



Multilevel Regression Analysis for Measuring Efficiency Gains in Rwanda's Transport Maintenance Depot Systems

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Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of transport maintenance depots systems in Rwanda: multilevel regression analysis for measuring efficiency gains in Rwanda. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of transport maintenance depots systems in Rwanda: multilevel regression analysis for measuring efficiency gains, Rwanda, Africa, Engineering, data descriptor This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \varepsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Rwanda, Multilevel Regression, Hierarchical Analysis, Transport Efficiency, Maintenance Systems, Methodology, Quantitative Research

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