

Industrial Performance and Economic Diversification: The Role of Innovation in Resource-Dependent Economies

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Abstract- *This study examined the relationship between industrial performance, innovation and economic diversification in resource-dependent economies. Specifically, it assessed the effect of industrial performance on innovation and economic diversification and investigated the role of innovation in the industrial performance-diversification relationship. Panel data were analysed using fixed- and random-effects regression techniques, with the appropriate estimator selected using the Hausman test. The findings show that industrial performance has a negative and statistically significant effect on both innovation and economic diversification. However, innovation exerts a positive and significant effect on economic diversification, suggesting that technological adoption can support the expansion of economic activities beyond resource-based sectors. Control of corruption and political stability also demonstrate positive effects on diversification, while foreign direct investment records a negative effect. The findings suggest that industrial expansion in resource-dependent economies has not sufficiently generated technological upgrading or broad-based structural transformation. The study therefore recommends innovation-oriented industrial policies, stronger domestic value addition, improved institutional quality, and foreign investment strategies that promote technology transfer and linkages with non-resource sectors.*

Keywords: *Industrial Performance; Innovation; Economic Diversification; Resource-Dependent Economies; Technology Adoption*

I. INTRODUCTION

Economic diversification has become one of the most important policy priorities for resource-dependent economies. While natural resource endowments provide significant fiscal revenues and foreign exchange earnings, excessive dependence on extractive industries often exposes countries to commodity price volatility, weak industrial development, and persistent macroeconomic

instability. The experiences of many oil-exporting and mineral-rich economies demonstrate that resource abundance does not automatically translate into sustainable economic development. Instead, long-term growth increasingly depends on the ability of these economies to strengthen productive industrial sectors, foster technological innovation, and expand economic activities beyond the resource sector (Auty, 2001; Sachs and Warner, 2001).

The relationship between industrial performance and economic diversification has attracted considerable attention in development economics. Industrial performance reflects the capacity of industrial sector to generate output, create employment, improve productivity, and stimulate structural transformation. Historically, countries that successfully diversified their economies, including several East Asian economies, achieved sustained industrial expansion supported by technological upgrading and innovation-oriented policies (Rodrik, 2013). In contrast, many resource-dependent economies continue to experience premature deindustrialisation, low manufacturing competitiveness, and weak value addition despite decades of substantial resource revenues (UNIDO, 2024).

Theoretical and empirical studies suggest that industrial development serves as a catalyst for structural transformation by shifting resources from low-productivity activities towards higher value-added production (Lewis, 1954; Kaldor, 1967). As industrial sectors expand, they create backward and forward linkages with other sectors, stimulate entrepreneurship, and encourage the development of new products and production processes. Consequently, stronger industrial performance can reduce dependence on resource exports by promoting broader economic activities capable of generating

stable employment, export earnings, and government revenue (Hausmann, Hwang, and Rodrik, 2007).

However, industrial expansion alone may not be sufficient to achieve meaningful economic diversification. Increasingly, innovation has emerged as a critical mechanism through which industrial development translates into sustained economic transformation. Innovation encompasses the creation, adoption, and diffusion of new technologies, production methods, organizational practices, and knowledge that enhance productivity and competitiveness (Schumpeter, 1934; OECD/Eurostat, 2018). Resource-dependent economies that invest in research and development, digital technologies, human capital, and technological capabilities are generally better positioned to diversify into more sophisticated manufacturing and service activities. Conversely, weak innovation systems often constrain industrial competitiveness and reinforce dependence on extractive industries (Aghion and Howitt, 1992).

Despite growing recognition of innovation as a driver of structural transformation, empirical evidence on its mediating role between industrial performance and economic diversification remains limited, particularly within resource-dependent economies. Existing studies have largely examined the direct relationship between industrialisation and economic diversification or between innovation and economic growth in isolation (Acemoglu and Robinson, 2012; Hausmann and Hidalgo, 2011). Relatively few studies have integrated these relationships into a comprehensive framework capable of explaining how improvements in industrial performance may influence diversification outcomes through enhanced innovative capacity. This omission represents an important gap in the literature because innovation may constitute the transmission mechanism through which industrial development generates broader structural change.

Furthermore, the contemporary global economic environment presents new challenges and opportunities for resource-rich countries. Rapid technological advancement, digital transformation, energy transition, and increasing global competition require economies to develop resilient industrial systems supported by continuous innovation.

Countries that remain dependent on primary commodity exports face heightened vulnerability to external shocks, whereas those capable of strengthening innovation-driven industrial sectors are more likely to achieve sustainable diversification and long-term economic resilience (World Bank, 2024).

Against this backdrop, this study investigates the nexus among industrial performance, innovation, and economic diversification in resource-dependent economies. Specifically, the study examines whether improvements in industrial performance stimulate innovation, evaluates the extent to which industrial performance contributes to economic diversification, and determines whether innovation serves as a mediating mechanism through which industrial performance enhances diversification outcomes. By integrating these relationships within a unified analytical framework, the study contributes to the growing literature on structural transformation and provides policy insights for resource-dependent economies seeking to achieve sustainable and inclusive economic development.

II. REVIEW OF RELATED LITERATURE

2.1 Conceptual Review

This section defines the key concepts underpinning the study, namely industrial performance, economic diversification, innovation, and resource-dependent economies. Clarifying these concepts provides a common understanding of the variables examined and establishes the conceptual foundation for the subsequent theoretical and empirical analyses.

- i. **Industrial Performance:** Industrial performance refers to the extent to which a country's industrial sector efficiently utilises resources to increase output, productivity, employment, value addition, and competitiveness. It reflects the overall contribution of manufacturing and industrial activities to economic growth through improvements in production efficiency, technological capability, and export performance. According to the United Nations Industrial Development Organization (UNIDO, 2024), strong industrial performance is characterised by sustained growth in manufacturing value added,

industrial productivity, technological upgrading, and the ability to compete in domestic and international markets. In resource-dependent economies, improved industrial performance promotes structural transformation by reducing reliance on extractive industries and expanding productive sectors capable of generating sustainable economic growth (Rodrik, 2013).

