REVISTA ELECTRÓNICA TRIMESTRAL
VOL. 10. NÚM. 3 (2026)
ISSN: 2594-0937

DEBATES SOBRE INNOVACIÓN

NACLICS SPECIAL ISSUE

Modeling Tomorrow: Innovation for Sustainable Development Innovation Systems, Technological Capabilities, and Sustainability Transitions in Latin America and the Caribbean



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DEBATES SOBRE INNOVACIÓN. Volumen 10, Número 3, Julio-septiembre de 2026, es una publicación trimestral de la Universidad Autónoma Metropolitana a través de la Unidad Xochimilco, División de Ciencias Sociales y Humanidades, Departamento de Producción Económica. Prolongación Canal de Miramontes 3855, Col. Ex-Hacienda San Juan de Dios, Alcaldía Tlalpan, C.P.14387, Ciudad de México y Calzada del Hueso 1100, Col.Villa Quietud, Alcaldía Coyoacán, C.P.04960, Ciudad de México. Teléfono 55 54837200, ext.7279. Página electrónica de la revista https://revistadebates.xoc.uam.mx/index.php/debinnovacion/issue/view/17 y dirección electrónica: noticiaslalics@gmail.com Editor responsable: Dra. Gabriela Dutrénit Bielous. Certificado de Reserva de Derechos al Uso Exclusivo de Título **No. 04-2022-101113015800-102. ISSN 2594-0937**, ambos otorgados por el Instituto Nacional del Derecho de Autor. Responsable de la última actualización de este número: Dra. Maribel García Barrientos y Dr. Guillermo Andrés Alpízar, Departamento de Producción Económica, División de Ciencias Sociales y Humanidades, Unidad Xochimilco. Calzada del Hueso 1100, Col.Villa Quietud, Alcaldía Coyoacán, C.P. 04960, Ciudad de México. Fecha de última modificación: 13 de noviembre de 2026. Tamaño del archivo: 3.5 MB Las opiniones expresadas por los autores no necesariamente reflejan la postura del editor de la publicación. Queda estrictamente prohibida la reproducción total o parcial de los contenidos e imágenes de la publicación sin previa autorización de la Universidad Autónoma Metropolitana.

Modeling Tomorrow: Innovation for Sustainable Development

Innovation Systems, Technological Capabilities, and Sustainability Transitions in Latin America and the Caribbean

CHAPTER II.

II. Building Innovation Capabilities in Small and Open Economies

Economic Diversification and Employment Patterns in Emerging Oil Economies: Insights from Guyana

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1. Introduction

Guyana's economic trajectory following the 2015 offshore discoveries within the Stabroek Block represents a classic development economics phenomenon (McDonald & Üngör, 2021). Between 2020 and 2024, real GDP expanded at an unprecedented average rate of 47% per annum (IMF, 2025). While this capital windfall offers a rare opportunity to alleviate infrastructure deficits, it simultaneously exposes a small economy to severe Dutch Disease distortions, localised inflation, and structural hollowing out (Balza et al., 2020; World Bank, 2025).

The primary vector of transmission is the Dutch Disease framework, where a booming primary resource export sector triggers real exchange rate appreciation and localised wage premiums (Corden & Neary, 1982). This pulls capital and labour away from traditional tradeable sectors like agriculture toward the resource enclave and non-tradeable sectors, primarily construction and public services, which are directly fueled by state capital expenditure (Hvidt, 2020; Ministry of Finance Guyana, 2025; Ross, 2017). This paper evaluates these dynamics to provide critical insights for policy formulation.

Guyana's capital-intensive petroleum extraction directly absorbs less than 5% of the workforce (World Bank, 2026). The remaining labour force is subject to localised inflation, wage distortions, and skills mismatches (Jouili & Khemissi, 2019). Benchmarking Guyana against Gabon (an established capital-scarce petrostate), Qatar (a capital-surplus petro-enclave), and Costa Rica (a diversified regional control) provides critical insights. The paper is structured as follows: Section 2 reviews the literature; Section 3 outlines the methodology and panel benchmarks; Section 4 analyzes results; and Section 5 details policy recommendations.

