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Research Article

Model of Infrastructure Finance on Economic Growth in Emerging Markets: A Case Studies BELSTAR Capital LLC

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ABSTRACT

Infrastructure finance plays a pivotal role in accelerating economic growth across emerging markets by enhancing productivity, stimulating employment, and enabling regional integration. This study investigates whether the Engineering, Procurement, and Construction with Finance (EPC+F) model delivers superior economic outcomes compared to traditional Public-Private Partnerships (PPPs). The core research question examines the effectiveness of EPC+F in mobilizing private capital and improving project performance metrics such as return on investment (ROI), net present value (NPV), and completion efficiency.

The research employs a mixed-methods approach combining comparative case studies and econometric analysis. Quantitative data were collected from 30 EPC+F and PPP infrastructure projects across Sub-Saharan Africa (2015–2023), sourced from the IFC database, national regulatory agencies, and financial disclosures. The analysis applies panel-data regression to assess the relationship between infrastructure investment and GDP growth, controlling for macroeconomicandpoliticalvariables.Sensitivityanalysesevaluateexposuretoexchangerate volatility, cost overruns, and financing risks.

Key findings reveal that EPC+F projects outperform PPP son average, with a 12% higher ROI, 9% faster completion times, and 7% lower cost over runs. The case of Belstar Capital LLC highlights best practices in risk mitigation, stakeholder engagement, and political risk insurance mechanisms that enhanced project viability. The study recommends wider adoption of EPC+F, supported by robust regulatory frameworks, ESG integration, and multilateral partnerships to unlock infrastructure-led development in emerging economies.

Keywords: Infrastructure finance, Economic growth, Emerging markets, EPC+F, Public-Private Partnerships, Private capital mobilization, Project performance metrics, Infrastructure-led development.

1.0 Introduction & Significance

Emerging markets face a for mid able infrastructure financing gap that hinders economic growth, industrialization, and social progress. According to estimates by the World Bank and the Asian Development Bank, these regions require over $1.5 trillion annually to meet infrastructure needs across energy, transport, digital systems, and water supply. However, public budgets remain constrained, necessitating the exploration of alternative financing mechanisms that can attract and leverage private capital.

The Engineering, Procurement, and Construction with Finance (EPC+F) model has gained traction as an integrated infrastructure delivery mechanism in which the contractor not only builds the project but also secures and structures the financing. This approach contrasts with traditional government procurement and Public-Private Partnerships (PPPs), which often face delays due to financing bottlenecks, misaligned incentives, or fragmented risk allocation.

While EPC+F has been implemented in various sectors such as power, roads, and health infrastructure, its comparative effectiveness versus PPPs or public procurement has received limited empirical examination in scholarly literature. Moreover, little is known about the specific impact of EPC+F investments on economic growth indicators such as GDP, job creation, and fiscal resilience in Sub-Saharan Africa.

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1.1 Research Objectives

This study seeks to address the above gaps by:

- Evaluating the economic performance of EPC+F projects compared to PPP-financed projects in emerging economies, particularly in Sub-Saharan Africa.
- Quantifying the effect of EPC+F infrastructure investments on macroeconomic indicators such as GDP growth, return on investment (ROI), and project completion efficiency.
- Analyzing the financial risk structures, sensitivity to market shocks, and debt sustainability features embedded in EPC+F models.
- Documenting best practices from case studies—including Belstar Capital LLC—to illustrate how risk mitigation tools (e.g., political risk insurance, financial hedging, and ESG screening) enhance bankability and sustainability.

By focusing on both comparative financial outcomes and policy implications, this paper aims to contribute empirical evidence and practical recommendations for governments, investors, and development partners exploring scalable infrastructure financing frameworks.

1.2 Literature Review

Infrastructure financing plays a central role in addressing development challenges in emerging economies. Existing literature identifies a range of financing models—from public procurement to Public-Private Partnerships (PPPs) and hybrid approaches like Engineering, Procurement, and Construction with Finance (EPC+F). This review is organized around four core thematic gaps: capital mobilization, risk allocation, sustainability integration, and technological innovation in finance.

1.2.1 Capital Mobilization and Efficiency

Traditional PPPs and sovereign-funded infrastructure have often underperformed in attracting sufficient private investment due to creditworthiness concerns and long project gestation periods. Scholars like Inderst & Stewart (2014) and Estache & Fay (2021) argue that EPC+F models can address this by integrating financing into the contracting structure. However, Mungai and Owino (2022) note that empirical comparisons remain sparse, particularly in Africa, where capital absorption capacity is uneven. Recent work by Alves & Moreira (2023) suggests

EPC+F arrangements may reduce transaction costs and accelerate financial closure, though dataset limitations remain a challenge.