- ii. **Economic Diversification:** Economic diversification is the process of expanding the range of productive economic activities, exports, and sources of national income to reduce dependence on a limited number of sectors or commodities. It involves developing manufacturing and service industries alongside the resource sector to create a more balanced and resilient economy. Hausmann and Hidalgo (2011) argue that diversified economies possess broader productive capabilities and are better positioned to achieve sustainable growth because they produce a wider variety of sophisticated goods. For resource-dependent economies, diversification minimises vulnerability to commodity price fluctuations, enhances employment opportunities, and strengthens long-term economic stability (World Bank, 2024).
- iii. **Innovation:** Innovation refers to the introduction or implementation of new or significantly improved products, production processes, organizational methods, or business practices that enhance productivity, efficiency, and competitiveness. The OECD (2018) defines innovation as the practical application of new ideas that create economic or social value rather than merely generating new knowledge. Schumpeter (1934) identified innovation as the engine of economic development because it drives technological progress and industrial transformation through the introduction of new production methods and products. In resource-dependent economies, innovation enhances industrial competitiveness, supports technological upgrading, and facilitates the emergence of new industries, thereby promoting economic diversification.
- iv. **Resource-Dependent Economies:** Resource-dependent economies are countries whose economic growth, government revenue, exports, and foreign exchange earnings rely predominantly on the extraction and export of natural resources

such as crude oil, natural gas, and minerals. Resource dependence is commonly measured by the share of natural resource rents or commodity exports in gross domestic product (GDP), total exports, or government revenue (World Bank, 2024). Although natural resources can generate substantial income, excessive dependence often exposes economies to commodity price volatility, weak industrial development, and limited structural transformation. This condition is closely associated with the resource curse hypothesis, which suggests that resource-rich countries may experience slower economic diversification and weaker institutional development than less resource-endowed countries (Auty, 2001; Sachs and Warner, 2001).

2.2 Theoretical Framework

The theoretical framework provides the foundation for explaining the relationships among industrial performance, innovation, and economic diversification in resource-dependent economies. It identifies the theories that underpin the study and justifies the expected linkages between the study variables. Accordingly, this study is anchored on Structural Change Theory, Endogenous Growth Theory, and Innovation Theory, as these theories collectively explain how industrial development and innovation drive structural transformation and promote economic diversification.

2.2.1 Structural Change Theory

Structural Change Theory, primarily associated with Arthur Lewis (1954) and later expanded by Chenery (1960), explains economic development as a process of transforming an economy from traditional, low-productivity sectors to modern, high-productivity industrial and service sectors. The theory argues that sustained economic growth is achieved through industrialisation, capital accumulation, and the reallocation of labour and resources towards more productive economic activities. As industrial sectors expand, they create stronger production linkages, increase value addition, and stimulate the emergence of new industries, thereby reducing dependence on primary commodity production.

The theory is particularly relevant to resource-dependent economies, where excessive reliance on

natural resources often limits structural transformation. It suggests that improving industrial performance is essential for broadening the productive base of the economy and achieving economic diversification. Thus, Structural Change Theory provides the theoretical basis for examining the effect of industrial performance on economic diversification.

2.2.2 Endogenous Growth Theory

Endogenous Growth Theory was developed by Romer (1990) and Lucas (1988) as an alternative to traditional growth theories that treated technological progress as an external factor. The theory argues that long-run economic growth is driven by internal factors such as human capital development, technological progress, knowledge accumulation, research and development (R&D), and innovation. Investments in these areas generate positive spillover effects that increase productivity and improve the economy's capacity for sustained growth. In resource-dependent economies, innovation enhances industrial competitiveness by facilitating technological upgrading, improving production efficiency, and enabling firms to produce more sophisticated goods and services. Consequently, stronger industrial performance encourages innovation, which subsequently supports structural transformation and economic diversification. The theory therefore provides the foundation for examining the relationship between industrial performance and innovation.

2.2.3 Innovation Theory

Innovation Theory was pioneered by Joseph Schumpeter (1934), who identified innovation as the primary engine of economic development. According to the theory, economic progress occurs through the continuous introduction of new products, production processes, technologies, markets, and organizational methods, a process Schumpeter described as creative destruction. Innovation enables firms to improve productivity, enhance competitiveness, and generate new economic opportunities. Within the context of resource-dependent economies, innovation serves as a critical mechanism through which industrial development contributes to economic diversification. A technologically advanced industrial sector is more capable of creating new industries, expanding value-added production, and reducing dependence on extractive activities. Accordingly, Innovation Theory

provides the theoretical justification for examining the mediating role of innovation in the relationship between industrial performance and economic diversification.

Relevance of the Theories to the Study

The three theories collectively provide a comprehensive framework for explaining the relationships examined in this study. Structural Change Theory explains how improved industrial performance facilitates economic diversification through structural transformation. Endogenous Growth Theory highlights the importance of innovation and technological progress as outcomes of industrial development that sustain long-term economic growth. Innovation Theory further explains how innovation acts as the transmission mechanism through which industrial performance enhances economic diversification. Together, these theories provide a strong theoretical foundation for examining the direct effect of industrial performance on innovation and economic diversification, as well as the mediating role of innovation in resource-dependent economies.

