Efficiency Evaluation of Nigerian Electricity Distribution Companies (2015-2022) Using DEA Models

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Abstract

This study evaluates the operational efficiency of Nigerian electricity distribution companies from 2015 to 2022 using Data Envelopment Analysis (DEA) models. The CCR (constant returns to scale) and BCC (variable returns to scale) DEA models are applied to measure technical and scale efficiencies. Additionally, the study incorporates Super-Efficiency DEA for ranking efficient firms and the Malmquist Productivity Index (MPI) to track productivity changes over time. A two-stage DEA approach further examines the influence of environmental factors such as regulatory policy and macroeconomic conditions on firm performance. The findings show that Ikeja (IKEDC) and Eko (EKEDC) consistently operate on the efficient frontier across both models, serving as benchmarks for other firms. In contrast, Enugu (EEDC) and Jos (JEDC) exhibit declining efficiency, underscoring the need for targeted operational reforms. The BCC model identifies potential scale inefficiencies in firms like Benin (BEDC) and Kaduna (KEDC), indicating opportunities for restructuring. MPI analysis reveals that productivity gains are primarily driven by technological improvements rather than efficiency enhancements. This research offers policy insights by recommending smart metering investments, regulatory reforms for cost-reflective tariffs, and strategic interventions for underperforming firms. The integration of advanced DEA techniques over an extended study period makes a novel contribution to the empirical literature on power sector performance in sub-Saharan Africa. Findings are crucial for regulators, investors, and policymakers aiming to enhance electricity distribution efficiency and ensure long-term sector sustainability.

Keywords

Data Envelopment Analysis (DEA), Electricity Distribution Companies, Efficiency, MPI, Nigerian, CCR, BCC, Super-Efficiency, Power Sector, Operational Efficiency.