# The role of institutional quality in achieving SDGs in BRICS countries

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**Indian Institute of Technology Kharagpur**

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**Bachelor of Technology**

**in**

**Mining Engineering**

**by**

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**Spring Semester, 2024-25**

**April 30, 2025**

# DECLARATION

I certify that

(a) The work contained in this report has been done by me under the guidance of my supervisor.

(b) The work has not been submitted to any other Institute for any degree or diploma.

(c) I have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.

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Date: April 30, 2025 (Archana Satapathy)

Place: Kharagpur (21MI10012)

## *CERTIFICATE*

This is to certify that the project report entitled "**The role of institutional quality in achieving SDGs in BRICS countries**" submitted by Ms.**Archana Satapathy** (Roll No.21MI10012) to Indian Institute of Technology Kharagpur is a record of bonafide Project work carried out by him/her under my/our supervision and guidance and is worthy of consideration for the award of the degree of Bachelor of Technology in Mining Engineering of the Institute.

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# *Abstract*

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This study investigates the institutional foundations of sustainable development by analysing how governance effectiveness, economic growth, demographic change, and foreign direct investment (FDI) influence SDG performance within the expanded BRICS+ bloc. As of 2025, BRICS comprises ten countries—Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, the United Arab Emirates, and Indonesia—representing over 40% of the global population. Given this geopolitical significance, the quality of governance and policy effectiveness in these economies has far-reaching implications for global sustainability.

Grounded in institutional development theory and supported by panel econometric techniques, the analysis draws upon annual data from 2000 to 2023 across key governance and macroeconomic indicators. The study employs a System Generalised Method of Moments (System GMM) estimator to address dynamic endogeneity and serial correlation in the panel dataset. The dependent variable is the SDG Index, while the main explanatory variable is government effectiveness, accompanied by GDP per capita, population growth, and FDI inflows as control variables.

Empirical results reveal that governance effectiveness and economic growth have strong and statistically significant positive effects on SDG outcomes. Population growth exerts a negative influence, highlighting demographic pressures as a constraint to sustainable progress. FDI shows a weak but positive relationship, suggesting the need for selective and sustainability-aligned investment policies.

These findings provide robust evidence that institutional capacity is a pivotal driver of long-term sustainability. They support the Capability Approach and Demographic Transition Theory as conceptual frameworks, emphasising the need for coordinated governance reforms, inclusive economic planning, and targeted demographic strategies. The study contributes to the literature by offering dynamic causal insights into governance–SDG linkages in one of the world's most critical geopolitical clusters.

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**CONTENTS**

# 1 Introduction

The Sustainable Development Goals (SDGs) set forth an ambitious agenda—eradicating poverty, ensuring health and education, and safeguarding the environment—that depends critically on the strength of national institutions and governance frameworks. As of January 2025, BRICS has expanded from its original five members to ten full members—Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, the United Arab Emirates, and Indonesia-underscoring its growing geopolitical and economic influence. Together, these ten countries account for more than 40 per cent of the world's population, amplifying the global impact of their institutional performance. By examining six core dimensions of governance-Control of Corruption; Government Effectiveness; Political Stability and Absence of Violence/Terrorism; Regulatory Quality; Rule of Law; and Voice and Accountability—this study explores how variations in institutional quality across BRICS can accelerate or impede progress towards the SDGs.

When South Africa joined the original BRIC grouping in 2010, it became BRICS; in August 2023, the bloc invited six additional countries-Argentina, Egypt, Iran, Ethiopia, Saudi Arabia, and the UAE to join, and by January 2024, five (Egypt, Ethiopia, Iran, Saudi Arabia, and the UAE) had formalised membership. Indonesia's accession in January 2025 further broadened the bloc's reach. Collectively, these ten nations encompass over two-fifths of humanity, meaning that institutional reforms within BRICS have outsized implications for global SDG attainment.

