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A Difference-in-Differences Framework for Evaluating Transport Depot Maintenance Efficiency in Ethiopia

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ABSTRACT

Background: Transport maintenance depots are critical infrastructure for road network efficiency and safety in developing nations. However, rigorous, quantitative methodologies for evaluating the impact of systemic interventions on their operational efficiency are lacking in the engineering literature, particularly for sub-Saharan Africa.

Purpose and objectives: This article presents a novel methodological framework to quantify causal efficiency gains from planned upgrades to transport depot systems. The objective is to provide engineers and planners with a robust analytical tool for ex-post evaluation of infrastructure investments.

Keywords: *difference-in-differences, transport maintenance, depot efficiency, Sub-Saharan Africa, infrastructure evaluation, engineering methodology*

Article Highlights

- Proposes a quasi-experimental DiD model for causal evaluation of depot upgrades.
- Moves beyond simple before-after comparisons to address confounding factors.
- Framework is transportable for post-implementation audits of infrastructure investments.
- Demonstrates application through a simulated case study from Sub-Saharan Africa.

Core Statistical Specification

$Y_{dt} = \beta_0 + \beta_1 \text{Treat}_d + \beta_2 \text{Post}_t + \delta (\text{Treat}_d \cdot \text{Post}_t) + \epsilon_{dt}$, where δ captures the average treatment effect on the composite efficiency score.

This is a methodology article presenting a framework, not empirical results.