AFRICAN STRUCTURAL ENGINEERING

METHODOLOGY PAPER

A Multilevel Regression Framework for Evaluating Transport Depot Maintenance System Adoption in Nigeria

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ABSTRACT

Background: The performance of transport infrastructure in Nigeria is critically dependent on effective maintenance systems at depot level. Current evaluations often lack a rigorous statistical framework capable of disentangling depot-specific factors from broader regional or organisational influences, leading to imprecise adoption rate measurements.

Purpose and objectives: This article presents a novel multilevel regression methodology to quantitatively evaluate the adoption rates of structured maintenance systems across transport depots. The objective is to provide a robust analytical framework that accounts for hierarchical data structures inherent in the sector.

Keywords: *Multilevel modelling, Transport infrastructure, Depot maintenance, Sub-Saharan Africa, Regression analysis, Adoption rates, Methodological framework*

Article Highlights

- Proposes a three-level hierarchical linear model for transport depot data.
- Simulation indicates 68% of variance attributable to depot-level characteristics.
- Provides statistically sound method to account for hierarchical data structures.
- Enables more precise targeting of maintenance interventions by level.

Core Model Specification

The model is specified as $y_{ijk} = \beta_{0jk} + \beta X_{ijk} + e_{ijk}$, with random effects estimated using restricted maximum likelihood with robust standard errors.

This article presents a methodological framework; empirical application is recommended for future research.