

# A Quasi-Experimental Evaluation of System Reliability in Tanzanian Manufacturing Plants

*A Methodological Framework*

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## ABSTRACT

**Background:** System reliability is a critical determinant of productivity and competitiveness in manufacturing, yet robust methodological frameworks for its evaluation in resource-constrained industrial settings are scarce. Existing approaches often lack the rigour to isolate causal effects from operational noise.

**Purpose and objectives:** This study aimed to develop and apply a novel quasi-experimental methodological framework to evaluate the reliability of production systems within Tanzanian manufacturing plants, focusing on the causal impact of specific maintenance interventions.

**Keywords:** *quasi-experimental design, system reliability, manufacturing systems, Sub-Saharan Africa, resource-constrained environments, industrial engineering, methodological framework*

### Article Highlights

- A difference-in-differences design isolates causal impact in real-world industrial settings.
- Targeted interventions increased mean time between failures by approximately 15 hours.
- The framework provides a rigorous alternative to purely observational studies.
- Demonstrates applicability for evidence-based decision-making in resource-constrained plants.

### Methodological Contribution

Develops and validates a quasi-experimental framework using a difference-in-differences model with cluster-robust inference, tailored for causal evaluation in operational environments.

*Presents a practical methodological advance for industrial engineering research in developing economies.*

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