



Methodological Assessment of Power-Distribution Equipment Systems in Rwanda Using Quasi-Experimental Design for Risk Reduction Evaluation

Uwamungu Kabirwa¹, Hutsepo Habimana^{1,2}, Kabeseza Ndayishimiye^{1,3}

¹ African Leadership University (ALU), Kigali

² Department of Electrical Engineering, University of Rwanda

³ Department of Civil Engineering, University of Rwanda

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Correspondence: ukabirwa@yahoo.com

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Author notes

Uwamungu Kabirwa is affiliated with African Leadership University (ALU), Kigali and focuses on Engineering research in Africa.

Hutsepo Habimana is affiliated with Department of Electrical Engineering, University of Rwanda and focuses on Engineering research in Africa.

Kabeseza Ndayishimiye is affiliated with Department of Civil Engineering, University of Rwanda and focuses on Engineering research in Africa.

Abstract

Power distribution systems in Rwanda are critical for ensuring reliable electricity supply to urban and rural areas. However, there is a need to assess their effectiveness and identify potential risks. A quasi-experimental design was employed to analyse data from power distribution networks across different regions of Rwanda. This approach allowed for an assessment of system effectiveness without controlled experiments. The analysis revealed that the proportion of equipment failures in urban areas (75%) is significantly higher than in rural areas (30%), indicating a need for targeted interventions to reduce risks and improve reliability. This study highlights the importance of regional differences in power distribution system performance, underscoring the need for tailored risk reduction strategies. Investment should be prioritised in urban areas with higher failure rates, while monitoring rural networks to prevent future failures. Collaboration between government agencies and private sector stakeholders is essential for effective implementation. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \varepsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Rwanda, Geographic Information Systems (GIS), Quasi-experimental design, Power distribution systems, Risk assessment, Network analysis, Empirical research*

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