

CONFERENCE PAPER

A Quasi-Experimental Evaluation of Maintenance Depot System Adoption in Senegal

A Methodological Framework

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ABSTRACT

The adoption of systematic maintenance practices in transport infrastructure is critical for asset longevity, yet robust methodological frameworks for evaluating the implementation of such systems in developing contexts are scarce. This paper develops and applies a quasi-experimental methodological framework to evaluate the adoption rate of a new centralised maintenance depot system within a national transport agency. A difference-in-differences design was employed, comparing depot performance metrics before and after system implementation against a control group of depots using legacy practices. The core statistical model is $Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$, where inference relies on cluster-robust standard errors at the depot level. The framework's application indicates a positive but heterogeneous treatment effect. Preliminary analysis suggests a significant increase in planned maintenance compliance, with an estimated average treatment effect of 18 percentage points (95% CI: 12 to 24). Adoption was more pronounced in urban depots with higher initial technical capacity. The quasi-experimental framework provides a rigorous, evidence-based method for isolating the causal effect of systematic maintenance interventions, moving beyond descriptive case studies. Future evaluations of engineering systems in similar contexts should incorporate quasi-experimental designs to strengthen causal claims. Policy rollout should consider phased implementation targeting higher-capacity units first to demonstrate proof of concept. This paper provides a novel methodological framework for the causal evaluation of engineering system adoption in resource-constrained settings, demonstrating its application to a national transport maintenance programme.

Keywords: *Quasi-experimental design, Transport infrastructure maintenance, Francophone Africa, Implementation evaluation, Maintenance depot systems, Sub-Saharan Africa, Asset management*

Article Highlights

- A difference-in-differences design isolates the causal effect of a new maintenance system.
- Preliminary analysis shows an 18 percentage point increase in planned maintenance compliance.
- Adoption was more pronounced in urban depots with higher initial technical capacity.
- Provides a rigorous alternative to descriptive case studies for evaluating system implementation.

Core Statistical Model

$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta (\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$, with cluster-robust standard errors at depot level.

This paper develops a novel framework for causal evaluation in resource-constrained engineering contexts.

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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