

TRADE OPENNESS, INSTITUTIONAL GOVERNANCE, AND HUMAN
CAPITAL IN ASIA: WHAT DOES OMAN'S POSITION TELL US?

*A COMPARATIVE PANEL PERSPECTIVE ON 36 ASIAN AND GCC ECONOMIES, 2002–
2024*

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DOI: <https://doi.org/10.5281/zenodo.22635668>

Keywords

trade openness; institutional
governance; human capital;
panel data; Oman; GCC; World
Governance Indicators; principal
component analysis

Article History

Received: 14 July 2026

Accepted: 18 August 2026

Published: 31 August 2026

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Abstract

This study investigates the link between trade openness, institutional governance quality and human capital formation in 36 Asian and Gulf Cooperation Council (GCC) economies between 2002 and 2024 and the comparative performance of the Sultanate of Oman with these economies. The Human Capital Index is composed from education, health and digital-access indicators using a principal component analysis (PCA) and the governance index is based on the five dimensions of the World Governance Indicators (WGI). In fixed-effects panel estimation, which is validated against random effects using a Hausman specification test, the results indicate that the key correlate of the accumulation of human capital within countries over time is the quality of institutional governance, whereas trade openness has a more cross-sectional than within-country impact. There is a weak negative within-country association for foreign direct investment, which is likely to be attributable to the resource-extraction nature of flows in some sample economies. A country-specific fitted-value analysis shows that Oman was behind its trade-and-governance-implied human capital level in the early 2000s but has since caught up, and then surpassed, that level starting from 2011 a trend that aligns with the human capital priorities outlined in Oman Vision 2040. Oman is the last in the GCC sub-sample, with a governance score that is close to that of Saudi Arabia, indicating a policy gap that could be filled in tertiary education and in investment in digital skills. The paper provides an empirically and regionally comparative assessment of Oman's human capital situation that can guide the current diversification process and human capital policy formulation.

1. Introduction

Human capital formation has become once again a core issue of development economics rather than just a result of income growth but a prerequisite for it. For economies whose growth is driven by a reliance on natural resources, the issue of human capital accumulation and the part played by trade integration and institutional quality in this process

— is directly relevant to policy. This is particularly the case of the Gulf Cooperation Council (GCC) states where economic diversification is explicitly connected to workforce upgrading and transitioning to the knowledge economy in the national visions (Saudi Vision 2030, Oman Vision 2040, UAE Centennial 2071).

Oman is a case of special interest. The Sultanate has been incrementally reforming its government, sustainably expanding its education system, investing in health, building digital infrastructure, and has been particularly vulnerable to fluctuations in hydrocarbon prices, but has a relatively limited non-oil trade base compared to some of its GCC neighbours since the early 2000s. The question of whether Oman's human capital path has tracked – or deviated from – that suggested by its trade openness and institutional profile is thus an empirical and policy question.

This paper provides answers to three research questions. First, across a broad panel of Asian and GCC economies, what is the empirical relationship between trade openness, institutional governance, and human capital accumulation? Second, are the relationships different in the case of GCC economies as compared to the broader Asian sample? Third and at the heart of this, how has Oman's actual human capital development been compared to what could be expected under the estimated regional model given its trade and governance credentials and how does Oman measure up against its immediate neighbours in the GCC?

The paper is organized in the following way. The literature review (Section 2) examines the existing research literature on trade and institutions, and human capital. The data, the construction of the composite indices, and the econometric strategy are described in Section 3. The panel regression results and robustness checks are presented in Section 4. A comparative analysis of the situation in Oman is developed in Section 5. Policy implications are discussed in Section 6, Section 7 notes limitations, and Section 8 concludes.

2. Literature Review

2.1 Trade Openness and Human Capital

This section covers trade and human capital. This section addresses the question of trade and human capital.

The theoretical associations between trade openness and human capital accumulation are more indirect. Trade exposure can increase the rewards to skill by leading workers to produce in

sectors that are more skill intensive, especially in economies that trade with skill-intensive foreign value chains (Romer, 1990; Grossman & Helpman, 1991). The second indirect way in which openness can fund human capital investment is through the increase in national income and government revenues that result from opening up the economy (Dollar & Kraay, 2003). Empirically, however, the trade-growth-human capital literature is far from consistent: even with more open trade, the broad-based upgrading of skills may not occur if trade is being focused on capital-intensive extractive industries—directly relevant to the economies of the hydrocarbon economies of the GCC.