1.2.2 Risk Allocation and Financial Structuring

Risk allocation mechanisms are a distinguishing feature of EPC+F. Unlike PPPs—where risk is often shifted unevenly to private consortia EPC+F consolidates execution and financing risks within the contractor's domain. Gupta et al. (2021) demonstrate that this model incentivizes performance alignment, especially when linked to political risk insurance or export credit guarantees. Still, concerns about contractor overexposure persist, especially in contexts with weak contract enforcement (Banerjee & Duflo, 2020). There is a growing literature on the role of multilateral insurance (e.g., DFC and MIGA) in de-risking EPC+F deals.

1.2.3 ESG Integration and Sustainability

The EPC+F model is increasingly evaluated for its ability to incorporate Environmental, Social, and Governance (ESG) criteria. Veenstra et al. (2021) and Amponsah-Tawiah & Mensah (2022) argue that integrated models can align project design and financing with green goals when ESG benchmarks are embedded contractually. Green bonds and climate risk hedging are being introduced in select EPC+F deals (UNEP, 2023), but regulatory capacity in recipient countries remains a barrier.

1.2.4 Digital Platforms and Innovation in Infrastructure Finance

Recent advances in digital finance are enabling more transparent and efficient infrastructure project pipelines. Smart contracts, blockchain-based escrow systems, and AI-driven risk analysis are now being piloted in EPC+F structuring

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(Li & Zheng, 2022). However, Zhang et al. (2021) emphasize that adoption is uneven across regions, and regulatory frameworks often lag technological innovations. This presents both an opportunity and a vulnerability for EPC+F expansion.

Gap Identified

Although the literature recognizes EPC+F as a promising model for closing financing gaps and improving project outcomes, few studies offer comparative, empirical analysis of EPC+F versus PPPs. Furthermore, quantitative assessments of EPC+F's impact on macroeconomic indicators such as GDP growth, employment, and return on investment remain limited—particularly in Sub-Saharan contexts. This study addresses that void by presenting original case-based data and statistical comparisons across financing models.

1.3 Methodology

This study adopts a mixed-methods research design combining quantitative data analysis with comparative case studies to assess the performance of Engineering, Procurement, and Construction with Finance (EPC+F) infrastructure projects in emerging markets. The methodological approach comprises three core components: data collection, econometric analysis, and sensitivity testing.

1.3.1 Data Sources and Sampling Criteria

Quantitative and qualitative data were obtained from:

- The International Finance Corporation (IFC) EPC Project Database (2015–2023)
- National infrastructure finance agencies (e.g., Nigeria's ICRC, Kenya PPP Directorate)
- Belstar Capital LLC project archives (for detailed EPC+F case data)
- Project financial reports from lenders and development finance institutions (DFIs)

The final dataset includes 30 infrastructure projects:

- 18 structured under the EPC+F model
- 12 structured as conventional PPPs or public procurement

Selection criteria required:

- Completion or at least 75% implementation between 2015–2023
- Availability of financial and operational KPIs (e.g., IRR, NPV, ROI, cost-overrun data)
- Sectoral comparability (transport, energy, and health sectors)

1.3.2 Analytical Framework

1. Econometric Analysis

To assess the impact of EPC+F investments on national economic outcomes, we estimate the following fixed-effects panel regression model:

$$GDP\_it = \alpha + \beta1(EPCF\_Inv\_it) + \beta2(PPP\_Inv\_it) + \beta3*(DebtRatio\_it) + \beta4*(FXRate\_it) + \varepsilon\_it$$

Where:

- GDP_it: GDP growth rate of country i at year t
- EPCF_Inv_it: EPC+F investment value (% of GDP)
- PPP_Inv_it: PPP investment (% of GDP)
- DebtRatio_it: Public debt-to-GDP ratio
- FXRate_it: Exchange rate volatility index
- ε_it: Error term with robust standard errors

2. Comparative Case Study Analysis

Three EPC+F projects (including Belstar Capital LLC) and two PPP counterparts are analyzed for:

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- Return on investment (ROI)
- Completion time (planned vs. actual)
- Cost deviations (%)
- Stakeholder satisfaction and ESG compliance metrics

1.3.3 Sensitivity Analysis

To evaluate risk resilience and stress tolerance of EPC+F versus PPP models, a scenario-based sensitivity analysis was conducted on 10 projects using Monte Carlo simulations and deterministic shock modeling. The following variables were tested:

Risk Variable	Shock Rang	Outcome Metric
Exchange Rate Volatility	±10%	NPV, Debt Service Ratio
Cost Overruns	±15%	ROI, Completion Time
Interest Rate Spikes	±2%	IRR, Payback Period
Delayed Disbursement	+6 months	Completion Schedule Variance
Policy Instability Index	0.1–0.6(scaled)	Bankability, PRI demand

These scenarios were selected based on stakeholder interviews and financial models from actual EPC+F deals.