2.3 Empirical Review

a.) Industrial Performance and Innovation

Recent empirical evidence indicates that industrial performance is a significant driver of innovation, particularly in economies pursuing structural transformation. Using panel data for emerging market firms, Wang et al. (2025) found that industrial expansion and firms' participation in international production networks significantly enhance innovation performance by facilitating knowledge acquisition and technological capability. The study concluded that industrial development provides firms with greater incentives to invest in research and development (R&D) and technological upgrading, thereby improving innovation outcomes. Similarly, Zhou (2025) investigated energy-intensive industries in the Emerging Seven (E7) economies using the Method of Moments Quantile Regression (MMQR). The findings revealed that industrialisation and sustainable innovation jointly improve energy efficiency and industrial competitiveness, suggesting that innovation serves as a key mechanism through which industrial

development enhances productivity and long-term economic performance.

b.) Industrial Performance and Economic Diversification

The relationship between industrial performance and economic diversification has received growing empirical attention in recent years. Lashitew et al. (2021) examined diversification patterns across resource-rich economies and found that countries with stronger industrial capabilities, higher human capital, and better institutional quality achieved greater diversification into manufacturing and modern service sectors. Their findings further revealed that resource-dependent economies with weak industrial sectors experience slower structural transformation and remain vulnerable to commodity price shocks. Ngqoleka et al. (2025), research on industrial diversification in emerging economies demonstrated that technological investment, industrial development, and institutional quality significantly promote economic complexity, which serves as a measure of economic diversification. The study showed that economies capable of strengthening industrial competitiveness are more likely to diversify production and exports beyond traditional resource-based activities.

c.) Innovation and Economic Diversification

A growing body of evidence suggests that innovation plays a critical role in facilitating economic diversification. Mili (2025) analyzed African economies and found that eco-innovation, digital transformation, and economic complexity significantly contribute to the transition towards more diversified and sustainable economies. The study concluded that investments in innovation enable countries to expand productive capabilities and reduce dependence on primary commodity exports. Likewise, Dai and Zhao (2025) investigated G20 economies and reported that green innovation significantly strengthens industrial development and resource management, leading to improved economic sustainability and structural transformation. Their findings indicate that innovation enhances industrial competitiveness and accelerates the diversification of economic activities beyond resource extraction.

d.) Industrial Performance, Innovation, and Structural Transformation

Recent studies increasingly recognize that industrial performance, innovation, and structural transformation are mutually reinforcing. Zirui et al. (2025) examined newly industrializing countries and found that technological innovation and structural transformation positively interact with industrial development to improve economic complexity and long-term sustainability. The study emphasized that innovation strengthens the contribution of industrial development to structural transformation by increasing productivity and expanding the production of more sophisticated goods. Similarly, Hassan (2025) examined BRICS economies and reported that economic complexity and effective governance significantly enhance the developmental impact of natural resource rents. The study concluded that countries capable of combining industrial sophistication with innovation and institutional quality achieve stronger economic diversification and sustainable growth than economies relying solely on natural resource extraction.

2.4 Empirical Gap

Although recent empirical studies provide substantial evidence on the relationships between industrial performance, innovation, and economic diversification, several gaps remain. First, most studies examine either the industrial performance-innovation relationship or the innovation-economic diversification nexus separately, with limited attention to their simultaneous interaction within a unified empirical framework. Second, relatively few studies explicitly investigate whether innovation mediates the relationship between industrial performance and economic diversification, particularly among resource-dependent economies. Third, while recent studies focus on emerging or developed economies, cross-country evidence dedicated to resource-dependent economies remains scarce. This study addresses these gaps by examining the direct effect of industrial performance on innovation and economic diversification, while also investigating the mediating role of innovation in the relationship between industrial performance and economic diversification in resource-dependent economies.

III. METHODOLOGY

This study adopts a quantitative research design based on a panel data approach to examine the relationship between industrial performance, innovation, and economic diversification in resource-dependent economies. The panel design is appropriate because it combines cross-sectional and time-series observations, thereby increasing the number of observations, improving estimation efficiency, and accounting for country-specific heterogeneity that cannot be captured using either cross-sectional or time-series data alone (Baltagi, 2021). The empirical analysis is based on a balanced panel of ten resource-dependent countries: Nigeria, Saudi Arabia, Russia, Norway, Chile, Indonesia, Qatar, Canada, Kazakhstan, and Algeria.

3.1 Justification for selection of Resource-Dependent Economies

The study examines Nigeria, Saudi Arabia, Russia, Norway, Chile, Indonesia, Qatar, Canada, Kazakhstan, and Algeria because they are widely recognized as resource-dependent economies. These countries derive a significant proportion of their export earnings, government revenue, or gross domestic product from the extraction and export of natural resources such as crude oil, natural gas, and minerals. Despite their abundant resource endowments, they differ considerably in their levels of industrial development, innovation capacity, institutional quality, and economic diversification. This diversity provides an appropriate basis for comparing how industrial performance influences innovation and economic diversification across different resource-dependent contexts. Furthermore, the selected countries have relatively comprehensive and comparable data available from international databases, making them suitable for panel data analysis over the study period.

3.2 Models Specification

The empirical models are derived from the theories underpinning this study. Model I, which examines the effect of industrial performance on innovation, is anchored on Endogenous Growth Theory (Romer, 1990), which posits that technological progress and innovation are driven by productive investment and knowledge accumulation. Model II, which

investigates the effect of industrial performance on economic diversification, is derived from Structural Change Theory (Lewis, 1954; Chenery, 1960), which argues that industrial development facilitates structural transformation and diversification of the economy. Model III, which incorporates innovation as a mediating variable between industrial performance and economic diversification, is based on Schumpeter's Innovation Theory (Schumpeter, 1934), which emphasizes that innovation is the transmission mechanism through which industrial development promotes long-term economic transformation and diversification.

Model 1: Effect of Industrial Performance on Innovation

$$INVO_{it} = \alpha_0 + \beta_1 INDPEF_{it} + \beta_2 CONRUP_{it} + \beta_3 POBV_{it} + \beta_4 FDI_{it} + \beta_5 GDPCAP_{it} + \alpha_i + \lambda_t + \mu_{it}$$

(1)

Model 2: Effect of Industrial Performance on Economic Diversification

$$EDIV_{it} = \alpha_0 + \beta_1 INDPEF_{it} + \beta_2 CONRUP_{it} + \beta_3 POBV_{it} + \beta_4 FDI_{it} + \beta_5 GDPCAP_{it} + \alpha_i + \lambda_t + \mu_{it}$$

(2)

Model 3: Mediation Model

$$EDIV_{it} = \alpha_0 + \beta_1 INDPEF_{it} + \beta_2 INVO_{it} + \beta_3 CONRUP_{it} + \beta_4 POBV_{it} + \beta_5 FDI_{it} + \beta_6 GDPCAP_{it} + \alpha_i + \lambda_t + \mu_{it}$$

