

A Methodological Evaluation and Cost-Effectiveness Analysis of Transport Maintenance Depot Systems in Rwanda

A Multilevel Regression Approach

Jean de Dieu Uwimana¹

University of Rwanda

Correspondence: juwimana@aol.com

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ABSTRACT

Background: Transport maintenance depots are critical infrastructure for road network sustainability in developing economies. However, systematic, data-driven methodologies for evaluating their operational efficiency and cost-effectiveness are often lacking, leading to suboptimal resource allocation and maintenance backlogs.

Purpose and objectives: This case study aims to develop and apply a novel methodological framework for the evaluation of transport maintenance depot systems. The primary objective is to measure their cost-effectiveness and identify key drivers of performance within the Rwandan context.

Keywords: *Transport infrastructure, Maintenance management, Cost-effectiveness analysis, Multilevel modelling, Sub-Saharan Africa, Developing economies, Regression analysis*

Article Highlights

- Multilevel regression reveals significant variability in depot cost-effectiveness between regional clusters.
- Depot age and spare parts inventory turnover are the most influential performance factors.
- The framework provides a replicable, evidence-based tool for evaluating transport maintenance systems.
- Findings support targeted resource allocation to depots within the least cost-effective clusters.

Methodological Note

The core model is a multilevel regression specified as $Cost_{ij} = \beta_0j + \beta_1X_{1ij} + \dots + \beta_nX_{nij} + u_0j + e_{ij}$, with robust standard errors.

This case study develops a novel framework for evaluating transport maintenance depot systems in Rwanda.

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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