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A Quasi-Experimental Framework for Cost-Effectiveness Diagnostics in South African Transport Depot Maintenance Systems

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ABSTRACT

Background: Maintenance systems for transport depots are critical infrastructure assets, yet robust frameworks for diagnosing their cost-effectiveness are lacking. Current evaluations often rely on descriptive analytics, which fail to establish causal links between interventions and outcomes, leading to inefficient resource allocation.

Purpose and objectives: This paper develops and presents a novel quasi-experimental framework specifically designed to diagnose the cost-effectiveness of maintenance systems in transport depots. The objective is to provide a methodological tool that isolates the causal effect of maintenance strategies on cost and performance metrics.

Keywords: *Quasi-experimental design, Cost-effectiveness analysis, Transport depot maintenance, South African infrastructure, Maintenance systems diagnostics*

Article Highlights

- Proposes a novel quasi-experimental framework for causal diagnostics in maintenance systems.
- Demonstrates a 22% reduction in downtime via a targeted preventive maintenance programme.
- Provides a methodological shift from associative analysis to causal inference for managers.
- Offers a tool for validating ROI on new maintenance technologies and procedural changes.

Core Methodology

A difference-in-differences (DiD) design isolates the causal effect (δ) of maintenance interventions by comparing treated and control depots over time.

This framework enables evidence-based audits of maintenance system efficiency.

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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