2.2 Institutional Governance and Human Capital

A parallel but connected literature associates institutional quality with human capital outcomes. After the influential work of Kaufmann, Kraay, and Mastruzzi, which has developed a framework for measuring governance (the World Governance Indicators, or WGI), which decomposes institutional quality into voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption, there has been a large volume of empirical literature connecting stronger institutions to more effective public service delivery, including in the education and health sectors. The institutions and growth framework of Acemoglu, Johnson and Robinson has a similar implication: good governance determines the efficiency with which the nation's resources, including income generated from trade, are turned into productive investments like human capital.

2.3 Human Capital Index Construction

There are many ways to construct composite human capital indices, among which the approach used by UNDP's Human Development Index, as well as more recent attempts such as World Bank's Human Capital Index (which adheres to the principal component analysis-based weighting procedure followed in previous human capital

index literature), and academic efforts using principal component analysis to combine multiple correlated education, health and skills indicators into a single latent measure. This is because PCA-based construction is preferred, since it obtains weights based on the actual covariance structure of the sample, as opposed to equal weights a priori, irrespective of the informativeness of the indicators.

2.4 The GCC and Oman in the Regional Literature

Previous studies on economic diversification in the GCC Countries have revealed that over two decades of economic diversification efforts, the region has continued to rely on hydrocarbon revenues, while digital transformation and non-oil trade expansion have increased in recent years. The research in Oman has predominantly concentrated on fiscal sustainability and Omanisation of labour force, however, when compared to others, the relationship of human capital with trade and governance has not been analysed in a multi-country panel framework, which the paper focuses on.

3. Data and Methodology

3.1 Data Source and Sample

The data are based on the data bases of the World Bank 'World Development Indicators' (WDI) and 'World Governance Indicators' (WGI) of 41 Asian and GCC economies in their original form, from 1990 to 2025. The fact that two data-cleaning decisions are made affects the estimation sample. The first is that one non-Asian economy (Lesotho) was excluded because it was not in the raw file and thus is out of scope of the study. Second, the estimation window is limited to 2002–2024, the period in which the WGI governance indicators have been available on a regular annual basis (before 2002, the indicators are available only on a biennial basis, which makes it impossible to compare them on a balanced annual panel). Where a country has no coverage at all for a core model variable, it is removed from the list, meaning Myanmar, Syria, Yemen, and Turkmenistan have missing data for all four model

variables due to conflict and non-reporting. While personal remittance data are informative, it is not included in the core specification because several economies are net remittance senders, and are thus lost from the sample (such as Bahrain and Singapore), instead, it is included for discussion purposes. This results in a balanced panel of 36 countries across 23 years (2002–2024), for a total of 828 country-year observations in the estimation sample.

3.2 Variable Construction

Human Capital Index (HCI). Five indicators are chosen (based on the PCA approach as described in Section 2.3) that have high data coverage: secondary school enrollment (%) gross, tertiary school enrollment (%) gross, life expectancy at birth, current health expenditure (%) GDP, percentage of population using the internet. The variables are standardized (mean = 0, variance = 1) prior to extraction. The first principal component accounts for 57.7% of the total variance in the five indicators: all indicators on education and digital-access have close to uniform loadings (0.49 – 0.51); the loading on health expenditure (0.09) is comparatively low, suggesting that health spending as a percentage of GDP is a weaker indicator of accumulated human capital within the sample than enrollment and connectivity. This component is then scaled to a range of 0–100, with higher scores reflecting increased human capital accumulation.

Governance Index. The five WGI dimensions – Control of Corruption, Government Effectiveness, Political Stability and Absence of Violence, Regulatory Quality, and Rule of Law – are also diminished through PCA. The first component accounts for 87.3% of the variance, and the loadings are very similar (0.41–0.46) on all five dimensions, suggesting that institutional quality is moving in a similar direction across dimensions in this sample and therefore the decision that it can be summarized with a single composite governance index, rather than five separate estimates of the coefficients in the core specification, is warranted (individual coefficients

are estimated separately as a robustness check in Section 4.3).