2. Literature Review

This study integrates three economic theories. First, Dutch Disease theory (Corden & Neary, 1982) explains how resource booms trigger spending and resource movement effects, hollowing out traditional tradeable sectors. Second, the Hartwick Rule (Hartwick, 1977) requires resource rents to be fully reinvested into reproducible capital, notably infrastructure and human capital (McDonald & Üngör, 2021). Third, Institutional Moderation Theory (Musikavanhu et al., 2026; Senadjki et al., 2025) asserts that commodity shock transmission to labour markets is actively moderated by domestic labour market institutions (LMIs), such as collective bargaining and social safety nets.

Nigeria serves as a cautionary model of heavy oil reliance and weak industrial policy, resulting in agricultural hollowing out, exchange rate crises, and high youth unemployment (Alley, 2018; Flores, 2023; Obakhume, 2026). Conversely, Saudi Arabia illustrates a model of state-led

dominance attempting to shift toward digital and service growth to reduce public sector reliance and foster private sector localisation (Alkhathlan et al., 2020; Neffati & Jbir, 2024).

Qatar represents a capital-surplus enclave with a small native population, where imported expatriate labour creates a native 'technical glass ceiling' (Kaya et al., 2019; Tok et al., 2020). Conversely, Gabon is a capital-scarce petrostate where rigid labour institutions contribute to persistent youth unemployment (Musikavanhu et al., 2026). Finally, Costa Rica serves as a regional control. Lacking oil enclaves, Costa Rica successfully diversified into high-value manufacturing and services, providing a baseline to isolate oil-induced Dutch Disease distortions from general growth trends (Ferreira, 2009; Corden & Neary, 1982). Comparing Guyana against Costa Rica's non-oil trajectory isolates specific Dutch Disease symptoms and validates whether labour market adjustments are direct consequences of a highly concentrated extractive sector.

3. Methodology

To evaluate structural shifts in Guyana's emerging petroleum economy, this study employs a mixed-method policy analysis framework integrated with descriptive labour market decomposition. Rather than estimating formal causal allocation equations on limited local time-series data, this study interprets labour reallocation through a series of key descriptive indicators, benchmarking them against two established global panel data models to draw robust comparative inferences.

The quantitative component utilises datasets from the Guyana Bureau of Statistics (2024), the IMF (2025), and the Ministry of Finance (2025), decomposed across four key dimensions: demographic segmentation, sectoral allocation, institutional distribution, and geographic shifts. Qualitative comparative policy analysis of Saudi Arabia, Nigeria, Gabon, Qatar, and Costa Rica contextualises Guyana's structural trajectory.

Observed domestic patterns are benchmarked against two econometric panels. The first is an FGLS model evaluating the impact of economic and structural variables on economic diversification across 14 resource-rich countries (Jolo et al., 2022). The second is a CS-ARDL model examining how the Labour Market Institutional Index (LMII) moderates the impact of resource price shocks on unemployment across 9 oil-exporting economies (Musikavanhu et al., 2026). Costa Rica serves as the vital non-oil baseline control to isolate resource-specific Dutch Disease distortions from general regional growth trends.

4. Analysis of Results

4.1 Comparative Labour Demographics and the Macro-Micro Paradox

Guyana's macroeconomic landscape features a classic dual-economy structure. While real GDP expanded by an extraordinary 43.6% in 2024, the non-oil sector grew at a lower rate of 13.1%, heavily concentrated in public logistics and infrastructure dependent on central government capital spending (IMF, 2025; Ministry of Finance Guyana, 2025). The national unemployment rate dropped to a historic low of 6.8% in Q4 2024 (Guyana Bureau of Statistics, 2024). However, as shown in Table 1, a granular review of the labour force microdata reveals deep structural disparities.

