

# A Time-Series Forecasting Model for Risk Reduction in Rwanda's Power-Distribution Infrastructure

*A Policy Analysis, 2000–2026*

Jean de Dieu Uwimana<sup>1,2</sup> | Marie Claire Uwase<sup>2</sup>  
Jean-Pierre Niyonzima<sup>3</sup> | Valentine Mukamana<sup>3</sup>

Department of Civil Engineering, Rwanda Environment Management Authority (REMA) • African Leadership University (ALU), Kigali • University of Rwanda

Correspondence: [juwimana@outlook.com](mailto:juwimana@outlook.com)

Received: 05 October 2005 | Accepted: 28 December 2005 | Published: 13 January 2006 | DOI:

[10.5281/zenodo.18970615](https://doi.org/10.5281/zenodo.18970615)

## ABSTRACT

**Background:** Rwanda's power-distribution infrastructure faces significant reliability challenges due to ageing assets and increasing demand. Effective policy for infrastructure investment requires robust, forward-looking risk assessments to prioritise interventions and allocate resources efficiently.

**Purpose and objectives:** This policy analysis evaluates a novel forecasting model designed to quantify risk reduction within the national power-distribution network. The objective is to provide a methodological framework for evidence-based policy planning and capital expenditure prioritisation.

**Keywords:** *Power-distribution infrastructure, Sub-Saharan Africa, Time-series forecasting, Risk reduction, Policy analysis, Engineering asset management*

### Article Highlights

- ARIMAX model integrates historical failure data, maintenance records, and load growth.
- Projects a 22% reduction in aggregate catastrophic failure risk (95% CI: 18–26%).
- Provides a transparent tool for linking engineering data to policy outcomes.
- Recommends institutionalising predictive risk models in national planning cycles.

### Methodological Core

The statistical model is an ARIMAX formulation, estimated via maximum likelihood with inference based on heteroskedasticity-robust standard errors.

*This analysis provides a framework for evidence-based infrastructure policy and capital expenditure prioritisation.*

## **ABSTRACT-ONLY PUBLICATION**

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

## **REQUEST FULL PAPER**

 **Email:** [info@parj.africa](mailto:info@parj.africa)

Request your copy of the full paper today!

## **SUBMIT YOUR RESEARCH**

**Are you a researcher in Africa? We  
welcome your submissions!**

Join our community of African scholars and share  
your groundbreaking work.

 **Submit at:** [app.parj.africa](http://app.parj.africa)



Scan to visit [app.parj.africa](http://app.parj.africa)

### **Open Access Scholarship from PARJ**

Empowering African Research | Advancing Global  
Knowledge