Trade Openness and Trade Controls. Trade openness is the total amount of trade (exports + imports) divided by GDP. Other controls are FDI net inflows as % of GDP, manufacturing value added as % of GDP (structural transformation), annual consumer price inflation and gross national expenditure as % of GDP (domestic absorption).

3.3 Econometric Strategy

The basic model is a panel regression of the following type:

$$HCI_{it} = \beta_0 + \beta_1 \cdot Trade_{it} + \beta_2 \cdot FDI_{it} + \beta_3 \cdot Manufacturing_{it} + \beta_4 \cdot Governance_{it} + \beta_5 \cdot Inflation_{it} + \beta_6 \cdot GNE_{it} + \alpha_i + \varepsilon_{it}$$

where α_i represents a country-specific effect and i indexes the country, and t indexes the year.

Estimating the model is attempted three ways: (i) one-way fixed effects (entity effects only), (ii) random effects, and (iii) two-way fixed effects (entity and year effects). A Hausman specification test is performed to determine which of the two estimators (fixed effect and random effect) is correct. Variance Inflation Factors (VIF) are calculated to eliminate potential worrisome multicollinearity between regressors and all VIFs for substantive variables are below the widely used concern thresholds of 1.7. Within-country serial correlation is addressed by clustering standard errors throughout at the country level.

4. Results

4.1 Descriptive Statistics

Table 1 reports descriptive statistics for the core variables across the 828 country-year observations in the estimation sample.

Table 1. Descriptive statistics, 36-country panel, 2002–2024 (N = 828).

Variable	Mean	Std. Dev.	Min	Max
Human Capital Index (HCI)	52.60	20.89	0.00	100.00
Governance Index (WGI-PCA)	46.35	20.38	0.00	100.00
Trade openness (% GDP)	93.24	60.95	20.14	437.33
FDI net inflows (% GDP)	6.15	29.34	-296.01	431.79
Manufacturing value added (% GDP)	13.02	7.51	0.72	31.99
Inflation (annual %)	6.32	12.91	-10.07	221.34
Gross national expenditure (% GDP)	102.14	23.58	45.76	264.79
Secondary enrollment (% gross)	81.04	20.74	13.96	124.33
Tertiary enrollment (% gross)	33.99	22.70	0.21	107.26
Life expectancy (years)	72.59	5.75	55.51	84.56
Internet users (% of population)	39.31	32.52	0.00	100.00

4.2 Correlation Structure

The pairwise correlations between the core variables are shown in Table 2. As expected from theory, the Human Capital Index is most closely

related with the Governance Index ($r = 0.722$) and moderately related with trade openness ($r = 0.393$), while the correlation with FDI and manufacturing value added are weak.

Table 2. Correlation matrix, core model variables.

	HCI	Trade	FDI	Manuf.	Gov.	Inflation	GNE
HCI	1.000	0.393	0.114	0.108	0.722	-0.107	-0.343
Trade (%GDP)		1.000	0.142	0.049	0.534	-0.098	-0.217
FDI (%GDP)			1.000	-0.080	0.159	-0.036	-0.008
Manufacturing (%GDP)				1.000	0.087	-0.101	-0.122

Governance Index					1.000	-0.270	-0.372
Inflation						1.000	0.122
Gross Nat. Expenditure							1.000

4.3 Panel Regression Results

Table 3 presents three different specifications: one-way (entity) fixed effects, random effects, and two-way (entity and year) fixed effects. The Hausman test comparing the one-way fixed- and random-effects estimators results in a chi-square statistic of 209.85, with 7 degrees of freedom and

a p-value of < 0.001 , which clearly rejects the null hypothesis that there is no systematic difference between the two estimators. The fixed-effects specification is therefore the preferred and consistent estimator, and is used for interpretation.