Table 1. Macroeconomic and Labour Market Indicators in Guyana (2022–2026)

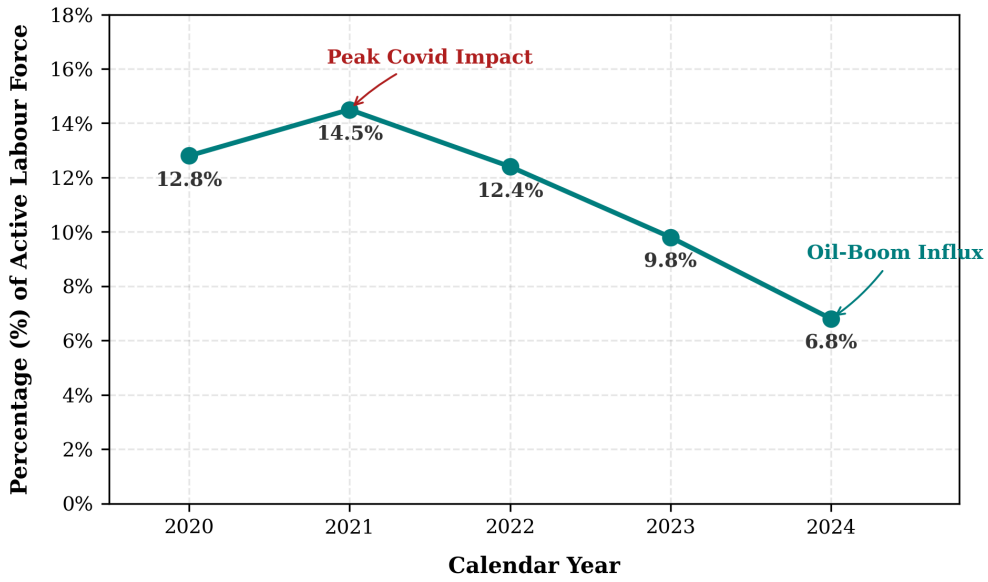
Macroeconomic & Labour Indicator	2022	2023	2024	2025 (Est.)	2026 (Proj.)
Real GDP Growth (%)	62.3%	33.0%	43.6%	21.4%	15.8%
Non-Oil Real GDP Growth (%)	11.5%	9.1%	13.1%	8.3%	6.5%
Consumer Price Inflation (%)	7.2%	2.0%	2.9%	4.2%	5.5%
National Unemployment Rate (%)	12.4%	9.8%	6.8%	7.1%	7.4%
Youth Unemployment Rate (%)	28.5%	19.4%	12.1%	13.5%	14.2%
Private Sector Share of Jobs (%)	54.1%	55.8%	57.6%	58.0%	58.2%

Source: Estimates and projections compiled from IMF (2025) and Ministry of Finance (2025).

In Q4 2024, female unemployment (9.3%) remains nearly double male unemployment (5.1%). This gender gap expands significantly within the youth cohort (ages 15–24), where female youth unemployment reaches 17.2%, compared to 8.4% for young males (Guyana Bureau of Statistics, 2024). This disparity highlights that the primary employment pathways generated by the resource boom—such as construction and civil engineering—are structurally aligned with historically male-dominated industries, while job growth in sectors with higher female participation lags behind (McDonald & Üngör, 2021).

This demographic segmentation and the resulting macro-micro paradox are illustrated by the unemployment contraction curve (Figure 1). While the drop from 14.5% in late 2021 to 6.8% in late 2024 represents a remarkable headline achievement, this positive trajectory remains structurally fragile. Because the employment expansion is primarily driven by indirect non-tradeable sectors funded by NRF fiscal transfers, rather than organic non-resource tradeable expansion, the labour market remains highly vulnerable to commodity price shocks.

Figure 1. Decline in Guyana's National Unemployment Rate, 2020–2024



Source: Plotted using tracking indicators extracted from the Guyana Bureau of Statistics Annual and Quarterly Labour Force Survey Bulletins (2020–2024).

4.2 Demographic Segmentations and Labour Market Disparities

To understand how demographic and gender disparities are consolidated under Dutch Disease, we examine hollowing-out effects across traditional sectors. The concentration of public capital infrastructure and shore-base operations along the Demerara River corridor has triggered a wave of internal rural-to-urban migration, drawing agricultural workers out of the rice and sugar fields of Regions 5 and 6 (Guyana Bureau of Statistics, 2024; IMF, 2025). This drains agricultural hubs of essential seasonal labour, raising domestic food production costs and import reliance.

