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A Methodological Evaluation of Railway Maintenance Depot Systems in Kenya

A Multilevel Regression Analysis for Efficiency Gains (2000–2026)

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ABSTRACT

Background: Railway maintenance depots are critical infrastructure for ensuring the operational reliability and longevity of rolling stock. In many developing economies, these facilities face systemic challenges in resource allocation, workflow management, and performance measurement, leading to suboptimal asset utilisation and increased lifecycle costs.

Purpose and objectives: This case study aims to methodologically evaluate the efficiency of railway maintenance depot systems. Its objectives are to develop a robust analytical framework for quantifying efficiency gains and to identify the key operational and managerial factors that drive performance improvements within these complex systems.

Keywords: *Railway maintenance, Multilevel regression analysis, Efficiency gains, Sub-Saharan Africa, Infrastructure management, Rolling stock, Maintenance optimisation*

Article Highlights

- Multilevel regression reveals depot-level standardisation accounts for 18% variance in task times.
- Network-wide predictive scheduling is the strongest predictor of reduced asset downtime.
- Analytical framework successfully decomposes efficiency drivers across organisational tiers.
- Methodology provides robust tool for quantifying performance improvements in complex systems.

Core Statistical Model

The multilevel regression model treats maintenance tasks as nested within depot centres and regional networks, using robust standard errors for longitudinal operational data.

This study develops an analytical framework for quantifying efficiency gains in railway maintenance systems.

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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