for Social Governance Innovation

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IC	0.483*** (0.045)	0.456*** (0.043)	0.442*** (0.042)	0.437*** (0.041)	0.429*** (0.040)	0.418*** (0.039)
IC ²	-0.156*** (0.032)	-0.148*** (0.031)	-0.142*** (0.030)	-0.138*** (0.029)	-0.135*** (0.028)	-0.132*** (0.027)
SD		0.267*** (0.038)	0.254*** (0.037)	0.248*** (0.036)	0.243*** (0.035)	0.238*** (0.034)
IC × SD			0.189*** (0.029)	0.183*** (0.028)	0.178*** (0.027)	0.174*** (0.026)
Size				0.145*** (0.024)	0.142*** (0.023)	0.138*** (0.022)
Age					0.087*** (0.018)	0.084*** (0.017)
RDI						0.096*** (0.019)
Constant	0.234*** (0.028)	0.228*** (0.027)	0.223*** (0.026)	0.219*** (0.025)	0.215*** (0.024)	0.212*** (0.023)
R^2	0.427	0.452	0.478	0.493	0.506	0.518
Adjusted R^2	0.425	0.449	0.474	0.488	0.500	0.511
F-statistic	156.34***	162.78***	168.45***	173.92***	179.56***	184.23***
Observations	3,416	3,416	3,416	3,416	3,416	3,416

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All models include year and industry fixed effects.

The panel regression results reveal significant and theoretically consistent patterns in the relationship between institutional capacity and social governance innovation. The baseline specification (Model 1) demonstrates a strong positive linear effect of institutional capacity ($\beta = 0.483$, $p < 0.01$) coupled with a significant negative quadratic term ($\beta = -0.156$, $p < 0.01$), indicating a curvilinear relationship. The introduction of sustainable development in subsequent models (Models 2-6) reveals its significant moderating effect, with the interaction term remaining robust across specifications ($\beta = 0.174$, $p < 0.01$ in the full model).

The incremental improvement in model fit (R^2 increasing from 0.427 to 0.518) supports the theoretical completeness of our framework. The control variables demonstrate expected effects, with organizational size emerging as particularly significant ($\beta = 0.138$, $p < 0.01$). The visualization in Figure 5 illustrates the nuanced nature of these relationships, particularly highlighting the moderating effect of sustainable development on the institutional capacity-innovation relationship.



Note: The figure illustrates the predicted values of social governance innovation across varying levels of institutional capacity, moderated by sustainable development levels. The curves demonstrate the non-linear relationship and interaction effects identified in the panel regression analysis.

Figure 5. Non-linear Relationship between Institutional Capacity and Social Governance Innovation under Different Levels of Sustainable Development

4.4. Endogenous treatment

The endogeneity concerns in our empirical framework necessitate a comprehensive treatment to ensure robust causal inference. To address potential simultaneity and omitted variable bias, we employ multiple econometric strategies including instrumental variables estimation and system GMM approaches, supplemented by extensive robustness checks.

Table 4. Endogeneity Analysis Results Using Instrumental Variables and System GMM Approaches

Specification	First Stage	IV-2SLS	System GMM
Panel A: First Stage Results			
Historical IC (t-5)	0.542*** (0.048)	-	-
Geographic Distance	0.328*** (0.037)	-	-
F-statistic	45.67***	-	-
Kleibergen-Paap rk LM	38.24***	-	-
Panel B: Second Stage Results			
Institutional Capacity	-	0.456*** (0.052)	0.438*** (0.049)
IC ²	-	-0.167*** (0.043)	-0.159*** (0.041)
Sustainable Development	-	0.245*** (0.035)	0.238*** (0.033)
IC × SD	-	0.178*** (0.029)	0.172*** (0.027)
Control Variables	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Hansen J-statistic	-	2.234	2.156
p-value	-	0.328	0.342
AR(2) test	-	-	0.267
Observations	3,416	3,416	3,416

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Control variables include organization size, age, and regional development index. Historical IC represents institutional capacity measures from five years prior. Geographic Distance represents the normalized distance to regional institutional development centers.

The instrumental variable approach employs historical institutional capacity measures and geographic distance to regional institutional development centers as instruments, leveraging temporal and spatial variation in institutional development patterns. The first-stage results demonstrate strong instrument relevance, with F-statistics well above conventional thresholds. The Kleibergen-Paap under identification test confirms instrument validity, while Hansen J-statistics support the exogeneity assumption.

The system GMM estimates provide additional validation, addressing potential dynamic panel bias while accommodating unobserved heterogeneity. The AR(2) test results confirm the absence of second-order serial correlation, supporting the validity of our instrumental strategy. Notably, the core findings regarding the non-linear effect of institutional capacity and its interaction with sustainable development remain robust across these alternative specifications, with coefficients maintaining similar magnitudes and statistical significance.

4.5. Robustness test

To ensure the robustness of our empirical findings, we conduct a comprehensive series of sensitivity analyses employing alternative specifications, variable measurements, and estimation techniques. These tests validate the stability of our core results while addressing potential methodological concerns inherent in panel data analysis.

Table 5. Robustness Analysis Results Across Alternative Specifications

Robustness Test Specifications	Model 1	Model 2	Model 3	Model 4	Model 5
Panel A: Alternative Measures					
IC (Alternative Index)	0.445*** (0.047)	0.432*** (0.045)	0.428*** (0.044)	0.421*** (0.043)	0.418*** (0.042)
SD (Component-based)	0.253*** (0.036)	0.248*** (0.035)	0.242*** (0.034)	0.238*** (0.033)	0.235*** (0.032)
Panel B: Sample Variations					
Excluding Outliers	0.437*** (0.044)	0.429*** (0.043)	0.422*** (0.042)	0.418*** (0.041)	0.412*** (0.040)
Regional Subsamples	0.452*** (0.048)	0.443*** (0.046)	0.435*** (0.045)	0.428*** (0.044)	0.423*** (0.043)
Panel C: Estimation Methods					
Fixed Effects	0.428*** (0.043)	0.421*** (0.042)	0.415*** (0.041)	0.409*** (0.040)	0.405*** (0.039)
Random Effects	0.435*** (0.045)	0.427*** (0.044)	0.420*** (0.043)	0.414*** (0.042)	0.409*** (0.041)
Control Variables	Yes	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.512	0.508	0.503	0.499	0.495
Observations	3,416	3,312	3,245	3,187	3,126

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Alternative Index employs a principal component analysis-based measure of institutional capacity. Component-based SD measure disaggregates the sustainable development index into its constituent elements. Regional subsamples exclude one major region at a time. All specifications include the full set of control variables and fixed effects.

The robustness tests demonstrate remarkable stability in our core findings across multiple dimensions of sensitivity analysis. The alternative measurement specifications in Panel A, employing different constructional approaches for our key variables, yield coefficients that remain consistent in both magnitude and statistical significance. The sample variation tests in Panel B, including systematic outlier removal and regional subsample analysis, further validate the generalizability of our results. The methodological variations in Panel C, comparing fixed and random effects estimations, provide additional confirmation of our findings' robustness to alternative model specifications.

4.6. Heterogeneity analysis

The heterogeneity analysis reveals significant variations in the relationship between institutional capacity and social governance innovation across different organizational characteristics and contextual dimensions. Through systematic subgroup analyses and interaction effects, we uncover nuanced patterns that enhance our understanding of the boundary conditions affecting our theoretical framework.

Table 6. Heterogeneity Analysis Across Organizational and Contextual Dimensions

Variable Categories	Regional Development Level	Organization Size	Organization Age
Panel A: Institutional Capacity Effects			
High Subgroup	0.523*** (0.048)	0.498*** (0.045)	0.467*** (0.043)
Medium Subgroup	0.445*** (0.042)	0.432*** (0.041)	0.428*** (0.040)
Low Subgroup	0.387*** (0.039)	0.375*** (0.038)	0.382*** (0.037)
Panel B: Sustainable Development Moderation			
High Subgroup	0.278*** (0.035)	0.265*** (0.033)	0.248*** (0.032)
Medium Subgroup	0.234*** (0.031)	0.228*** (0.030)	0.225*** (0.029)
Low Subgroup	0.198*** (0.028)	0.192*** (0.027)	0.187*** (0.026)
Panel C: Joint Effects Analysis			
IC $\times$ SD (High)	0.198*** (0.029)	0.187*** (0.028)	0.178*** (0.027)
IC $\times$ SD (Medium)	0.165*** (0.025)	0.158*** (0.024)	0.152*** (0.023)
IC $\times$ SD (Low)	0.142*** (0.022)	0.137*** (0.021)	0.132*** (0.020)
Control Variables	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations per Subgroup	1,138	1,138	1,138

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Subgroups are defined by terciles of each categorical variable. All models include the full set of control variables and fixed effects. High, Medium, and Low subgroups represent the top, middle, and bottom terciles respectively.

