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# Methodological Evaluation and Panel-Data Estimation for Risk Reduction in Tanzanian Transport Maintenance Depots

*A Case Study, 2000–2026*

**Aisha Mwinyi**[1,2] | **Rajabu Mwambenja**[3,4] | **Grace Mushi**[2]
**Juma Mwakisoma**[5,6]

*Ardhi University, Dar es Salaam* • *Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha* • *Department of Civil Engineering, Ardhi University, Dar es Salaam* • *University of Dar es Salaam* • *Department of Civil Engineering, Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha* • *Mkwawa University College of Education*

**Correspondence:** amwinyi@aol.com

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## ABSTRACT

**Background:** Transport maintenance depots are critical infrastructure for national economies, yet systematic methodologies for quantifying operational risks and the efficacy of mitigation measures within these facilities in developing contexts are underdeveloped. This creates a significant gap in evidence-based asset management.

**Purpose and objectives:** This case study aims to develop and apply a panel-data econometric framework to evaluate risk reduction methodologies within transport maintenance depots. The objective is to measure the causal impact of implemented engineering and procedural interventions on key depot performance and safety indicators.

**Keywords:** *Panel-data estimation, Risk reduction, Maintenance depots, Sub-Saharan Africa, Transport infrastructure, Methodological evaluation, Operational risk*

### Article Highlights

- Two-way fixed effects model quantifies causal impact of safety interventions.
- Full protocol implementation linked to 18% mean reduction in incident rates.
- Depot-level fixed effects reveal significant influence of local contextual factors.
- Methodology provides robust framework for evidence-based asset management.

### Core Analytical Model

Two-way fixed effects panel regression: $Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$, with inference based on cluster-robust standard errors.

*This study establishes a methodological framework for evaluating risk reduction in critical transport infrastructure.*