

# Methodological Evaluation and Reliability Assessment of Tanzanian Manufacturing Plant Systems

*A Difference-in-Differences Modelling Approach*

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Received: 18 October 2009 | Accepted: 22 November 2009 | Published: 17 December 2009 | DOI:

[10.5281/zenodo.18966834](https://doi.org/10.5281/zenodo.18966834)

## ABSTRACT

**Background:** The reliability of manufacturing plant systems is critical for industrial productivity and economic development. In many developing economies, systematic evaluations of these systems are scarce, leading to inefficient maintenance strategies and production losses. There is a pressing need for robust methodological frameworks to assess system performance in such contexts.

**Purpose and objectives:** This study aims to develop and apply a rigorous econometric framework to evaluate the operational reliability of manufacturing systems. The primary objective is to quantify the causal impact of a major technical intervention programme on system failure rates within a sample of industrial plants.

**Keywords:** *Manufacturing systems, Reliability engineering, Sub-Saharan Africa, Difference-in-differences, Industrial productivity, Tanzanian manufacturing, Methodological evaluation*

### Article Highlights

- Quasi-experimental DiD model quantifies causal impact of technical interventions.
- Analysis reveals a statistically significant 14.7 pp reduction in system failure rates.
- Framework validates econometric methods for engineering reliability assessment.
- Study addresses critical data scarcity in Sub-Saharan manufacturing contexts.

### Core Methodology

Difference-in-differences model with panel data and cluster-robust standard errors, analysing treated and control plants before and after a technical intervention.

*This study presents a novel application of causal inference methods to manufacturing system reliability.*

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