African Infrastructure Planning (Technical focus)

Methodological Evaluation of Power-Distribution Equipment Systems in Rwanda Using Panel Data for Risk Reduction Analysis

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Abstract

The power distribution systems in Rwanda face challenges such as frequent outages and equipment failures. A panel data approach was employed, considering multiple years' worth of operational data from various regions in Rwanda. The analysis utilised logistic regression models to estimate the probability of system failures based on historical performance indicators. The logistic regression model revealed that systems using solar hybrid technologies had a lower failure rate by approximately 20% compared to traditional diesel generators, indicating their superior reliability in Rwanda’s diverse climate conditions. This study provides empirical evidence supporting the adoption of more resilient power-distribution equipment systems for improved reliability and risk reduction in Rwanda's power infrastructure. Rwanda should prioritise the deployment of solar hybrid technologies to enhance its power distribution system, thereby reducing operational risks and improving service quality. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Rwanda, Power Distribution, Panel Data, Econometrics, Risk Analysis, Equipment Failure, Methodology*