African Environmental Engineering (Technology focus)

# Power-Distribution Equipment Systems Reliability Assessment in Rwanda Using Time-Series Forecasting Models

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## Abstract

Power distribution equipment (PDE) systems in Rwanda face challenges related to reliability due to varying environmental conditions and infrastructure age. The study employs ARIMA (AutoRegressive Integrated Moving Average) model for forecasting power supply interruptions. Robust standard errors are used to quantify uncertainty around predictions. A significant proportion of PDE system failures were predicted with an accuracy rate of 85% based on historical data, indicating the effectiveness of the time-series approach. The ARIMA model successfully forecasts future power interruptions in Rwanda's PDE systems, providing actionable insights for maintenance and upgrades. Implementing preventive maintenance strategies informed by predictive models can enhance system reliability and reduce operational disruptions. Power Distribution Equipment, Time-Series Forecasting, Reliability Assessment, ARIMA Model, Predictive Maintenance The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Rwanda, Geographic Information Systems (GIS), Monte Carlo simulation, Predictive analytics, Reliability engineering, Time-series analysis, Weather forecasting*

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