1.3.4 Ethical and Governance Considerations

Ethical approval was secured from Bodhisastra University's Institutional Review Board. Data confidentiality agreements were observed where corporate or government data were used.

Project identifiers have been anonymized where necessary.

This robust methodology ensures that findings are not only generalizable across emerging markets but also grounded in verifiable data and real-world risk exposure.

2.1 Case Study: Belstar Capital LLC – Nigeria

Belstar Capital LLC serves as a regional EPC+F project coordinator and financier operating across West Africa, with a core focus on large-scale infrastructure projects in transport, healthcare, and energy. This case study evaluates the firm's performance in EPC+F delivery using financial and operational KPIs, and benchmarks outcomes against two comparable PPP projects in the region.

2.1.1 Project Portfolio Overview

Project	**Sector**	**Cost (USD)**	**Delivery Time**	**Completion Status**	**Financing Source**
National medical upgrade.	Healthcare	$38million	18 months(target)	Completed in 15 months	EPC+F via U.S.DFC
Solar Mini-Grid (Rural Access)	Energy	$12million	12 months(target)	Completed in 10 months	Blended EPC+F
River Port Revitalization	Transport	$51million	24 months(target)	In final commissioning	EPC+F via Belstar-SPV

Average costunder run: 7.2%

Average early delivery: 11% (vs. schedule) Average internal rate of return (IRR):13.4%

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2.1.2 Key Performance Metrics

Indicator	Belstar EPC+Average	PPP Benchmark (2projects)
IRR	13.4%	9.1%
Cost Overrun	-7.2%(underrun)	+11.5%
Delivery Time Variance	-11%(early delivery)	+8.5%(delayed)
ESG Compliance Score	84/100	72/100
Political Risk Insurance	Yes(100%coverage)	No

Belstar's access to the U.S. International Development Finance Corporation (DFC) enabled the provision of political risk insurance (PRI) and long-term debt at concessional rates. This substantially enhanced project bankability, as confirmed through stakeholder interviews and lender documentation.

2.2 Success Factors and Risk Mitigation Framework

Belstar's success in delivering high-performing EPC+F projects is attributed to six core factors:

1) Integrated Risk Ownership

By bundling engineering, procurement, construction, and financing, Belstar assumes operational and financial risks, incentivizing efficient delivery.

2) Structured Hedging Strategy

All projects utilized forward contracts to hedge currency risk (USD-Naira), and interest rate swaps to manage cost of capital.

3) Performance-Based Milestones

Disbursements were linked to construction KPIs, improving cash flow discipline and reducing moral hazard.

4)Stakeholder-Centric Governance

Early-stage community and government engagement ensured local buy-in and minimized regulatory friction.

5)Environmental and Social Governance

Independent audits confirmed full compliance with IFC Performance Standards, includingenvironmental impact assessments, labor safety, and gender equity indicators.

6) PRI Integration

Through the DFC and OPIC mechanisms, Belstar obtained 100% PRI coverage on all cross-border capital inflows, which led to reduced financing costs and attracted secondary lenders.

This case illustrates how EPC+F can outperform PPPs in terms of efficiency, risk management, and impact delivery—particularly when paired with strong governance, insurance instruments, and ESG alignment.

2.3 Analysis & Results

This section presents the empirical outcomes from the comparative evaluation of EPC+F and PPP infrastructure projects in Sub-Saharan Africa (2015–2023). Using a combination of descriptive statistics, regression analysis, and sensitivity modeling, we assess the financial performance, delivery efficiency, and macroeconomic contribution of the two models.

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2.3.1 Descriptive Statistics Summary

Metric	EPC+F Projects (n=18)	PPP Projects (n=12)
Average ROI(%)	12.9	8.4
Average IRR(%)	13.4	9.1
Cost Overrun(%)	–7.2 (underrun)	+11.5
Time Variance(%)	–11% (early delivery)	+8.5
ESG Compliance Score (0–100)	84	72
Debt Service Ratio (avg)	1.42	1.09
Completion Certainty Index*	0.89	0.67

Completion Certainty Index = % of milestones met on or ahead of schedule.

These results show that EPC+F projects exhibit stronger financial discipline, faster delivery, and better ESG alignment than their PPP counterparts.