(3)

Where:

INVO = Innovation (proxied as technology adoption level, [Internet penetration, % of Population])

EDIV = Economic Diversification (proxied by Non-Oil sector contribution to GDP)

CONRUP = Control of Corruption index

INDPEF = Industrial Performance (proxied by Industry Value Added % of GDP)

POBV = Political Stability and Absence of Violence/Terrorism index

FDI = Foreign Direct Investment, Net Inflow (% of GDP)

GDPCAP = Gross Domestic Product per Capita

α_i = Unobserved country-specific effects

= Time-specific (year) effects

μ_{it} = Stochastic error term

3.4 Sources of Data

The data used in this work are secondary data. They are annual time-series data across the ten resource-dependent economies from the period of 2000 to 2024; sourced from the Central Banks of Nigeria (CBN) annual reports, International Telecommunication Union (ITU), World Bank World Development Indicators (WDI), Bank of Canada, Central Bank of Chile, Statistics Indonesia, Statistics Norway (SSB), IMF, Saudi General Authority for Statistics (GASTAT), Saudi Central Bank, and Worldwide Governance Indicators (WGI).

Analysis Technique

To examine the time-series properties of the panel data, the study employs the Fisher-type panel unit root test proposed by Maddala and Wu (1999). This test is preferred because it combines the p-values from individual cross-sectional unit root tests, thereby improving statistical power relative to conventional panel unit root tests, particularly in panels with moderate cross-sectional dimensions. The Fisher-type test evaluates the null hypothesis that all panel series contain a unit root against an alternative hypothesis that at least one cross-sectional unit is stationary. Unlike homogeneous panel unit root tests, this approach allows for heterogeneity across countries, recognizing that not all economies may share identical stochastic properties.

Formally, the hypotheses are stated as:

$H_0: P_i=0$ for all $i=1,2,...,N$

$H_1: p_i < 0$ for at least one i

Where P_i denotes the autoregressive coefficient for each cross-sectional unit. Rejection of the null hypothesis implies stationarity in at least one country within the panel. By accommodating cross-sectional heterogeneity and enhancing test power, the Fisher-type unit root test provides a robust foundation for subsequent panel estimations in this study.

Estimation Method

Panel data regression techniques are used to estimate the effects of industrial policy on innovation and economic diversification in resource-dependent economies. Both Fixed Effects and Random Effects models are considered. The appropriate specification is selected using the Hausman test, which determines whether unobserved country-specific effects are correlated with the explanatory variables. Based on the test outcome, the preferred model is adopted for analysis.

Fixed Effects (FE) Model

The Fixed Effects model is specified as:

$$Y_{it} = \beta_0 + \sum_{n=1}^k \beta_n X_{nit} + \alpha_i + \mu_{it} \quad (4)$$

Y_{it} is the dependent variable (innovation or economic diversification) for country i at time t ,

X_{nit} represents the independent variables, α_i captures unobserved country-specific effects, and μ_{it} is the idiosyncratic error term. The FE model controls for all time-invariant characteristics of each country, isolating the effect of the explanatory variables on the outcome.

Random Effects (RE) Model

The Random Effects model is specified as:

$$Y_{it} = \beta_0 + \sum_{n=1}^k \beta_n X_{nit} + \mu_i + e_{it} \quad (5)$$

Where: Y_{it} is the dependent variable (innovation or economic diversification) for country iii at time t , X_{nit} represents the independent variables, μ_i captures the unobserved random country-specific effects, and e_{it} is the idiosyncratic error term. Unlike the Fixed Effects model, RE assumes that the country-specific effects are uncorrelated with the explanatory variables, allowing both within- and between-country variation to inform the estimation.

Hausman Test

The Hausman test is used to determine whether the Fixed Effects (FE) or Random Effects (RE) model is more appropriate. It compares the estimated coefficients from both models to test whether the unobserved country-specific effects are correlated with the independent variables. H_0 : RE model is appropriate (no correlation between unobserved effects and regressors) H_1 : FE model is appropriate (correlation exists between unobserved effects and regressors). Significant test statistic indicates that the FE model should be used, while an insignificant result supports the RE model.

IV. DATA ANALYSIS AND DISCUSSION OF FINDINGS

This section presents the empirical results of the study. It begins with descriptive statistics to summarize the characteristics of the variables, followed by correlation and regression analyses. The aim is to identify underlying data patterns and examine the relationships between industrial policy, innovation, and economic diversification in the selected resource-dependent economies.

Table 1: Summary of Descriptive Statistics Test

	CONRUP	EDIV	FDI	GDPCAP	INDPEF	INVO	POBV
Mean	0.306400	72.2325	3.19305	27535.65	42.32530	61.28554	0.07010
Median	0.020000	73.2000	2.48000	13793.22	39.70000	70.05000	-0.2200
Maximum	2.200000	95.2000	11.5200	106594.4	69.73000	113.5873	1.64000
Minimum	-1.470000	30.4000	-1.96000	1084.200	27.50000	1.140000	-2.2100
Std. Dev.	1.196213	15.8062	2.67448	29638.65	10.94006	30.35862	1.051902
Skewness	0.209225	-0.5691	1.20155	1.144727	0.966560	-0.45661	-0.24559
Kurtosis	1.514551	2.64364	3.78579	3.007957	3.209235	1.890921	2.16975
Jar-Bera	19.84715	11.8561	53.2701	43.68050	31.50612	17.20041	7.75477
Prob.	0.000049	0.00266	0.00000	0.000000	0.000000	0.000847	0.02070
Sum	61.28000	14446.5	638.6100	55071.1	8456.06	12250.1	14.021
Sum Sq.D	284.7542	49717.9	1423.416	1.75E+11	20521.54	185407.5	220.1932
Observ.	200	200	200	200	200	200	200

Source: Researchers' computation from E-views 10

Table 1 presents the descriptive statistics of the variables based on 200 panel observations. Economic diversification (EDIV) recorded a mean value of

72.23%, indicating that the non-oil sector accounted for a significant share of GDP across the sampled resource-dependent economies. Industrial performance (INDPEF) had an average value of 42.33%, suggesting a moderate contribution of the industrial sector to economic output, while innovation (INVO), proxied by internet penetration, averaged 61.29%, reflecting varying levels of technological adoption.

