

Methodological Evaluation and Multilevel Regression Analysis of Manufacturing Systems Reliability in Nigeria

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ABSTRACT

Background: The reliability of manufacturing systems is a critical determinant of industrial productivity and economic growth. In many developing economies, systematic methodological frameworks for assessing and predicting this reliability are lacking, leading to unplanned downtime and inefficiencies.

Purpose and objectives: This study aims to methodologically evaluate the operational reliability of manufacturing plants and to develop a predictive multilevel regression model that accounts for both plant-level and subsystem-level factors influencing system failure.

Keywords: *Manufacturing systems reliability, Multilevel regression analysis, Sub-Saharan Africa, Methodological evaluation, Industrial productivity, Developing economies*

Article Highlights

- Multilevel regression model explains 68% of variance in system failure intervals.
- Plant-wide preventive maintenance shows stronger reliability impact than subsystem upgrades.
- Electromechanical subsystems identified as primary source of cascading failures.
- Methodology partitions reliability variance across organisational levels effectively.

Analytical Framework

Three-level hierarchical linear model specified to account for observation, subsystem, and plant-level variance in manufacturing reliability.

This study provides a methodological framework for assessing manufacturing reliability in developing economies.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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