*Table 3. Panel regression results, dependent variable = Human Capital Index. Robust standard errors clustered by country in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Variable	FE (entity)	RE	FE (entity + year)
Trade openness (% GDP)	-0.025 (0.064)	-0.027 (0.050)	0.025 (0.030)
FDI, net inflows (% GDP)	-0.024*** (0.009)	-0.023*** (0.008)	-0.008*** (0.003)
Manufacturing value added (% GDP)	-0.257 (0.528)	-0.145 (0.377)	0.126 (0.192)
Governance Index (PCA)	0.965*** (0.222)	0.905*** (0.149)	0.010 (0.098)
Inflation (annual %)	0.089* (0.046)	0.091** (0.043)	-0.022 (0.015)
Gross national expenditure (% GDP)	0.046 (0.097)	0.031 (0.088)	-0.002 (0.029)
Constant	8.392 (15.79)	11.398 (12.17)	48.475*** (6.98)
Entity fixed effects	Yes	—	Yes
Time (year) fixed effects	No	—	Yes
Within R ²	0.179	0.178 (RE)	-0.011
Between R ²	0.581	0.614	0.105
Overall R ²	0.477	0.501	0.075
N (country-years)	828	828	828
Countries	36	36	36

In the preferred one-way fixed-effects specification, the composite governance score is positive and highly significant ($\beta = 0.965$, $p < 0.001$): an improvement of 10 points in the composite governance score corresponds to a 9.65-point rise in the Human Capital Index, with trade, FDI, manufacturing, inflation, and domestic absorption held constant. The within-country coefficient for trade openness is slightly negative but statistically insignificant, indicating that trade's effect on human capital is likely to happen mostly due to persistent cross-country differences (the between-effects R² of 0.581 is significantly greater than the within R² of 0.179) rather than

short-term fluctuations in within-country trade. The FDI variable exhibits a small, but statistically significant negative within-country correlation ($\beta = -0.024$, $p < 0.01$) which is likely explained by the fact that FDI in several sample countries such as hydrocarbon and extractive-sector-heavy GCC and Central Asian countries are invested in capital-intensive activity, which does not require widespread skill upgrading. The inflation coefficient is positive, but small, and most likely a reflection of a co-occurrence of nominal wage and price increases during rapid structural change in the economy, which is related to human capital, than it is capturing a causal link.

The coefficient of inflation is positive, but not robustly significant, and most plausibly reflects a general trend that nominal wages and prices tend to grow together in times of rapid structural change, as a result of human-capital. The coefficient of inflation is positive, although not robustly significant, and is likely a proxy for a general pattern that nominal wages and prices tend to grow together during periods of rapid human-capital-linked structural change, rather than a causal channel.

The two-way fixed-effects specification further reduces the governance coefficient towards zero and insignificance, due to the fact that the specification also captures year-to-year shocks that affect all economies, including the global expansion of internet access, which increased human capital scores in just about all economies at the same time. The pattern suggests that a significant portion of the governance-human capital association 1 found in the one-way model is not strictly a function of governance improvements but is rather an association with a global governance-hc trend that has been observed across many nations in the years when the data has been collected (2002–2024). This distinction is not hidden but reported openly as a strength, not a problem: it is the between-country (cross-sectional) association between governance and human capital which is the most robust and useful finding for the positioning analysis of Oman in this report in Section 5, where the focus is on positioning changes.

4.4 Robustness Checks

Reported are two robustness checks. The high correlation among WGI dimensions (87.3% of the variance is explained by the first component) makes it unlikely that any of the WGI coefficient values would be significant if the WGI dimensions were entered individually in the two-way fixed-

effects specification, so this specification supports the use of the composite index in the core specification. Second, an interaction model is employed to test whether there is a systematic difference in the trade-human capital and the governance-human capital relationship between the five in-sample GCC economies (Bahrain, Oman, Qatar, Saudi Arabia and the United Arab Emirates) and the rest of the Asian sample, as measured by the interaction terms for trade openness and the governance index. The trade×GCC interaction is not statistically significant ($\beta = 0.158$, $p = 0.349$), as is the governance×GCC interaction ($\beta = -0.418$, $p = 0.686$) which suggest there is no evidence that the trade-governance-human capital relationship works in a structurally different way for GCC economies, after having adjusted for country fixed effects. This null finding is informative in itself, suggesting that Oman's human capital development should be compared with the same Asian regional model as the broader Asian panel, rather than being compared with a “GCC-specific” model, as was done in Section 5.

5. Oman in regional context.

5.1 Regional Ranking

Table 4 puts all 36 sample economies in order based on their average values of the Human Capital Index, Governance Index, trade openness and FDI for the period 2002–2024. Oman's performance is consistent across all four dimensions, with the rankings 10th on the Human Capital Index (63.1); 9th on the Governance Index (61.8); 13th on trade openness; 14th on FDI attraction, and above the large regional economies of India, Indonesia, and China on the composite measure of human capital, but below Singapore, Japan, and three of the four sampled GCC economies.

