

A Difference-in-Differences Model for the Cost-Effectiveness Evaluation of Transport Maintenance Depot Systems in Rwanda

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ABSTRACT

Background: Evaluating the cost-effectiveness of transport maintenance depot systems in low-resource settings is a persistent challenge for infrastructure asset management. Traditional before-and-after comparisons are often confounded by external factors, leading to unreliable estimates of intervention impact.

Purpose and objectives: This article presents a methodological framework for the rigorous evaluation of transport maintenance depot systems. The primary objective is to detail the application of a difference-in-differences (DiD) model to isolate the causal effect of system upgrades on maintenance costs and vehicle availability.

Keywords: *Cost-effectiveness analysis, Difference-in-differences, Infrastructure asset management, Transport maintenance depots, Sub-Saharan Africa*

Article Highlights

- Proposes a quasi-experimental DiD model for causal evaluation of depot systems.
- Controls for unobserved, time-invariant confounders and common trends.
- Framework designed for low-resource settings with panel data from treatment and control depots.
- Methodology demonstrates detection of a hypothesised 15% cost reduction in simulation.

Core Model Specification

$$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \epsilon_{it}$$
, where δ is the average treatment effect on the outcome (e.g., cost per kilometre).

This is a methodology article presenting an evaluative framework, not empirical results from a completed study.

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