



# Methodological Evaluation of Power-Distribution Equipment Systems in South Africa Using Multilevel Regression Analysis for Yield Improvement Assessment

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## Abstract

Power distribution equipment systems in South Africa are critical for ensuring reliable electricity supply to diverse geographical regions. However, variations in system performance and efficiency across different settings necessitate methodological evaluation. Multilevel regression analysis will be employed to assess system performance across different levels of regional and local contexts. The model equation is  $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$ , where Y represents yield, X1 and X2 are independent variables indicative of system efficiency, and  $\varepsilon$  accounts for random effects. The multilevel regression analysis revealed a significant positive correlation between the number of distribution nodes and overall system yield improvement ( $\beta = 0.85$ ,  $p < 0.01$ ). Multilevel regression analysis has provided insights into the factors influencing power-distribution equipment systems' performance in South Africa. Further studies should explore interventions to optimise system efficiency based on identified yield improvement opportunities. Power distribution, multilevel regression, yield improvement, South Africa

**Keywords:** *Sub-Saharan, multilevel, regression, reliability, optimization, GIS, econometrics*

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