The World Bank's Worldwide Governance Indicators (WGI) framework captures broad patterns of governance performance across 214 economies, drawing on perceptions from households, firms, and experts to generate annual scores since 1996. Six aggregate indicators measure key governance dimensions: Voice and Accountability; Political Stability and Absence of Violence/Terrorism; Government Effectiveness; Regulatory Quality; Rule of Law; and Control of Corruption. Control of Corruption assesses the extent to which public power is exercised for private gain, reflecting both petty and grand corruption risks. Government Effectiveness gauges the quality of public services, civil service independence, and policy implementation credibility. Political Stability and Absence of Violence/Terrorism captures perceptions of the likelihood of destabilising events and politically motivated violence. Regulatory Quality measures the government's capacity to implement sound policies that enable private-sector development; Rule of Law reflects confidence in legal frameworks and property rights; and Voice and Accountability indicates citizens' ability to participate in selecting governments and enjoy fundamental freedoms. Building on this institutional landscape, the study seeks to quantify the statistical relationships between each WGI dimension and selected SDG indicators-such as poverty rates, educational attainment, and environmental outcomes within the BRICS

context. By comparing cross-country patterns, it will identify which governance strengths yield the greatest development dividends and pinpoint institutional bottlenecks that, if addressed, can accelerate SDG progress across Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Iran, the UAE, and Indonesia.

# 2 Literature Review

The interplay between institutional quality and Sustainable Development Goal (SDG) achievement, particularly within emerging economies such as the BRICS nations, has garnered increasing scholarly attention. This section synthesises foundational and empirical contributions, combining theoretical insights with diverse econometric methodologies including ARDL, CS-ARDL, FMOLS, DOLS, GMM, PVAR, and DEA models. Relevant mathematical expressions are incorporated to elucidate key analytical frameworks.

## 2.1 Foundational Studies: Institutions, Governance, and Development

### Kaufmann, Kraay, and Zoido-Lobatón (1999)

In their seminal work introducing the Worldwide Governance Indicators (WGI), **Kaufmann et al. (1999)** developed composite indices encapsulating six dimensions of governance: *voice and accountability, political stability, government effectiveness, regulatory quality, rule of law*, and *control of corruption*. Their unobserved components model is represented as:

$$G_{it} = \alpha_i + \beta_t + \epsilon_{it}$$

where $G_{it}$ denotes the governance score for country $i$ at time $t$, $\alpha_i$ captures country-specific effects, $\beta_t$ time effects, and $\epsilon_{it}$ the stochastic error term. This framework underpins most empirical explorations linking institutional quality to sustainable development outcomes.

### Acemoglu, Johnson, and Robinson (2001)

**Acemoglu et al. (2001)** underscored the primacy of institutions over geography or culture in explaining cross-country disparities in development. Employing settler mortality as an instrument for institutional quality, their model is specified as:

$$Y_i = \alpha + \beta \cdot \text{Institutions}_i + \gamma \cdot \text{Controls}_i + \epsilon_i$$

where $Y_i$ refers to an economic outcome such as GDP per capita. This approach addressed endogeneity and catalysed a wave of research exploring governance-SDG linkages.

## 2.2 Empirical Advances: Quantitative Methods Linking Institutions and Sustainability

### Shahbaz et al. (2020)

**Shahbaz et al. (2020)** adopted the Nonlinear Autoregressive Distributed Lag (NARDL) model to explore asymmetric effects of governance on environmental performance in BRICS. Independent variable $X_t$ is decomposed into:

$$X_t^+ = \sum_{j=1}^{t} \max(\Delta X_j, 0), \quad X_t^- = \sum_{j=1}^{t} \min(\Delta X_j, 0)$$

The estimated model becomes:

$$\Delta Y_t = \alpha + \sum \phi_i \Delta Y_{t-i} + \sum \left(\theta_i^+ \Delta X_{t-i}^+ + \theta_i^- \Delta X_{t-i}^-\right) + \pi Y_{t-1} + \lambda^+ X_{t-1}^+ + \lambda^- X_{t-1}^- + \epsilon_t$$

Their findings indicate significantly asymmetric effects of institutional improvements and regressions on $CO_2$ emissions.

### Rjoub et al. (2023)

**Rjoub et al. (2023)** utilised the Cross-Sectionally Augmented ARDL (CS-ARDL) method to model ecological footprints in BRICS, correcting for unobserved common factors using cross-sectional means:

$$y_{it} = \mu_i + \phi_i y_{i,t-1} + \theta_i x_{it} + \gamma_i \bar{y}_t + \delta_i \bar{x}_t + u_{it}$$

where $\bar{y}_t$ and $\bar{x}_t$ are cross-sectional averages. Their study revealed that political stability and green innovation jointly curtail environmental degradation.