Simultaneously, an internal brain drain has emerged, as multinational prime contractors offer substantial wage premiums that local public institutions, SMEs, and traditional domestic tradeable firms cannot match. This factor-price distortion pulls skilled professionals out of critical public services and into corporate roles within the energy supply chain, reducing the international competitiveness of traditional non-oil exports and reinforcing Dutch Disease pressures.

4.3 Factor-Market Distortions: Expatriate Labour and the "Technical Glass Ceiling"

Because Guyana's historical technical baseline was geared toward primary commodities (sugar, rice, bauxite), the rapid offshore oil expansion created an immediate, acute deficit in advanced technical skills (McDonald & Üngör, 2021). To bridge this gap, multinational tier-one contractors imported thousands of highly skilled expatriate technical experts from the Caribbean, North America, and Europe (Balza et al., 2020). This parallel influx has generated dual crowding-out effects on the native population.

First, high-earning expatriates drive localised inflation in urban real estate along the Demerara River corridor, pricing native Guyanese out of primary urban zones. Second, a 'technical glass ceiling' has emerged: while native workers are rapidly absorbed into lower-multiplier construction and basic service roles, the tech-heavy, managerial core of the energy sector remains dominated by foreign nationals (Guyana Bureau of Statistics, 2024). This structural dynamic is highly visible in Qatar, which relies on a massive, imported labour force, separating a highly paid expatriate class from a native population concentrated in public administration (Kaya et al., 2019; Tok et al., 2020).

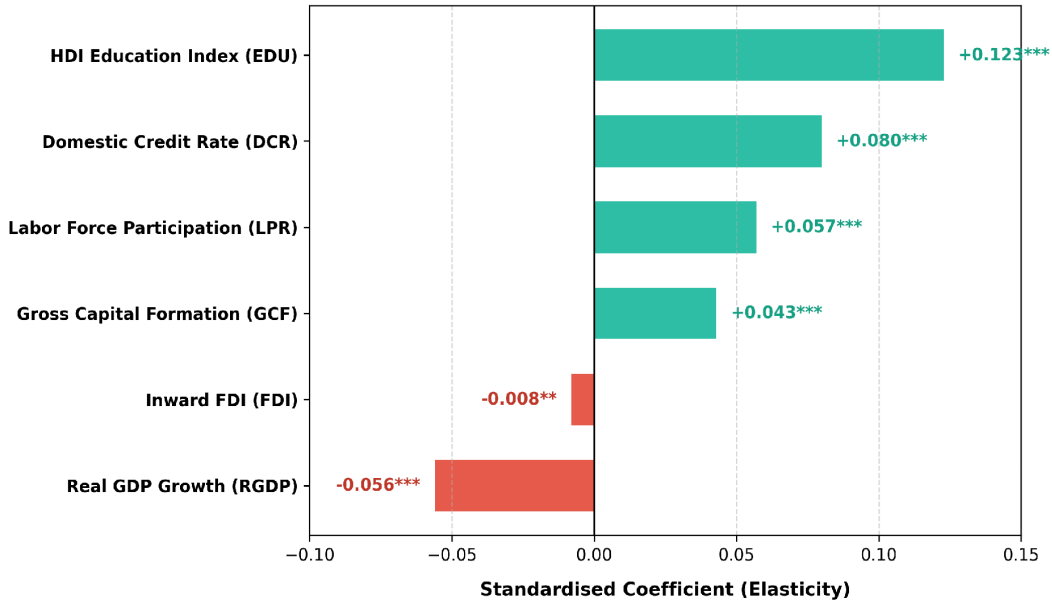
4.4 Econometric Validation and Panel Benchmarking

Applying parameters from the FGLS panel (Jolo et al., 2022) and CS-ARDL panel (Musikavanhu et al., 2026) allows for formal statistical inferences. The FGLS panel demonstrates that long-run economic diversification is negatively associated with resource-based real GDP growth ($\beta_RGDP = -0.056$, $p < 0.01$) and inward foreign direct investment ($\beta_FDI = -0.008$, $p < 0.05$). Large extractive multinational capital inflows—such as the importation of the One Guyana FPSO valued at US$2,534.1 million—reinforce resource dependency, crowding out domestic manufacturing and agriculture through real exchange rate appreciation and hollowing out adjacent tradeable sectors.

