



Panel Data Estimation for Measuring System Reliability in South African Transport Maintenance Depots Systems

Njabulo Dlamini¹

¹ Council for Scientific and Industrial Research (CSIR)

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Correspondence: ndlamini@aol.com

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Author notes

Njabulo Dlamini is affiliated with Council for Scientific and Industrial Research (CSIR) and focuses on Engineering research in Africa.

Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of transport maintenance depots systems in South Africa: panel-data estimation for measuring system reliability in South Africa. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of transport maintenance depots systems in South Africa: panel-data estimation for measuring system reliability, South Africa, Africa, Engineering, conference paper This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \varepsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Maintenance, Panel, Econometrics, Reliability, Time-Series, African*

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