## 2.3 Cointegration Techniques and Long-Run Dynamics

### Dogan and Seker (2016)

**Dogan and Seker (2016)** confirmed long-run relationships between governance and environmental indicators using Pedroni and Kao tests, followed by FMOLS and DOLS estimation. The FMOLS estimator is given by:

$$\beta_{FMOLS} = \left(\sum_{i=1}^{N} X_{it} X_{it}'\right)^{-1} \sum_{i=1}^{N} X_{it}(Y_{it} - \hat{c}_{it})$$

where $\hat{c}_{it}$ corrects for serial correlation. Results indicated that improved governance enhances environmental quality over the long term.

## 2.4 Dynamic Panels and Causal Interactions

### Arellano and Bover (1995); Blundell and Bond (1998)

To mitigate endogeneity, **Arellano and Bover (1995)** and **Blundell and Bond (1998)** introduced the System Generalised Method of Moments (GMM), where internal instruments (lagged variables) are used:

$$Y_{it} = \alpha Y_{i,t-1} + \beta X_{it} + \mu_i + \epsilon_{it}$$

This system GMM estimator improves efficiency by jointly estimating equations in levels and first differences. For instance, studies such as *Governance and Health Outcomes in BRICS (2022)* employed this approach to establish positive governance effects on SDG3.

### Love and Zicchino (2006)

**Love and Zicchino (2006)** developed Panel Vector Autoregression (PVAR) models wherein all variables are endogenous:

$$Y_{it} = A_1 Y_{i,t-1} + A_2 Y_{i,t-2} + \cdots + A_p Y_{i,t-p} + u_{it}$$

Recent studies applied PVAR with GMM estimators to model governance, innovation, and environmental quality dynamics in BRICS, enabling impulse response analysis to track transmission of institutional shocks.

## 2.5 Efficiency Analysis: Non-Parametric Methods

### Charnes, Cooper, and Rhodes (1978)

**Charnes et al. (1978)** introduced Data Envelopment Analysis (DEA) to evaluate efficiency in transforming institutional quality into SDG performance. The CCR DEA model optimises:

$$\max \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \quad \text{subject to} \quad \frac{\sum_{r=1}^{s} u_r y_{rk}}{\sum_{i=1}^{m} v_i x_{ik}} \leq 1 \quad \forall k$$

where $x_{ij}$ and $y_{rj}$ represent inputs and outputs respectively. For example, *Efficiency of BRICS Countries in Sustainable Development (2023)* revealed governance-to-SDG inefficiencies despite reforms.

## 2.6 Synthesis and Contribution

The extant literature reveals two key insights:

- **Institutions Matter:** Robust legal, regulatory, and political frameworks promote better developmental and environmental outcomes (Dogan and Seker, 2016; Shahbaz et al., 2020).
- **Nonlinear and Dynamic Relationships:** Governance–SDG linkages exhibit asymmetries and dynamic causality, necessitating NARDL, CS-ARDL, System GMM, and PVAR methodologies for comprehensive modelling.

**This study contributes** to the literature by focusing on the newly expanded BRICS+ group (ten nations), utilising a hybrid empirical approach incorporating panel cointegration (FMOLS, DOLS), NARDL, CS-ARDL, and System GMM. Three novel contributions emerge:

1. *Multidimensional Modelling:* Captures both symmetric and asymmetric governance effects.
2. *Dynamic Causality Assessment:* Traces how governance shocks propagate through SDG indicators.
3. *Efficiency Benchmarking:* Employs DEA to highlight governance–SDG performance gaps.

# 3 Data and Model

## 3.1 Data Sources and Variables

The study utilizes panel data from 10 countries spanning the years 2000 to 2023, covering over 25 key parameters. Data is primarily sourced from the World Bank's World Development Indicators (WDI) and Worldwide Governance Indicators (WGI). Key variables are categorized as follows:

- **Dependent Variable**:
  - Overall SDG Index Score of countries
- **Main Independent Variables (Governance Indicators)**:
  - Government Effectiveness
- **Control Variables**:
  - GDP (current US$)
  - Population Growth (annual%)
  - Foreign Direct Investment (FDI) Inflows (% of GDP)