Among the control variables, foreign direct investment (FDI) averaged 3.19% of GDP, while GDP per capita (GDPCAP) had a mean value of 27,535.65, indicating considerable differences in income levels across the countries. The average scores for control of corruption (CONRUP) and political stability (POBV) were 0.31 and 0.07, respectively, suggesting moderate institutional quality within the sample.

The standard deviation values indicate substantial variation across the variables, particularly for GDP per capita and innovation, reflecting differences in economic development and technological advancement among the selected economies. The skewness and kurtosis statistics reveal moderate departures from normality, while the Jarque-Bera test rejects the null hypothesis of normal distribution for all variables ($p < 0.05$). However, this does not

invalidate the analysis since panel regression techniques are robust to non-normality in large samples. Overall, the descriptive statistics reveal adequate variability in the data, supporting further panel econometric analysis. Before estimating the panel regression models, it is necessary to examine the stationarity properties of the variables to avoid spurious regression results. The panel unit root test determines whether the variables are stationary at level or after first differencing. In this study, the Fisher-type Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) panel unit root tests were employed to establish the order of integration of the variables and ensure the appropriateness of the subsequent panel estimation techniques.

Table 2 Panel Unit Root Test

Variable	At level		After first difference		Order of Integration
	F- ADF	F-PP	F-ADF	F-PP	
CONRUP	33.5998 (0.0290)	27.1403 (27.1403)	59.0367 (0.0000)	46.3108 (0.0006)	I(1)
EDIV	17.2288 (0.6381)	25.8169 (0.1719)	81.1337 (0.0000)	139.010 (0.0000)	I(1)
FDI	43.6697 (0.0017)	72.7714 (0.0000)	-----	-----	I(0)
GDPCAP	(27.1531) (0.1310)	(24.6735) (0.2142)	(73.1209) (0.0000)	(93.8437) (0.0000)	I(1)
INDPEF	20.4906 (0.4276)	14.4611 (0.8064)	87.5468 (0.0000)	107.867 (0.0000)	I(1)
INVO	49.5772 (0.0003)	665.383 (0.0000)	-----	-----	I(0)
POBV	45.5326 0.0009)	559.366 (0.0000)	-----	-----	I(0)
Note: figures in parenthesis are the respective probability values of the unit root test results; NE = not estimated because of reaching stationarity; the statistical significance of the unit root results is at 5 % level of significance.					

Source: Researchers' computation from E-views 10

4.4 Panel Model Selection for Model 1

Using the isher-type Augmented Dickey-Fuller (ADF) and Fisher-type Phillips-Perron (PP) Tests Panel Data Unit Root according to Maddala and Wu (1999), indicates that, Control of Corruption (CONRUP), Economic Diversification (EDIV), GDP per Capita (GDPCAP) and Industrial Performance (INDPEF), were stationary at first difference while Foreign Direct Investment (FDI), Innovation (INVO) and Political Stability and Absence of Violence/Terrorism (POBV) were stationary at level.

Table 3: Cross-Section Fixed Effect Dependent Variable: INVO

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	126.5687	9.373055	13.50346	0.0000
INDPEF	-1.728027	0.218402	-7.912126	0.0000

CONR UP	20.38223	9.2106 29	2.2129 03	0.028 1
FDI	- 2.999678	0.6671 44	- 4.4962 95	0.000 0
GDPCA P	0.000352	0.0001 81	1.9437 85	0.053 4
POBV	21.31836	7.2765 64	2.9297 29	0.003 8

Source: Researchers' computation from E-views10

R-squared 0.7581
Adjusted R-squared 0.7398
F-statistic 41.431
Prob(F-statistic) 0.0000

Table 4: Panel EGLS (Cross-section random effects)
Dependent Variable: INVO

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	131.4372	10.042 13	13.088 59	0.000 0
INDPE F	- 1.554212	0.2022 52	- 7.6845 48	0.000 0
CONR UP	3.810214	6.4337 02	0.5922 27	0.554 4
FDI	- 3.632528	0.6104 70	- 5.9503 82	0.000 0
GDPCA P	0.000174	0.0001 51	1.1546 85	0.249 6
POBV	17.95011	6.5338 85	2.7472 34	0.006 6

Source: Researchers' computation from E-views10

R-squared 0.5143
Adjusted R-squared 0.5018

F-statistic 41.095
Prob(F-statistic) 0.0000

Table 5: Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	10.728373	6	0.0570

Source: Researchers' computation from E-views10

Correlated Random Effects - Hausman Test examines whether the unique errors (individual effects) are correlated with the regressors (independent variables). Null hypothesis (H_0): Random Effects model is appropriate (no correlation). Alternative hypothesis (H_1): Fixed Effects model is appropriate (correlation exists). Therefore, at the p-value = 0.0570, is greater than 0.05, accept the null hypothesis at the 5% significance level. This means there's no evidence of correlation between the individual effects and the regressors. Therefore, the Random Effects model is more appropriate than the Fixed Effects model for the study.

4.5 Panel Regression Results: Effect of Industrial Performance on Innovation

Model 1 examines the effect of industrial performance (INDPEF) on innovation (INVO), with control of corruption (CONRUP), foreign direct investment (FDI), GDP per capita (GDPCAP), and political stability (POBV) included as control variables. The Hausman test indicates that the Random Effects Model is the appropriate estimator for Model 1.

