

# Replication and Methodological Evaluation of a Difference-in-Differences Model for Industrial Machinery Fleet Reliability in Tanzania

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## ABSTRACT

**Background:** Difference-in-differences (DiD) models are increasingly applied in engineering asset management to evaluate the impact of interventions on system reliability. A prior study proposed a specific DiD framework for assessing maintenance policy changes on heavy machinery fleets, but its methodological robustness and applicability in a sub-Saharan African context required independent verification.

**Purpose and objectives:** This study aimed to replicate and critically evaluate the methodological application of a published DiD model for analysing industrial machinery fleet reliability. The objective was to assess the model's assumptions, estimation stability, and practical utility within the Tanzanian industrial sector.

**Keywords:** *Replication study, Difference-in-differences, Engineering asset management, Industrial machinery fleets, Sub-Saharan Africa, System reliability, Methodological evaluation*

### Article Highlights

- Direct replication produced a treatment effect estimate ( $\delta=0.18$ ) consistent with the original study
- Methodological evaluation revealed violation of key parallel trends assumption
- Wide confidence intervals indicate substantial estimation uncertainty
- Findings question robustness of DiD application in this specific context

### Methodological Insight

The study demonstrates that diagnostic checks for model assumptions—particularly parallel trends—are more critical than point estimates when drawing causal inferences from observational engineering data.

*This replication study emphasizes methodological rigor over definitive results.*

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