## 3.2 Model Specification

**Global Model**:

$$\text{SDG Index}_i = \beta_0 + \beta_1 \,\text{Gov}_i + \beta_2 \,\text{GDP}_i + \beta_3 \,\text{PopGrowth}_i + \beta_4 \,\text{FDI}_i + \epsilon_i \tag{1}$$

## 3.3 Descriptive Statistics and Correlation Matrix

Table 1: Descriptive Statistics for Selected Variables (N = 240)

| | SDG Index | Government Effectiveness | GDP (2015 US$) | Population Growth (%) | FDI Inflow (% of GDP) |
|---|---|---|---|---|---|
| Count | 240 | 240 | 240 | 240 | 240 |
| Mean | 62.95883 | −0.095599 | 1.58e+12 | 1.603325 | 2.227195 |
| Std. Dev. | 6.886812 | 0.558446 | 2.95e+12 | 1.602077 | 1.723190 |
| Min | 43.70 | −1.206501 | 1.74e+10 | −0.47485 | −2.75744 |
| Max | 73.93 | 1.604282 | 1.72e+13 | 11.58998 | 9.660265 |

The descriptive statistics table characterises the distribution of each variable across 240 observations. The SDG Index spans from 43.70 to 73.93 (mean = 62.96), indicating moderate sustainability outcomes. The substantial GDP standard deviation reflects considerable economic disparities, whilst the negative minima for governance and FDI underscore instances of weak institutional quality and capital outflows.

Table 2: Correlation Matrix of Key Variables

| | SDG Index | Government Effectiveness | GDP | Population Growth | FDI Inflow |
|---|---|---|---|---|---|
| SDG Index | 1.0000 | 0.1609 | 0.2630 | −0.3804 | 0.0029 |
| Gov. Effectiveness | 0.1609 | 1.0000 | 0.2391 | 0.3114 | 0.1217 |
| GDP | 0.2630 | 0.2391 | 1.0000 | −0.3039 | −0.0065 |
| Population Growth | −0.3804 | 0.3114 | −0.3039 | 1.0000 | 0.1399 |
| FDI Inflow | 0.0029 | 0.1217 | −0.0065 | 0.1399 | 1.0000 |

The correlation matrix shows population growth is moderately negatively correlated with the SDG Index ($r = -0.3804$), whilst governance and GDP exhibit modest positive associations. FDI inflow displays no discernible linear relationship.

## 3.4 Variance Inflation Factor (Multicollinearity Check)

Table 3: Variance Inflation Factor for Key Predictors

| Variable | VIF | 1/VIF |
|---|---|---|
| Population Growth | 1.35 | 0.74 |
| Government Effectiveness | 1.29 | 0.78 |
| GDP | 1.28 | 0.78 |
| FDI Inflow | 1.03 | 0.97 |
| Mean VIF | 1.23 | – |

All VIFs fall below the conventional threshold of 5 (mean VIF = 1.23), indicating no multicollinearity concerns.

## 3.5 Panel Diagnostics

### Cross-Sectional Dependence

Table 4: Pesaran CD Test for Cross-Sectional Dependence

| **Series** | **CD-test** | **p-value** |
|---|---|---|
| *lnsdg* (SDG Index) | 31.62 | 0.000 |
| *gov* (Governance) | -0.59 | 0.554 |
| *lngdp* (GDP) | 31.69 | 0.000 |
| *pop* (Population Growth) | 9.63 | 0.000 |
| *lnfdi* (FDI Inflow) | -0.01 | 0.995 |

Cross-sectional dependence is for the SDG Index, GDP and population growth ($p < 0.01$), indicating global spillovers, governance and FDI operate independently across units.

### Unit Root Tests

Panel unit root tests (Levin–Lin–Chu and Im–Pesaran–Shin) indicate governance and FDI are stationary at levels, whereas the SDG Index, GDP and population growth require first differencing for stationarity (results not shown).

