



Power-Distribution Equipment Systems Risk Assessment Framework in Senegal: A Multilevel Regression Analysis

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Abstract

The power-distribution equipment systems in Senegal face significant operational risks that can lead to service disruptions and economic losses. The proposed framework employs multilevel logistic regression models to analyse data from multiple levels of power-distribution networks (national, regional, local) across Senegal. The models account for spatial autocorrelation using robust standard errors. This framework provides a systematic approach to understanding and mitigating risks associated with power-distribution equipment systems, offering actionable insights for policy-makers and engineers. Implementing the recommended strategies could lead to substantial reductions in operational risks within Senegalese power networks, enhancing service reliability and economic stability. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + v_i \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Multilevel Modelling, Risk Analysis, Logistic Regression, Geographic Information Systems, Sustainable Engineering Practices, Network Theory*

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