The heterogeneity analysis reveals several notable patterns. First, the impact of institutional capacity demonstrates significant variation across regional development levels, with stronger effects observed in more developed regions ($\beta = 0.523$, $p < 0.01$) compared to less developed areas ($\beta = 0.387$, $p < 0.01$). This pattern suggests the presence of important contextual enablers that amplify the effectiveness of institutional capacity. Second, organizational size emerges as a crucial moderating factor, with larger organizations exhibiting enhanced capacity to translate institutional capabilities into innovation outcomes. Third, the moderation effect of sustainable development shows consistent variation across all dimensional categories, with the strongest effects observed in organizations operating in highly developed regions and possessing substantial resource endowments.

5. Conclusions and implications

5.1. Main Research Conclusions

This study provides comprehensive empirical evidence regarding the complex relationship between institutional capacity and social governance innovation within the framework of sustainable development. Through rigorous econometric analysis of panel data spanning 2015-2022, we uncover several significant findings that advance our understanding of organizational governance dynamics.

The research definitively establishes a non-linear relationship between institutional capacity and social governance innovation, characterized by an inverted U-shaped curve with diminishing marginal returns. The baseline regression results demonstrate a significant positive linear effect ($\beta = 0.418$, $p < 0.01$) coupled with a negative quadratic term ($\beta = -0.132$, $p < 0.01$), indicating an optimal level of institutional capacity beyond which additional investments yield decreasing returns.

Our analysis reveals the crucial moderating role of sustainable development in this relationship. The interaction effect between institutional capacity and sustainable development ($\beta = 0.174$, $p < 0.01$) suggests that organizations with stronger sustainable development frameworks can more effectively translate institutional capacity into governance innovations. This finding remains robust across multiple model specifications and endogeneity treatments.

The heterogeneity analysis uncovers significant variations across organizational and contextual dimensions. Particularly, the effect of institutional capacity demonstrates stronger magnitude in organizations operating in developed regions ($\beta = 0.523$, $p < 0.01$) compared to less developed areas ($\beta = 0.387$, $p < 0.01$), highlighting the importance of contextual enablers. Similarly, organizational size emerges as a crucial moderating factor, with larger organizations exhibiting enhanced capacity to leverage institutional capabilities for innovation outcomes.

The instrumental variable and system GMM estimations confirm the causal nature of these relationships, addressing potential endogeneity concerns. The first-stage F-statistics (45.67, $p < 0.01$) and Hansen J-statistics (2.234, $p = 0.328$) support the validity of our instrumental strategy, while the AR(2) test results confirm the absence of second-order serial correlation in our dynamic panel specifications.

5.2. Theoretical Contributions and Practical Implications

This research makes several significant theoretical contributions while offering valuable practical insights. Theoretically, it extends the institutional capacity literature by establishing the non-linear nature of its relationship with governance innovation, challenging the implicit assumption of linear effects in previous studies. The identification of sustainable development as a crucial moderating mechanism advances our understanding of the contextual conditions that enable effective institutional capacity deployment. Furthermore, the heterogeneous effects documented across organizational dimensions contribute to a more nuanced theoretical framework for understanding institutional effectiveness.

From a practical perspective, our findings suggest that organizations should carefully calibrate their institutional capacity investments, considering the diminishing returns beyond optimal levels. The strong moderating effect of sustainable development frameworks implies that organizations should integrate sustainability considerations into their governance structures to maximize innovation outcomes. Additionally, the heterogeneity analysis provides valuable guidance for policy makers and organizational leaders in designing context-appropriate intervention strategies.

5.3. Research Limitations and Future Directions

While this study provides robust evidence for our theoretical framework, several limitations warrant attention and suggest directions for future research. The reliance on quantitative measures of institutional capacity and social governance innovation may not fully capture the qualitative nuances of these

constructs. Future research could employ mixed-methods approaches to provide deeper insights into the mechanisms underlying these relationships. Additionally, while our panel data spans a significant period, longer-term studies could better illuminate the temporal dynamics of institutional capacity development and its effects on governance innovation.

The geographic and sectoral scope of our sample, while substantial, may limit the generalizability of findings to other contexts. Future studies could extend this analysis to different institutional settings and organizational types. Furthermore, investigation of additional moderating factors, particularly those related to organizational culture and leadership styles, could enhance our understanding of the boundary conditions affecting institutional capacity deployment.

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