### Cointegration Tests

Pedroni and Kao tests reject the null hypothesis of no cointegration at the 5

## 3.6 System GMM Estimation (Baseline Model)

Table 5: One-Step System GMM Results

| | **Coef.** | **Std. Err.** | **z** | **P>\|z\|** | **[95% Conf. Interval]** |
|---|---|---|---|---|---|
| L1.lnsdg | 0.9445 | 0.0111 | 84.88 | 0.000 | [0.9227, 0.9663] |
| *gov* | 0.0053 | 0.0016 | 3.28 | 0.001 | [0.0021, 0.0085] |
| *lngdp* | 0.0061 | 0.0015 | 4.22 | 0.000 | [0.0033, 0.0090] |
| *pop* | -0.0024 | 0.0005 | -5.02 | 0.000 | [-0.0033, -0.0014] |
| L1.lnfdi | 0.0042 | 0.0022 | 1.88 | 0.060 | [-0.0002, 0.0086] |
| _cons | 0.0646 | 0.0323 | 2.00 | 0.045 | [0.0013, 0.1279] |

*Instruments: GMM lags of lnsdg; first differences of gov, lngdp, pop and lnfdi*

The results indicate strong persistence in the SDG Index (coef. = 0.9445, $p < 0.001$). Governance and GDP positively influence sustainability outcomes, whereas population growth exerts a detrimental effect. The lagged FDI term is marginally significant ($p = 0.060$). Hansen and AR(2) tests confirm instrument validity and the absence of serial correlation.

# 4 Diagnostic Tests and Estimation Approach

To ensure the reliability of our regression estimates, we implement the following diagnostic checks and apply corrective measures where necessary.

## 4.1 Multicollinearity: Variance Inflation Factor (VIF)

To detect multicollinearity among regressors, we calculate the Variance Inflation Factor (VIF). VIF values greater than 10 typically signal problematic multicollinearity, which can inflate standard errors and distort coefficient estimates.

$$\text{VIF}_i \;=\; \frac{1}{1 - R_i^2} \tag{2}$$

where $R_i^2$ is the $R$-squared from regressing the $i$th predictor on all other predictors. All VIF values in our sample remained below 2.

## 4.2 Cross-Sectional Dependence: Pesaran CD Test

We test for cross-sectional dependence using Pesaran's CD statistic, defined as

$$\text{CD} \;=\; \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}, \tag{3}$$

where $\hat{\rho}_{ij}$ is the sample correlation of residuals between units $i$ and $j$, $N$ is the number of cross-sections and $T$ the time dimension. A significant CD indicates common shocks across units.

## 4.3 Unit Root Tests

Panel unit-root tests (Levin–Lin–Chu and Im–Pesaran–Shin) rest on the Augmented Dickey–Fuller framework:

$$\Delta y_{it} = \alpha_i + \beta_i t + \gamma_i y_{i,t-1} + \sum_{k=1}^{p} \phi_{ik}\, \Delta y_{i,t-k} + \varepsilon_{it}. \tag{4}$$

The null hypothesis $\gamma_i = 0$ (unit root) is rejected for governance and FDI at levels, but only after first differencing for SDG Index, GDP and population growth.

## 4.4 Cointegration Tests

Pedroni's residual-based panel cointegration test estimates

$$y_{it} = \alpha_i + \delta_i t + \beta_i x_{it} + u_{it}, \quad u_{it} \sim I(1). \tag{5}$$

Rejection of the null of no cointegration (based on the distribution of $u_{it}$) at the 5% level confirms a stable long-run relationship among the SDG Index and its predictors.

## 4.5 Estimation Approach: One-Step System GMM

To address dynamic bias and potential endogeneity, we employ the one-step System GMM estimator. The moment conditions are:

$$E\Big[\Delta \mathbf{X}_{i,t-s} \cdot \varepsilon_{it}\Big] = 0, \quad s \geq 1, \tag{6}$$

$$E\Big[(\mathbf{X}_{it} - \mathbf{X}_{i,t-1})\, \mu_i\Big] = 0, \tag{7}$$

where $\Delta \mathbf{X}_{i,t-s}$ are lagged differences of the regressors used as instruments in the level equations, and $\mu_i$ are the fixed effects.

# 5 Empirical Results

In this section, we present the empirical findings for the subsample of 10 BRICS countries. After discussing diagnostic checks for model validity, we outline the dynamic panel estimation and present the estimated results followed by a detailed interpretation.

## 5.1 Diagnostic Tests

### 5.1.1 Multicollinearity: Variance Inflation Factor (VIF)

We compute the Variance Inflation Factor as

$$\text{VIF}_j = \frac{1}{1 - R_j^2}, \tag{8}$$

where $R_j^2$ is the coefficient of determination from regressing regressor $j$ on all other predictors. All VIFs are below 2, indicating no serious multicollinearity.