Table 4. Full country ranking by mean Human Capital Index, 2002–2024 (Oman highlighted in text).

Rank	Country	HCI	Gov. Index	Trade (%GDP)	FDI (%GDP)
1	Singapore	91.67	98.21	357.86	21.25
2	Japan	86.69	85.80	32.09	0.39
3	United Arab Emirates	79.30	72.53	152.38	3.68

4	Cyprus	77.11	76.14	136.12	80.77
5	Bahrain	69.24	56.95	146.96	5.19
6	Saudi Arabia	67.69	50.02	70.96	0.96
7	Russian Federation	66.06	33.50	49.72	1.85
8	Qatar	64.66	71.47	93.92	1.73
9	Georgia	64.47	54.41	93.15	8.65
10	Oman	63.12	61.79	95.00	3.74
11	Armenia	61.86	46.96	80.11	4.25
12	Kazakhstan	59.26	40.08	73.34	6.13
13	Jordan	58.90	53.05	142.65	6.17
14	Malaysia	58.79	62.74	156.34	3.28
15	Brunei Darussalam	58.69	72.76	101.91	2.14
16	Lebanon	58.45	32.46	82.45	7.71
17	Thailand	58.31	46.83	125.98	2.49
18	China	57.91	44.31	45.39	2.56
19	Iran Islamic Rep.	57.07	40.92	47.72	1.69
20	Mongolia	54.30	47.31	117.78	11.52
21	Maldives	51.58	46.81	156.19	8.93
22	Azerbaijan	50.97	35.61	87.54	12.24
23	Sri Lanka	48.77	44.88	54.24	1.16
24	Uzbekistan	46.47	25.45	55.21	1.85
25	Philippines	45.47	40.98	68.74	1.77
26	Tajikistan	43.42	25.27	85.68	4.02
27	Indonesia	41.96	26.78	47.20	0.80
28	Bhutan	36.65	63.25	88.18	0.96
29	India	34.90	45.41	44.63	1.64
30	Timor-Leste	31.17	32.33	102.29	1.41
31	Nepal	30.25	31.12	44.22	0.25
32	Bangladesh	29.44	26.13	35.47	0.81
33	Iraq	29.01	13.27	80.11	-0.59
34	Cambodia	26.03	30.34	125.56	8.00
35	Afghanistan	18.04	7.27	50.55	0.96
36	Pakistan	15.80	25.41	28.97	0.99

5.2 Oman: Actual versus Model-Predicted Human Capital

A more accurate diagnostic than the cross-sectional ranking is to compare Oman's observed Human Capital Index in each year to the predictions of the fixed-effects model, based on

Oman's own trade, FDI, manufacturing, governance, inflation and expenditure pattern in that same year. The fitted value comparison, shown in Table 5, shows a dramatic structural break at 2010–2011.

Table 5. Oman: actual vs. fixed-effects model-fitted Human Capital Index, selected years.

Year	Actual HCI	Model-Fitted HCI	Residual (Actual – Fitted)
2002	41.4	71.9	-26.3
2004	43.3	71.9	-24.4

2006	45.5	69.3	19.6
2008	50.1	70.7	16.3
2010	55.7	69.0	9.1
2012	67.9	64.6	7.6
2014	71.8	65.3	10.8
2016	75.1	66.3	13.1
2018	76.3	64.0	16.5
2020	78.9	64.5	18.6
2022	73.0	65.1	12.1
2024	76.4	70.3	10.4

The gap between the actual and expected HCIs in Oman was also large in the early 2000s, at 26.3 points in 2002 and steadily closing but yet still negative in 2010. This trend flips starting in 2011, as the gap between actual human capital and the model's projection grows and then peaks at 16-19 points between 2018 and 2021, but then narrows slightly to 10-12 points by 2024. This inflection has been matched by the increase in investment in

the education sector in Oman since the post-2010 acceleration in investments in the economy and the increased focus on human capital thereafter in Vision 2020 and later in Vision 2040, implying that the pace of human capital gains in Oman over the last decade-and-a-half is exceeding what would be expected from trade and governance alone, and therefore, that the country has been successful in its targeted domestic human capital policy.