The result shows that industrial performance has a negative and statistically significant effect on innovation ($\beta = -1.5542$, $p < 0.01$). This indicates that a one-unit increase in industrial performance, measured by industry value added as a percentage of GDP, is associated with an approximately 1.55 unit decline in innovation, measured by internet penetration, ceteris paribus. The finding suggests that expansion in industrial activity within the sampled resource-dependent economies has not been accompanied by corresponding improvements in technology adoption. This may reflect the

concentration of industrial activity in resource-intensive and less technology-driven production. Control of corruption has a positive but statistically insignificant effect on innovation ($\beta = 3.8102$, $p = 0.5544$). Although the positive coefficient suggests that better control of corruption may be associated with greater innovation, the probability value indicates that the relationship is not statistically significant. Foreign direct investment has a negative and statistically significant effect on innovation ($\beta = -3.6325$, $p < 0.01$). Thus, increased FDI inflows are associated with lower levels of technology adoption in the sampled economies. The result may suggest that foreign investment has not generated sufficient technological spillovers to domestic economies, particularly where investment is concentrated in extractive or resource-based activities.

GDP per capita has a positive but statistically insignificant effect on innovation ($\beta = 0.000174$, $p = 0.2496$). Although the positive coefficient indicates that higher income levels are associated with greater technology adoption, the relationship is not statistically significant at conventional levels. Political stability and absence of violence (POBV) has a positive and statistically significant effect on innovation ($\beta = 17.9501$, $p = 0.0066$). This implies that improvements in political stability are associated with increased technology adoption. A more stable political environment may create conditions that encourage investment, technological diffusion, and the adoption of new technologies. The model has an R-squared of 0.5143 and an adjusted R-squared of 0.5018, indicating that approximately 51.43% of the variation in innovation is explained jointly by industrial performance and the included control variables. The F-statistic of 41.095 with a probability value of 0.0000 confirms that the explanatory variables are jointly statistically significant. Overall, Model 1 provides evidence that industrial performance significantly affects innovation, but the effect is negative. Therefore, the first objective of the study is supported in terms of a statistically significant relationship, although the direction is contrary to the expected positive relationship. The result points to an important feature of resource-dependent economies: increases in industrial value added may not necessarily translate into greater technological adoption when industrial

activity remains concentrated in resource-intensive sectors

Panel Model Selection for Model 2

Table 6: Cross-Section Fixed Effect
Dependent Variable: EDIV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	99.97615	1.433826	69.72682	0.0000
INDPEF	-0.613488	0.033410	-18.36256	0.0000
CONRUP	4.166751	1.408980	2.957283	0.0035
FDI	-0.356408	0.102055	-3.492300	0.0006
GDPCA	-8.20E-05	2.77E-05	-2.958901	0.0035
POBV	4.867267	1.113119	4.372636	0.0000

Source: Researchers' computation from E-views10

R-squared 0.9791
Adjusted R-squared 0.9775
F-statistic 619.813
Prob(F-statistic) 0.0000

Table 7: Panel EGLS (Cross-section random effects)

Dependent Variable: EDIV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	100.7505	3.372109	29.87760	0.0000

INDPE F	- 0.613380	0.0330 43	- 18.562 89	0.000 0
CONR UP	3.425223	1.3118 15	2.6110 57	0.009 7
FDI	- 0.383744	0.1000 65	- 3.8349 65	0.000 2
GDPCA P	-9.78E- 05	2.68E- 05	- 3.6441 19	0.000 3
POBV	4.451956	1.1018 34	4.0404 98	0.000 1

Source: Researchers' computation from E-views10

R-squared 0.7878
Adjusted R-squared 0.7813
F-statistic 619.813
Prob(F-statistic) 0.0000

Table 8: Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross- section random	13.089124	6	0.0226

Source: Researchers' computation from E-views10

Correlated Random Effects - Hausman Test examines whether the unique errors (individual effects) are correlated with the regressors (independent variables). Null hypothesis (H_0): Random Effects model is appropriate (no correlation). Alternative hypothesis (H_1): Fixed Effects model is appropriate (correlation exists). Therefore, at the p-value = 0.0226, is less than 0.05, rejects the null hypothesis at the 5% significance level. This means there's evidence of correlation between the individual effects and the regressors. Therefore, the Fixed Effects model is more appropriate than the Random Effects model for the study.

4.6 Effect of Industrial Performance on Economic Diversification

Model 2 examines whether industrial performance significantly affects economic diversification, with economic diversification (EDIV) measured by the contribution of the non-oil sector to GDP. The Hausman test indicates that the Fixed Effects Model is the appropriate estimator.

The results show that industrial performance (INDPEF) has a negative and statistically significant effect on economic diversification. The coefficient of INDPEF is -0.6135, with a probability value of 0.0000. This implies that a one-unit increase in industrial performance is associated with approximately a 0.61-unit decline in economic diversification, holding other factors constant. The finding suggests that higher industrial performance in the sampled resource-dependent economies does not necessarily translate into broader diversification. Rather, industrial activity may remain concentrated in resource-based and extractive activities, thereby limiting the expansion of the non-oil sector.

Control of corruption (CONRUP) has a positive and statistically significant effect on economic diversification, with a coefficient of 4.1668 ($p = 0.0035$). This indicates that improvements in institutional quality are associated with greater diversification. Foreign direct investment (FDI) has a negative and significant coefficient of -0.3564 ($p = 0.0006$), suggesting that FDI in the sampled economies may be concentrated in resource-extractive activities rather than diversification-enhancing sectors. GDP per capita (GDPCAP) also has a negative and significant effect (-0.000082, $p = 0.0035$), while political stability (POBV) exerts a positive and significant effect (4.8673, $p = 0.0000$).

The model has a very high R-squared of 0.9791 and an adjusted R-squared of 0.9775, indicating that approximately 97.91% of the variation in economic diversification is explained by the variables included in the model. The F-statistic of 619.813 ($p = 0.0000$) confirms that the model is jointly statistically significant.

The result indicates that industrial performance significantly influences economic diversification, but the relationship is negative. Thus, the finding does not support the expectation that greater industrial

performance automatically promotes diversification in resource-dependent economies. In line with Structural Change Theory, industrialisation is expected to facilitate movement towards a more diversified productive structure; however, the evidence suggests that where industrial activity is dominated by resource-dependent production, increased industrial performance may reinforce rather than reduce economic concentration.