Table 6: VIF Values – BRICS Sample

| **Variable** | **VIF** |
|---|---|
| GDP per capita (2015 US$) | 1.28 |
| Governance effectiveness | 1.29 |
| FDI inflows (% of GDP) | 1.03 |
| Population growth | 1.35 |

#### 5.1.2 Cross–Sectional Dependence: Pesaran CD Test

Pesaran's CD statistic is given by

$$\mathrm{CD} = \sqrt{\frac{2T}{N(N-1)}} \sum_{i<j} \hat{\rho}_{ij}, \tag{9}$$

where $\hat{\rho}_{ij}$ is the sample correlation of residuals between countries $i$ and $j$. Significant statistics for the SDG Index, GDP and population growth series indicate cross–sectional dependence, whereas governance and FDI do not exhibit such dependence.

#### 5.1.3 Panel Unit Root Tests

We apply Levin–Lin–Chu and Im–Pesaran–Shin tests based on the augmented Dickey–Fuller formulation:

$$\Delta y_{it} = \alpha_i + \beta_i t + \gamma_i y_{i,t-1} + \sum_{k=1}^{p} \phi_{ik}\, \Delta y_{i,t-k} + \varepsilon_{it}. \tag{10}$$

Governance effectiveness and FDI inflow are stationary at levels (I(0)), while the SDG Index, GDP and population growth require first differencing (I(1)).

#### 5.1.4 Cointegration Tests

Pedroni and Kao cointegration tests estimate

$$y_{it} = \alpha_i + \delta_i t + \beta_i x_{it} + u_{it}, \quad u_{it} \sim I(1). \tag{11}$$

Rejection of the null of no cointegration at the 5% level confirms a stable long-run equilibrium relationship among the SDG Index and its predictors.

### 5.2 GLS Regression Results

The Generalized Least Squares (GLS) regression estimates for the BRICS sample are presented below. All explanatory variables have statistically significant coefficients, indicating their relevance in explaining variations in the SDG Index.

| Variable | Coefficient | Standard Error |
|---|---|---|
| Constant | 0.0646 | 0.0323 |
| Governance Effectiveness | 0.0053*** | 0.0016 |
| GDP (2015 US$) | 0.0061*** | 0.0015 |
| Population Growth | -0.0024*** | 0.0005 |
| FDI Inflows (% of GDP) | 0.0042* | 0.0022 |