2.3.2 Econometric Hypothesis Testing

Model:

GDP Growth = $\beta_0 + \beta_1$*(EPC+F Investment % GDP) + β_2*(PPP Investment) + Controls + ε

- β_1 (EPC+F): +0.37 ($p = 0.018$, 95% CI [0.06, 0.68])
- β_2 (PPP): +0.14 ($p = 0.147$, not significant)
- R^2 (model fit): 0.61
- F-statistic: 8.92 ($p < 0.01$)

Interpretation: A 1% increase in EPC+F investment as a share of GDP is associated with a 0.37 percentage point increase in annual GDP growth, holding other factors constant. The PPP variable was statistically insignificant, suggesting weaker marginal impact.

2.3.3 Sensitivity Analysis

A tornado chart (Figure 1) illustrates the relative sensitivity of Net Present Value (NPV) across five key risk variables for EPC+F and PPP projects. Key insights:

Risk Variable	Impact on EPC+FNPV	Impact on PPPNPV
Exchange Rate (±10%)	–5.3%to+6.1%	–9.8%to+8.2%
Cost Overruns (±15%)	–8.5%to+10.4%	–13.7%to+12.5%
Interest Rate Spike	–4.7%	–7.6%
Delayed Disbursement	–2.1monthsinNPVterms	–4.8months
Policy Instability	NPVdropof3.2	NPVdropof6.1%

Finding: EPC+F projects display higher resilience to external shocks, attributed to upfront financing closure and integrated hedging strategies.

2.3.4 Key Comparative Finding

Across all 30 projects, EPC+F projects achieved:

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- 53% higher average ROI
- 72% fewer delays
- 37% lower exposure to currency shocks
- Greater statistical significance in contributing to GDP growth

These findings support the hypothesis that EPC+F models outperform PPPs in mobilizing capital, managing risks, and accelerating infrastructure-led development.

3.0 Discussion

The findings of this study confirm that the EPC+F model provides significant advantages over conventional Public-Private Partnerships (PPPs) in infrastructure financing within emerging markets. Specifically, EPC+F projects exhibited superior outcomes in ROI, delivery timelines, ESG compliance, and resilience to financial shocks.

The enhanced performance of EPC+F models is largely due to their integrated structure, which:

- Aligns financial and delivery incentives
- Enables early risk identification and mitigation through PRI and hedging instruments
- Accelerates project execution via performance-linked disbursement
- Supports stronger compliance with sustainability frameworks (e.g., IFC's ESG standards)

These results validate the hypothesis that EPC+F financing yields both economic efficiency and developmental impact, particularly when combined with effective governance and institutional backing (e.g., DFC, MIGA, national infrastructure commissions).

3.1 Conclusions & Prioritized Recommendations

To translate these insights into policy and operational reforms, this study proposes three prioritized recommendations, based on their impact-to-effort ratio:

1. Institutionalize EPC+F Frameworks within National Infrastructure Plans

Why: EPC+F projects yielded 12.9% average ROI and 11% faster delivery.

How:

- Adopt EPC+F procurement templates in infrastructure ministries
- Create special-purpose vehicles (SPVs) under sovereign infrastructure funds
- Provide regulatory clearance mechanisms for financial closure in <6 months

2. Expand Risk-Sharing Instruments (PRI & Hedging) for EPC+F Projects

Why: Political risk insurance and currency hedging reduced NPV volatility by over 30% in EPC+F projects.

How:

- Partner with international DFIs (e.g., DFC, AfDB) to offer bundled risk products
- Encourage use of blended finance platforms to absorb first-loss risk
- Train contractors and finance officers on hedging strategy design

3. Integrate ESG Criteria into EPC+F Financing Agreements

Why: ESG-compliant projects scored 12 points higher on stakeholder satisfaction and sustainability metrics.

How:

- Mandate third-party ESG audits before project initiation

- Tie disbursement tranches to green and social performance indicators
- Establish ESG training programs for project developers and local regulators

Additional Recommendations (Secondary Priority):

- Establish a regional EPC+F Monitoring Unit to evaluate performance benchmarks
- Encourage technology-enabled EPC+F (e.g., blockchain, AI risk modeling) for increased transparency
- Promote PPP-EPC+F hybrids in sectors like water and telecom for broader access

Final Reflection

This study contributes to infrastructure finance literature by offering a comparative, data-driven evaluation of EPC+F and PPP models in Sub-Saharan Africa. It demonstrates that EPC+F is not merely a financing mechanism but a transformative model for delivering infrastructure efficiently, sustainably, and inclusively.

Future work should explore how this model performs under sovereign debt stress, climate adaptation demands, and regional trade integration strategies (e.g., AfCFTA).

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