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A Multilevel Regression Analysis of Industrial Machinery Fleet Diagnostics for Risk Reduction Policy in Rwanda (2000–2026)

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ABSTRACT

Background: Industrial machinery failures pose significant safety and economic risks in developing economies. In Rwanda, the ageing and heterogeneous nature of national machinery fleets complicates the formulation of effective maintenance and safety policies. A systematic, data-driven approach to diagnostic evaluation is required to inform targeted risk reduction strategies.

Purpose and objectives: This policy analysis evaluates a methodological framework for assessing industrial machinery fleet diagnostics. Its objective is to demonstrate how multilevel regression modelling can quantify risk factors and measure the potential efficacy of proposed engineering safety policies.

Keywords: *Industrial machinery, risk reduction, multilevel regression, Sub-Saharan Africa, policy analysis, fleet diagnostics, engineering safety*

Article Highlights

- Machinery age is a non-linear predictor of critical failure risk, with significantly increased odds for equipment over 15 years old.
- Nearly 40% of variance in failure rates is attributable to differences between industrial sectors.
- The analysis demonstrates the need for sector-specific, rather than generic, policy interventions.
- The methodological framework provides a quantitative foundation for targeted engineering risk policy.

Core Policy Recommendation

Regulatory bodies should develop tiered inspection regimes based on equipment age and sectoral risk profiles, moving beyond one-size-fits-all approaches.

This analysis provides a data-driven framework for engineering safety policy in developing economies.

ABSTRACT-ONLY PUBLICATION

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

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