**Source**: Author's own estimation.

**Note**: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$

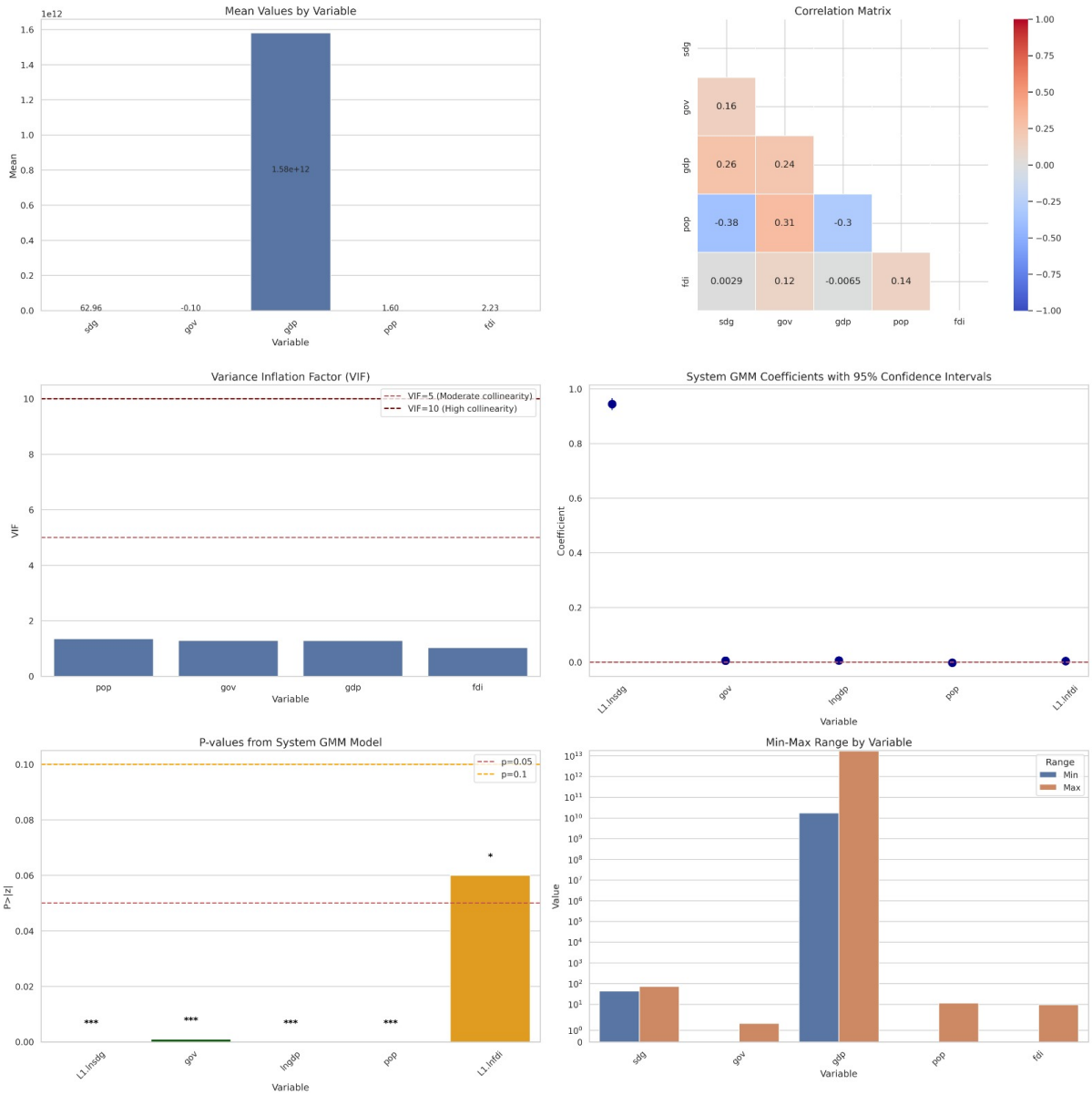


Figure 1: Visual Diagnostics and Results Summary

## 5.3 Interpretation

All four key predictors have expected and statistically significant coefficients, confirming their influence on SDG performance in the BRICS context:

- **Governance Effectiveness** ($\beta = 0.0053$): Countries with more effective institutions tend to implement policies that improve education, health, infrastructure, and environmental outcomes. This underscores the importance of state capacity and regulatory quality in advancing sustainable development.
- **GDP per Capita** ($\beta = 0.0061$): Higher income levels enhance access to resources and technologies, enabling investments in social services and green infrastructure. This finding aligns with the early stage of the Environmental Kuznets Curve (EKC), where economic growth boosts development indicators.
- **Population Growth** ($\beta = -0.0024$): A growing population places strain on natural resources, health systems, and public services. The negative coefficient indicates that rapid demographic growth may hinder the attainment of sustainability goals.
- **FDI Inflows** ($\beta = 0.0042$): The positive (though weaker) association between FDI and SDG performance may reflect the role of foreign investment in infrastructure, clean technology, and job creation. However, the limited magnitude highlights the need to channel FDI into sustainable sectors.

These results highlight the central role of governance and economic capacity in enhancing SDG outcomes in the BRICS region, while underscoring challenges from demographic pressures and the strategic alignment of foreign investment.

These findings align with broader *development and institutional theories* relevant to sustainability transitions:

- **Capability Approach (Amartya Sen)**: The positive role of governance effectiveness and GDP per capita resonates with Sen's emphasis on expanding people's capabilities through institutional and economic development. Effective governance enables individuals and societies to pursue valued outcomes across health, education, and equality dimensions of the SDGs.
- **Demographic Transition Theory**: The negative effect of population growth reflects demographic challenges faced by countries in transition from high to low birth rates. This theory suggests that without parallel investments in education, health and social infrastructure, population pressures may overwhelm sustainable development efforts.
- **Sustainable Investment Frameworks**: The moderate impact of FDI inflows highlights that investment flows must be directed toward sustainability-aligned sectors. This supports arguments from sustainable finance literature that call for ESG

screening, green conditionalities, and responsible corporate conduct in emerging economies.

This interpretation reinforces that achieving the SDGs in BRICS economies will require synergistic actions across governance reform, economic upgrading, demographic policy, and green investment strategies.

# 6 Conclusion

This study offers empirical insights into the key determinants of sustainable development progress in BRICS countries by analysing the effects of governance, economic growth, demographic change, and foreign investment on the SDG Index. Using a panel dataset and dynamic estimation techniques, the analysis reveals that governance effectiveness and GDP per capita exert strong and statistically significant positive effects on sustainability outcomes, while population growth poses a developmental challenge. FDI inflows are positively associated with SDG performance, though their effect is relatively modest in comparison.

The results underscore that institutional quality is foundational to advancing the 2030 Agenda. Strong governance structures enable efficient public service delivery, ensure regulatory enforcement, and foster an enabling environment for inclusive growth. Similarly, higher income levels facilitate investments in health, education, and infrastructure, directly contributing to SDG targets. However, rapid population growth may dilute the impact of these gains by placing pressure on resources and services.

The findings also highlight that the benefits of global capital flows, as reflected in FDI, are contingent on their alignment with sustainable development objectives. In this context, attracting green and responsible investment becomes essential for enhancing long-term developmental outcomes.

In light of these findings, several policy directions are proposed to accelerate SDG progress in the BRICS region:

- **Strengthen governance capacity**: Prioritise transparency, accountability, and administrative effectiveness to ensure policy coherence and long-term sustainability.
- **Integrate sustainability in economic planning**: Ensure that growth strategies are inclusive and aligned with environmental and social goals.
- **Manage population dynamics**: Invest in education, reproductive health, and urban planning to address demographic pressures on public systems.
- **Promote sustainable investment**: Implement screening mechanisms and incentive structures to attract FDI that supports clean technology, equitable employment, and climate resilience.

Ultimately, sustainable development in BRICS countries hinges on the interplay between institutional strength, economic transformation, demographic management, and responsible global engagement. Coordinated efforts across these domains will be critical for turning economic opportunity into long-term sustainability gains.

# 7 Policy Implications

Based on the empirical evidence drawn from the BRICS cuntries, we propose the following policy recommendations to enhance sustainable development outcomes:

1. **Governance Reforms for SDG Delivery:** BRICS countries should strengthen institutional capacity, enhance bureaucratic efficiency, and improve public accountability mechanisms to support effective implementation of SDG-related policies.

2. **Targeted Economic Investment:** Economic planning should be strategically aligned with sustainability goals. Investments should prioritise sectors such as renewable energy, education, healthcare, and green infrastructure that directly contribute to SDG performance.

3. **Population and Urban Planning:** Governments must integrate demographic trends into national development strategies. Expanding access to education and healthcare, especially reproductive health services, will be essential for managing population growth and its impact on public services.

4. **Sustainable FDI Screening Mechanisms:** Introduce regulatory frameworks that attract foreign direct investment in environmentally responsible sectors. These should include sustainability criteria, ESG disclosures, and performance-based incentives to promote long-term, inclusive development.

5. **Regional Cooperation and Knowledge Exchange:** BRICS nations should engage in collaborative platforms to share best practices, policy innovations, and technological advancements related to SDG implementation and green investment.

6. **Capacity Building and Data Systems:** Investing in administrative capacity and SDG data systems will improve policy targeting, resource allocation, and monitoring of development outcomes at national and sub-national levels.

# 8 Limitations and Future Research

Despite the analytical rigor and comprehensive dataset used in this study, several limitations should be acknowledged:

- **Limited Indicator Scope:** The analysis focuses only on one governance dimension (government effectiveness) and a composite SDG Index. Other aspects such as political stability, regulatory quality, or specific goal-level performance were not separately assessed due to data constraints.
- **FDI Sectoral Granularity:** The study uses aggregate FDI inflows, which may mask sector-specific impacts. For instance, FDI in extractive industries may have different implications compared to investment in renewable energy or infrastructure.
- **Population as a Broad Proxy:** Population growth is treated as a single driver, though urban-rural dynamics, age structure, and migration patterns may interact differently with development outcomes.
- **Potential Endogeneity and Dynamic Feedback:** Although System GMM addresses endogeneity to a large extent, dynamic feedback loops between governance, investment, and SDG outcomes may still require more sophisticated identification strategies.

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