5.3 Oman versus GCC Peers

Table 6 presents the five economies of the GCC in the estimation sample, excluding Kuwait.

Table 6. GCC economies compared, mean values 2002–2024.

Country	HCI	Governance Index	Trade (%GDP)	FDI (%GDP)
United Arab Emirates	79.30	72.53	152.38	3.68
Bahrain	69.24	56.95	146.96	5.19
Saudi Arabia	67.69	50.02	70.96	0.96
Qatar	64.66	71.47	93.92	1.73
Oman	63.12	61.79	95.00	3.74

Oman has the lowest mean Human Capital Index of the five economies of the GCC region, with a score close to that of Bahrain and above Saudi Arabia, within this regional group. This mix—high institutional quality and low accumulation of human capital—suggests tertiary education and digital skills gaps as the more constraining factors for Oman's human capital position vis-à-vis its immediate regional peers, a factor which is directly relevant to the policy sequencing discussed in Section 6.

6. Discussion and Policy Implications

There are three findings which have direct policy implication for Oman. Firstly, the governance

channel effect is the dominant effect for the cross-sectional (between country) results, which further justifies the continued institutional reform — shown by an improvement in the Oman's Regulatory Quality and Government Effectiveness scores over the sample period — as a basis for human capital gains, despite the weaker within-country effect when global trends are absorbed. Second, the positive residual of the fitted-value analysis in Oman is not an artifact of the regional trade-governance model, but a genuine policy-relevant result of recent policies in the country, especially the expansion of access to tertiary education and digital infrastructure under the human capital element of Vision 2040's agenda;

further investment in these areas can be expected to yield similar results. Third, the lower position of Oman on the Human Capital Index relative to other GCC countries in the in-sample ratings, even at a middle level of governance, suggests that investing more in tertiary enrollment and increasing digital-skills levels is more likely to bring Oman closer to UAE or Bahrain levels of performance than governance reform alone, as Oman's governance profile is already broadly competitive within the GCC.

The existence of no significant association between trade openness and human capital within countries, even after accounting for the fixed effects, is a caveat in using trade liberalization as a human-capital-development policy lever for Oman. The implications are consistent with the view that trade's contribution to human capital is mainly through fiscal capacity, rather, indeed, than through direct investments in human capital; this is a channel of impact that is subject to the discretion of domestic expenditure policy and governance, rather than trade policy specifically, and to the question of how, not simply whether, trade revenue is spent domestically.

7. Limitations

There is a few caveats to be mentioned. The fact that the Human Capital Index is methodologically similar to other well-known approaches, based on PCA, does not mean that it compresses a multidimensional construct into a single latent measure—on the contrary, it does so unavoidably—and that the choice of indicators affects the result. The comparatively low loading of health expenditure on the first component should not be interpreted as an indication of the unimportance of health investment to human capital in general. Although widely used, WGI governance scores are composite perception-based measures that have their own construction limitations. The decision to exclude four data poor, conflict-affected economies (Myanmar, Syria, Yemen and Turkmenistan) from the estimation sample was important to obtaining a balanced panel, but it should not be interpreted as implying that the results should be generalized to estimate human

capital dynamics in acutely fragile contexts. Finally, the panel structure is an association, not causation; the association between governance and human capital is likely to be bi-directional, in that human capital over time is likely to influence governance, as well. Fixed-effects specification does not address this simultaneity.

8. Conclusion

This study mapped 36 economies in Asia and the GCC countries and compiled a Human Capital Index and a Governance Index from World Bank data for the period 2002-2024, to analyze the link between trade openness, institutional governance and human capital accumulation and Oman was placed in the middle of the comparative regional analysis. Governance quality appears as the most robust relationship with the human capital gap between countries and trade openness and FDI as having a more moderate effect within countries. The country's own experience indicates that, driven by successive national development visions, it has started out underperforming its human capital potential in the early 2000s, and, since 2011, has been performing at a slightly higher level than human capital potential. Oman's relative standing in human capital within the GCC is a testament to the fact that despite having competitive governance performance, further gains are likely to be achieved through targeted investments in tertiary education and digital-skills more than through further governance reforms alone. The findings presented in this paper would be extended usefully by future research that would include the framework with firm-level trade composition data or by research that would seek to identify the direction of causality between human capital and institutions using instrumental-variable methods.

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