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Quasi-experimental evaluation of risk reduction frameworks for industrial machinery fleets in Uganda

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ABSTRACT

Background: Industrial machinery fleets in developing economies present significant operational safety challenges. Existing risk reduction frameworks are often derived from contexts with mature regulatory and maintenance cultures, limiting their direct applicability and measured efficacy in different industrial settings.

Purpose and objectives: This study aimed to methodologically evaluate the effectiveness of a structured, context-adapted risk management framework for heavy machinery fleets. The primary objective was to quantify the reduction in incident rates following a targeted intervention.

Keywords: *quasi-experimental design, risk reduction frameworks, industrial machinery safety, Sub-Saharan Africa, operational safety, developing economies, fleet management systems*

Article Highlights

- Quasi-experimental design provides robust causal evidence beyond simple pre-post analysis.
- Integrated framework combined procedural standardisation, operator re-certification, and predictive maintenance.
- Reduction was most pronounced for incidents related to mechanical failure and procedural non-compliance.
- Study demonstrates efficacy of locally validated standards over imported frameworks.

Methodological Note

Difference-in-differences design with fixed-effects panel model, comparing 47 treatment and 52 control fleets over an observation period.

This study offers evidence-based guidance for enhancing operational safety in industrial settings with developing infrastructure.