Conversely, human capital development ($\beta_EDU = 0.123$, $p < 0.01$) and labour force participation ($\beta_LPR = 0.057$, $p < 0.01$) yield the highest positive marginal returns to diversification. This explains why Costa Rica's baseline economic resilience is strongly correlated with its historical investments in human capital and balanced labour participation (Ferreira, 2009). For Guyana to escape the negative coefficient drag of resource-based growth, it

must systematically translate physical oil revenues into digital and educational assets, as illustrated in the standardised FGLS coefficient mapping.

Figure 2. Standardised FGLS Econometric Coefficients of Diversification Determinants used as an Empirical Benchmark for Guyana's Pathway



Source: Adapted from cross-country panel parameters estimated by Jolo et al. (2022).

Furthermore, the CS-ARDL panel estimation confirms that the Labour Market Institutional Index (LMII) is a critical moderator of economic shocks. The model demonstrates that the presence of strong LMIs directly reduces structural unemployment ($\beta_LMII = -0.272$, $p < 0.05$). More importantly, the interaction term between oil prices and the LMII is highly negative and significant ($\beta_OP*LMII = -0.386$, $p < 0.05$), proving that countries with high-quality, flexible labour institutions are significantly more resilient to commodity price cycles, cushioning the negative consequences of oil price shocks (Musikavanhu et al., 2026).

4.5 Sovereign Wealth Fund Governance and Fiscal Pacing

The management of Guyana's petroleum revenues is legally governed by the Natural Resource Fund (NRF) Act. While the NRF was structured to insulate the domestic economy from revenue volatility via a clear rule-based withdrawal system, recent legislative amendments have significantly increased the front-loaded ceiling for budgetary transfers (IMF, 2025; World Bank, 2026). This institutional shift permits the immediate absorption of large oil windfalls directly into the national consolidated budget to finance massive capital infrastructure programmes (Ministry of Finance Guyana, 2025).

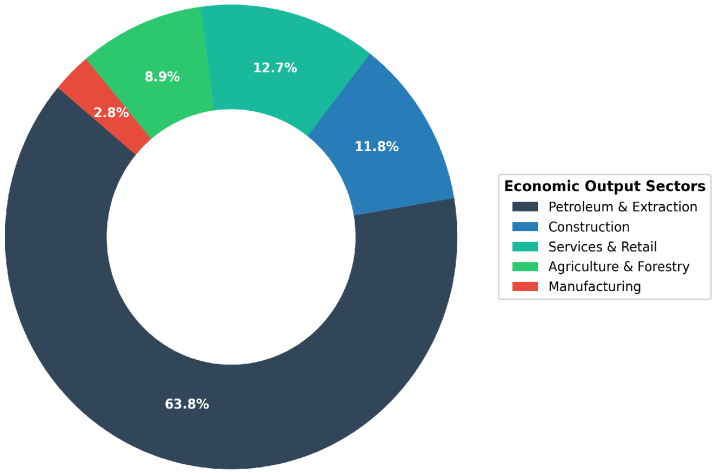
However, under the Hartwick Rule, resource depletion must be offset by the equivalent accumulation of other productive reproducible assets (Hartwick, 1977). Guyana's rapid fiscal front-loading has overwhelmed the domestic carrying capacity of its tight labour and material markets. Because the domestic supply of materials and qualified personnel is inelastic in the short run, the injection of massive fiscal liquidity has driven up consumer price inflation

(projected to reach 5.5% by 2026) and forced an unsustainable reliance on imported inputs and expatriate contractors, hollowing out the domestic multiplier effect (Musikavanhu et al., 2026).

4.6 Sectoral Concentration and the Output-Labour Decoupling

To diagnose the true state of economic diversification, the absolute structural distribution of the domestic output basket must be evaluated. The nominal distribution of sectors illustrates a massive asymmetry between the expanding extractive perimeter and the traditional, labour-absorptive non-oil industries. Figure 3 visually diagnoses Guyana's severe dual-economy vulnerability using consolidated data from the IMF (2025), the Guyana Bureau of Statistics (2024), and the Ministry of Finance Guyana (2025).

Figure 3. Structural Concentration of Guyana's Nominal GDP Shares (2025 Snapshot)



Source: Generated using statistical indicators retrieved from the International Monetary Fund (2025) and the Guyana Bureau of Statistics National Accounts Database (2024).

Nearly two-thirds (63.8%) of Guyana's nominal output is tied to a single resource extraction sector (World Bank, 2025). This proves a profound decoupling between economic output and employment: the oil sector generates the vast majority of GDP but absorbs less than 5% of formal domestic employees. This leaves the majority of the population dependent on shrinking traditional sectors or state-funded construction, exposing the country to intense Dutch Disease pressures.

4.7 The Regional Non-Oil Baseline: Isolating Dutch Disease Distortions

To isolate precise macroeconomic distortions driven by Guyana's offshore petroleum windfall, this study contrasts its trajectory with Costa Rica, the regional non-oil baseline control. Lacking extractive enclaves, Costa Rica achieved a balanced growth model where manufacturing and services expansion is closely linked to domestic human capital and high female labour force participation (Ferreira, 2009). This provides a stark contrast to Guyana’s emerging dual-economy structure, where rapid spending of the resource windfall has triggered severe localised inflation and real exchange rate appreciation, hollowing out traditional tradeable sectors like agriculture, forestry, and manufacturing (Corden & Neary, 1982; Ross, 2017).

Guyana's historic drop in unemployment to 6.8% is structurally unstable compared to Costa Rica's organic labour absorption (Guyana Bureau of Statistics, 2024). In Costa Rica, labour force participation is gender-balanced and driven by high-multiplier, knowledge-intensive sectors. In contrast, Guyana's labour market features a profound gender gap (68.2% male participation versus 44.8% female participation) and elevated female youth unemployment (17.2%), because the resource boom's indirect employment channels are concentrated in male-dominated construction and logistics (Guyana Bureau of Statistics, 2024). Costa Rica serves as a direct policy contrast, proving that long-term structural resilience requires transitioning away from transient construction cycles toward diverse, knowledge-based tradeable services.

This baseline contrast is further validated by the econometric panel benchmarking. The FGLS model demonstrates that long-run economic diversification is negatively associated with resource-based GDP growth ($\beta_RGDP = -0.056$, $p < 0.01$) and inward foreign direct investment ($\beta_FDI = -0.008$, $p < 0.05$), illustrating the structural lock-in effect of extractive enclaves (Jolo et al., 2022). Costa Rica has avoided this resource drag by systematically investing in human capital development ($\beta_EDU = 0.123$, $p < 0.01$) and active labour force participation ($\beta_LPR = 0.057$, $p < 0.01$). Conversely, Guyana's accelerated fiscal withdrawals from the Natural Resource Fund have front-loaded liquidity directly into the domestic consolidated budget, outpacing domestic carrying capacity and inducing an internal brain drain (IMF, 2025; Ministry of Finance Guyana, 2025).

Table 2. Comparative Framework of Structural Interventions and Cross-Country Policy Lessons