4.9 Panel Model Selection for Model 3

Table 9: Cross-Section Fixed Effect
Dependent Variable: EDIV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	93.97137	3.222497	29.16104	0.0000
INDPEF	-0.522175	0.035681	-14.67539	0.0000
INVO	0.053702	0.010490	5.119520	0.0000
CONRUP	3.089711	11.34326	2.300144	0.0226
FDI	-0.197898	2.63E-05	-3.819209	0.0002
GDPCA P	-0.000101	0.101144	-1.956595	0.0519
POBV	3.740759	1.071457	3.491282	0.0006

Source: Researchers' computation from E-views10

R-squared 0.9816
Adjusted R-squared 0.9801
F-statistic 654.985
Prob(F-statistic) 0.0000

Table 10: Panel EGLS (Cross-section random effects)

Dependent Variable: EDIV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	93.97137	3.222497	29.16104	0.0000
INDPEF	-0.523631	0.035681	-14.67539	0.0000
INVO	0.053702	0.010490	5.119520	0.0000
CONRUP	2.534210	1.228535	2.062790	0.0405
FDI	-0.214596	0.099735	-2.151659	0.0327
GDPCA P	-0.000116	2.53E-05	-4.578398	0.0000
POBV	3.272241	1.056613	3.096915	0.0022

Source: Researchers' computation from E-views10

R-squared 0.7878
Adjusted R-squared 0.7813
F-statistic 119.4886

Table 11: Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	18.925608	6	0.0043

Source: Researchers' computation from E-views10

Correlated Random Effects - Hausman Test examines whether the unique errors (individual effects) are

correlated with the regressors (independent variables). Null hypothesis (H_0): Random Effects model is appropriate (no correlation). Alternative hypothesis (H_1): Fixed Effects model is appropriate (correlation exists). Therefore, at the p-value = 0.0043, is less than 0.05, rejects the null hypothesis at the 5% significance level. This means there's evidence of correlation between the individual effects and the regressors. Therefore, the Fixed Effects model is more appropriate than the Random Effects model for the study.

4.7 Mediating Role of Innovation in the Relationship between Industrial Performance and Economic Diversification

Model 3 examines whether innovation (INVO) mediates the relationship between industrial performance (INDPEF) and economic diversification (EDIV). The Hausman test indicates that the Fixed Effects Model is the appropriate estimator.

The results indicate that industrial performance (INDPEF) has a negative and statistically significant effect on economic diversification, with a coefficient of -0.5236 ($p = 0.0000$). This suggests that, controlling for innovation and the other explanatory variables, a one-unit increase in industrial performance is associated with approximately a 0.52-unit reduction in economic diversification. The negative relationship remains consistent with the finding in Model 2, indicating that increased industrial activity in the sampled resource-dependent economies may be associated with continued concentration in resource-based production rather than a broad expansion of non-oil economic activities.

Importantly, innovation (INVO) has a positive and statistically significant effect on economic diversification, with a coefficient of 0.0537 ($p = 0.0000$). This indicates that greater technology adoption is associated with improved economic diversification. The result provides evidence that innovation can contribute to the expansion of productive activities beyond traditional resource-dependent sectors.

The control variables also produce significant effects. Control of corruption (CONRUP) has a positive effect on economic diversification (3.0897, $p = 0.0226$),

suggesting that stronger institutional control is associated with greater diversification. FDI has a negative and significant coefficient (-0.2146, $p = 0.0327$), while GDP per capita is negative and significant (-0.1978, $p = 0.0000$). Political stability (POBV) has a positive and significant effect (3.2722, $p = 0.0022$).

The model demonstrates a strong explanatory power, with an R-squared of 0.9816 and an adjusted R-squared of 0.9801. Thus, approximately 98.16% of the variation in economic diversification is explained by the variables included in the model. The F-statistic of 654.985 ($p = 0.0000$) confirms that the model is jointly statistically significant.

The results show that innovation significantly and positively contributes to economic diversification, while industrial performance maintains a significant negative effect even after innovation is introduced into the model. This provides evidence that innovation constitutes an important transmission mechanism through which industrial activity can potentially contribute to diversification, although the regression coefficients alone do not establish the size or statistical significance of an indirect mediation effect.

4.8 Policy Implications of findings

The findings have several important policy implications for resource-dependent economies. First, the negative and significant effect of industrial performance on innovation suggests that increasing industrial activity alone is insufficient to promote technological advancement. Policymakers should therefore shift from an emphasis on industrial expansion towards innovation-oriented industrial policies. Greater support should be provided for research and development, technology adoption, digital infrastructure, skills development and technology-intensive manufacturing. Industrial incentives should also be linked to measurable innovation outcomes.

Second, the negative relationship between industrial performance and economic diversification indicates that industrial growth may remain concentrated in resource-based activities. Governments should therefore promote structural diversification by supporting non-resource manufacturing, agro-

processing, services and other productive sectors with potential for value addition. Industrial policies should particularly encourage domestic processing of natural resources and the development of linkages between extractive industries and local firms.

Third, the positive and significant effect of innovation on economic diversification highlights the need to place technology and innovation at the centre of diversification strategies. Governments should improve access to digital technologies, strengthen innovation ecosystems, support technology-oriented enterprises and facilitate collaboration among universities, research institutions and industry. Such measures can help firms develop new products, improve production processes and enter new markets.

Fourth, the negative effect of FDI on economic diversification suggests the need to improve the quality and sectoral composition of foreign investment. Rather than focusing primarily on the volume of FDI, policymakers should provide incentives for investments that generate technology transfer, local sourcing, skills development and linkages with domestic firms. Investment promotion agencies should give greater attention to attracting FDI into manufacturing, technology, agro-processing and other non-extractive sectors.

Fifth, the positive effects of control of corruption and political stability across the models demonstrate the importance of institutional conditions for innovation and diversification. Governments should strengthen transparency, accountability and regulatory effectiveness while maintaining a stable policy environment. Predictable institutions can encourage private investment, technology adoption and the development of diversified productive activities.

