

# Methodological Evaluation and Efficiency Diagnostics for Transport Maintenance Depot Systems in Ethiopia

A Quasi-Experimental Data Framework

Tewodros Bekele<sup>1,2</sup>, Meklit Assefa<sup>3</sup>

Department of Electrical Engineering, Africa Centers for Disease Control and Prevention (Africa CDC), Addis Ababa

| Department of Electrical Engineering, Bahir Dar University | Bahir Dar University

Correspondence: [tbekele@outlook.com](mailto:tbekele@outlook.com)

Received: 05 June 2024 | Accepted: 03 August 2024 | Published: 11 September 2024 | DOI:

[10.5281/zenodo.18970281](https://doi.org/10.5281/zenodo.18970281)

## ABSTRACT

Transport maintenance depots are critical infrastructure for road network functionality and economic productivity. In developing nations, systematic evaluations of their operational efficiency are scarce, hindering evidence-based asset management and investment. This data descriptor presents a structured, quasi-experimental framework designed to methodologically evaluate the efficiency of transport maintenance depot systems. The primary objective is to provide a replicable dataset for diagnosing performance gaps and measuring causal efficiency gains from interventions. A longitudinal, panel dataset was constructed from administrative records, direct observations, and controlled engineering audits across multiple depot sites. The core analytical model is a stochastic frontier analysis (SFA) specified as  $\ln(\text{Output}_{it}) = \beta_0 + \beta X_{it} + (v_{it} - u_{it})$ , where  $u_{it}$  represents technical inefficiency. Robust standard errors were clustered at the depot level to account for intra-group correlation. The dataset reveals significant heterogeneity in technical efficiency scores across depots, with a central tendency indicating that average operational efficiency is approximately 0.65. Diagnostic analysis identifies spare parts inventory management as a predominant theme linked to inefficiency, with a negative correlation coefficient of -0.42. The constructed dataset provides a robust empirical foundation for analysing depot system performance. It confirms the applicability of the quasi-experimental framework for isolating operational inefficiencies in this engineering context. Future research should apply this framework to longitudinal intervention studies. Depot managers should prioritise inventory control systems, as indicated by the diagnostic correlations within the dataset. infrastructure management, stochastic frontier analysis, technical efficiency, maintenance engineering, panel data, developing countries This work provides the first publicly available, structured dataset applying a quasi-experimental design and stochastic frontier modelling to evaluate transport maintenance depot efficiency in a sub-Saharan African context.

**Keywords:** transport infrastructure, maintenance depots, quasi-experimental design, operational efficiency, Sub-Saharan Africa, data framework, engineering diagnostics

### Article Highlights

- Structured quasi-experimental framework for depot efficiency evaluation
- Stochastic frontier analysis model with technical inefficiency parameter  $u_{it}$
- Identifies spare parts inventory as key inefficiency driver (correlation: -0.42)
- Provides first public dataset for depot systems in Sub-

### Core Analytical Model

Stochastic frontier analysis specified as  $\ln(\text{Output}_{it}) = \beta_0 + \beta X_{it} + (v_{it} - u_{it})$ , where  $u_{it}$  represents technical inefficiency. Robust standard errors clustered at depot level.

*This data descriptor provides a replicable framework for diagnosing transport depot performance gaps.*

Saharan Africa	
----------------	--

## **ABSTRACT-ONLY PUBLICATION**

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

## **REQUEST FULL PAPER**

 **Email:** [info@parj.africa](mailto:info@parj.africa)

Request your copy of the full paper today!

## **SUBMIT YOUR RESEARCH**

**Are you a researcher in Africa? We  
welcome your submissions!**

Join our community of African scholars and share  
your groundbreaking work.

 **Submit at:** [app.parj.africa](http://app.parj.africa)



Scan to visit [app.parj.africa](http://app.parj.africa)

### **Open Access Scholarship from PARJ**

Empowering African Research | Advancing Global  
Knowledge