Country & Model	**Structural Policy Strategy**	**Labour Market Outcomes**	**Strategic Lesson for Guyana**
Nigeria (Capital-Scarce established petrostate)	Heavy oil reliance; weak industrial policy implementation (Flores, 2023).	Severe hollowing out of agriculture; persistently high youth and graduate unemployment.	Avoid rent-seeking institutional frameworks; enforce early-stage transparency (Obakhume, 2026).
Saudi Arabia (Capital-Surplus established petrostate)	Historical state dominance; recent shift toward digital and service growth (Neffati & Jbir, 2024).	High public sector reliance; rapid push for private sector localisation through digitalisation.	Diversify public wealth directly into domestic innovation infrastructure (Alkhathlan et al., 2020).
Qatar (Established Capital-Surplus Petro-Enclave)	Heavy Gross Capital Formation (GCF) in infrastructure; reliance on imported expatriate labour.	Creation of a "technical glass ceiling" for native workers; localised housing hyperinflation.	Set up robust structural joint ventures, specialised technical apprenticeships, and international certifications to systematically replace the expatriate workforce (Tok et al., 2020).
Gabon (Established Capital-Scarce Petrostate)	Oil-dependent economy; rigid labour market institutions and strict employment protection.	High structural unemployment; severe youth labour market stagnation.	Prioritise labour market institutional reforms, flexible labour policies, and targeted active labour market programmes (Musikavanhu et al., 2026).

Costa Rica (Non-Oil Regional Baseline Control)	Successfully diversified economy into high-value manufacturing, tourism, and services.	Balanced gender participation; high-value non-oil tradeable growth; strong macroeconomic resilience.	Invest systematically in human capital, technical and vocational education (TVET), and balanced labour force participation (Ferreira, 2009).
Guyana (Emerging Petrostate; current)	Rapid infrastructure expansion via Sovereign Wealth Fund (NRF) transfers.	Labour tightening in urban areas; skill shortages in traditional sectors; internal brain drain.	Implement targeted technical/vocational training matching non-oil priorities; align NRF withdrawals with domestic carrying capacity (IMF, 2025).

Source: Synthesised from Alkhathlan et al. (2020), Flores (2023), IMF (2025), Neffati & Jbir (2024), Obakhume (2026), Jolo et al. (2022), and Musikavanhu et al. (2026).

5. Next Steps

The empirical findings of this comparative research and the associated econometric panel benchmarks point to four straightforward, practical policy directions that Guyana must undertake to manage its rapid resource expansion and prevent long-term hollowing out of its non-resource sectors:

Pacing Public Spending to Control Inflation: To avoid economic overheating and the domestic price increases often associated with rapid, resource-led expansion, the government should pace Natural Resource Fund transfers to match what the local economy can realistically absorb. In addition to careful budgeting, this study recommends establishing a separate, ring-fenced "Non-Oil Innovation" Fund offshore. This sub-fund would intentionally keep excess oil revenues out of the local money supply to prevent localised inflation, using those resources instead to provide credit guarantees and research matching grants exclusively to private, non-oil businesses, such as advanced agro-processing and domestic manufacturing. This strategy ensures that physical resource wealth is successfully converted into long-term technological innovation and private-sector growth.

Establishing Worker Safety Nets: Rather than relying on temporary construction booms to keep unemployment low, Guyana must build permanent, formal support systems for its workforce. Based on cross-country evidence showing that strong labour market institutions are critical for cushioning economic shocks, the state should establish a formal unemployment insurance system paired with practical skills-retraining programmes. These systems will protect local families during global oil price crashes, provide workers with transferable skills, and prevent the rigid structural unemployment and youth labour market stagnation historically observed in resource-dependent nations like Gabon.

Expanding Job Opportunities for Women: To address the severe gender labour gap, where male participation dominates and female youth unemployment remains acutely high, the state must move beyond general social grants and implement targeted incentives. Introducing statutory, gender-targeted wage subsidies for private, non-oil tradeable sectors, such as digital services, communications, and specialised manufacturing, will actively encourage businesses to hire young women. This targeted fiscal intervention will help dismantle the male-biased hiring patterns of the current infrastructure boom and support a more inclusive, balanced economy similar to the diversified baseline model of Costa Rica.

Recalibrating Local Content for Local Skills: To break the emerging "technical glass ceiling" where high-paying engineering and managerial roles are dominated by foreign nationals while

local workers are concentrated in lower-value support services, Guyana must update its Local Content Act. Following the lessons of other petrostates, the state should shift its focus from simple service contracts (such as catering, driving, and security) to mandating formal "Joint Venture Technology Transfers." Under this framework, multinational prime contractors would be required to establish structured training partnerships with local firms, legally tying their extraction licences to verified milestones for transferring skills and certified roles to native Guyanese professionals.

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