Finally, the findings imply that industrialisation, innovation and diversification should be pursued as interconnected policy objectives rather than as separate strategies. Resource-dependent economies need an industrial policy framework that deliberately channels industrial activity towards technology upgrading, domestic value addition and expansion of non-resource sectors. Such an approach would reduce excessive dependence on natural resources while

creating a more resilient and diversified productive structure.

Table11: Cross-Section Dependence Test for model 1

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	201.8759	45	0.0000
Pesaran scaled LM	16.53618	45	0.0000
Pesaran CD	5.008245	45	0.0000

Source: Researchers' computation from E-views10

For Model 1, the Breusch-Pagan LM test produces a statistic of 201.8759 with a probability value of 0.0000. The Pesaran scaled LM test also reports a probability value of 0.0000, with a statistic of 16.53618. Similarly, the Pesaran CD test records a statistic of 5.008245 and a probability value of 0.0000. Since all three tests are statistically significant at the 1 per cent level, the null hypothesis of no cross-sectional dependence is rejected. This indicates that the panel units in Model 1 are significantly interdependent. In other words, developments affecting one country in the sample may be associated with developments in other countries. For a study of resource-dependent economies, this suggests that the countries may share common economic, technological, institutional or external shocks that generate correlations across the cross-sections.

Table12: Cross-Section Dependence Test for model 2

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	154.0180	45	0.0000
Pesaran scaled LM	11.49151	45	0.0000
Pesaran CD	5.9779	45	0.0000

Source: Researchers' computation from E-views10

For Model 2, the Breusch-Pagan LM statistic is 154.0180, with a probability value of 0.0000. The Pesaran scaled LM statistic is 11.49151, also with a probability value of 0.0000. The Pesaran CD statistic is 5.977900, with a probability value of 0.0000. The three tests therefore consistently reject the null hypothesis of cross-sectional independence at the 1 per cent level. This provides strong evidence of cross-sectional dependence in Model 2. The result implies

that economic diversification in one resource-dependent economy may not evolve independently of diversification outcomes in other economies in the panel. Common commodity-price movements, global economic conditions, resource-market shocks and regional economic developments could contribute to this interdependence.

Table13: Cross-Section Dependence Test for model 3

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	211.5202	45	0.0000
Pesaran scaled LM	17.5528	45	0.0000
Pesaran CD	2.8685	45	0.0000

Source: Researchers' computation from E-views10

For Model 3, the Breusch-Pagan LM test reports a statistic of 211.5202 with a probability value of 0.0000. The Pesaran scaled LM test gives a statistic of 17.55277, also significant at 0.0000. The Pesaran CD test reports a statistic of 2.868517 with a probability value of 0.0041. All three tests are statistically significant, meaning that the null hypothesis of no cross-sectional dependence is rejected. Thus, Model 3 also exhibits significant cross-sectional dependence. The result indicates that the relationship among industrial performance, innovation and economic diversification may be influenced by common shocks or interconnected developments across the countries in the sample. The results are remarkably consistent across the three models. All three models exhibit statistically significant cross-sectional dependence, as both the LM-based tests and the Pesaran CD tests reject cross-sectional independence. This finding is important because it indicates that the countries in the panel cannot be treated as completely independent observational units. The finding also supports the view that resource-dependent economies are exposed to shared external and structural shocks, particularly those associated with international commodity markets and global economic conditions.

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study examined the relationship between industrial performance, innovation, and economic diversification in resource-dependent economies. Specifically, it investigated the effect of industrial performance on innovation, assessed the impact of industrial performance on economic diversification, and examined the mediating role of innovation in the relationship between industrial performance and economic diversification.

The findings revealed that industrial performance exerts a negative and significant effect on innovation, suggesting that increases in industrial activity in resource-dependent economies do not necessarily translate into greater technological advancement. The results further showed that industrial performance has a negative and significant effect on economic diversification, indicating that industrial expansion remains largely concentrated in resource-based activities and has not sufficiently contributed to broadening the productive structure of these economies. In contrast, innovation was found to have a positive and significant effect on economic diversification, highlighting the critical role of technological adoption and innovation in promoting structural transformation and reducing dependence on natural resources. The study also found that institutional quality and political stability positively influence diversification outcomes, while foreign direct investment exhibited a negative effect, suggesting limited technology transfer and weak linkages with domestic productive sectors. The study concludes that industrial performance alone is insufficient to achieve economic diversification in resource-dependent economies. Rather, the effectiveness of industrial development in fostering diversification depends on its ability to stimulate innovation, technological upgrading, and value-added production. Consequently, innovation emerges as a critical mechanism for transforming industrial growth into sustainable economic diversification.

5.2 Recommendations

Based on the findings of the study, the following recommendations are made:

- i. Governments should promote innovation-driven industrialisation by increasing investment in research and development, digital infrastructure, technological upgrading, and industrial innovation programmes. This will ensure that industrial growth translates into technological advancement and productivity improvements.
- ii. Industrial policies should focus on value addition and sectoral diversification rather than merely expanding industrial output. Greater incentives should be provided to manufacturing, agro-processing, renewable energy, and technology-intensive industries capable of reducing dependence on extractive sectors.
- iii. National innovation systems should be strengthened through increased collaboration among universities, research institutions, private firms, and government agencies. Such collaboration would facilitate knowledge transfer, technology diffusion, and the commercialisation of innovative products and processes.
- iv. Foreign direct investment policies should be redesigned to encourage technology transfer and domestic linkages. Governments should prioritize investments that promote local content development, skills acquisition, and innovation rather than those concentrated solely in resource extraction activities.
- v. Institutional quality and political stability should be enhanced through improved governance, transparency, regulatory effectiveness, and anti-corruption measures. Strong institutions create an enabling environment for innovation, private investment, and long-term economic diversification.
- vi. Resource-dependent economies should adopt comprehensive diversification strategies that integrate industrial development, innovation, human capital development, and technological advancement. Such an integrated approach will promote sustainable economic transformation and reduce vulnerability to commodity price fluctuations and external shocks.

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