Bayesian Hierarchical Model for Risk Reduction in Industrial Machinery Fleets of Rwanda

Kabuga Nziza[1,2]**, Hutu Bizimana**[3,4]**, Gatera Inginya**[5]**, Karugamba Nthi**[6]

[1] Department of Mechanical Engineering, African Leadership University (ALU), Kigali

[2] Rwanda Environment Management Authority (REMA)

[3] Department of Mechanical Engineering, Rwanda Environment Management Authority (REMA)

[4] Department of Sustainable Systems, University of Rwanda

[5] African Leadership University (ALU), Kigali

[6] Department of Electrical Engineering, University of Rwanda

Author notes

Kabuga Nziza is affiliated with Department of Mechanical Engineering, African Leadership University (ALU), Kigali and focuses on Engineering research in Africa.

Hutu Bizimana is affiliated with Department of Mechanical Engineering, Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

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

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

Abstract

Industrial machinery fleets in Rwanda face significant operational risks that can lead to downtime and increased maintenance costs. A Bayesian hierarchical model was developed to analyse data from Rwanda's industrial machinery fleet. The model accounts for both individual machine variability and shared environmental influences. The analysis revealed that temperature fluctuations had the most significant impact on equipment failure rates, with a proportion of 40% attributed to this factor. The Bayesian hierarchical model demonstrated its effectiveness in quantifying risk reduction strategies within industrial machinery fleets in Rwanda. Based on the findings, recommendations are made for implementing targeted maintenance schedules and upgrading infrastructure to mitigate temperature-induced risks. Bayesian Hierarchical Model, Risk Reduction, Industrial Machinery Fleets, Rwanda The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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

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

Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge