

# Methodological Evaluation and Panel-Data Estimation for Yield Improvement in Ghanaian Transport Maintenance Depots

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Received: 08 October 2025 | Accepted: 07 November 2025 | Published: 19 December 2025 | DOI:

[10.5281/zenodo.18970381](https://doi.org/10.5281/zenodo.18970381)

## ABSTRACT

Persistent inefficiencies in transport maintenance depots undermine road network reliability and economic productivity. A lack of robust, data-driven methodologies for evaluating operational yield in this critical infrastructure sector impedes targeted interventions. This study aims to develop and apply a panel-data econometric framework to methodologically evaluate operational systems and quantify determinants of yield improvement within the depot network. A novel panel-data model was specified and estimated using operational records from a national sample of depots. The fixed-effects model,  $Y_{it} = \alpha_i + \beta_1 X_{1,it} + \beta_2 X_{2,it} + u_{it}$ , controlled for unobserved heterogeneity, with inference based on cluster-robust standard errors. Inventory turnover ratio exhibited a statistically significant positive association with overall yield ( $\beta = 0.18$ ,  $p < 0.01$ ). A one-standard-deviation increase in skilled technician density was associated with a 12% improvement in mean output, holding other factors constant. The methodological framework confirms that yield is principally driven by human capital and inventory management, not merely by budgetary allocation. Panel estimation effectively isolates persistent depot-specific inefficiencies. Depot management should prioritise investments in technical training and implement real-time inventory monitoring systems. Policymakers should adopt panel-data performance benchmarking for resource allocation. This paper provides a novel panel-data estimation framework for infrastructure performance analysis, generating the first empirical evidence quantifying the elasticities of key operational drivers in this context.

**Keywords:** *transport maintenance depots, panel-data estimation, yield improvement, Sub-Saharan Africa, operational efficiency, data-driven methodologies, Ghanaian transport sector*

### Article Highlights

- Inventory turnover ratio shows a significant positive association with overall yield ( $\beta = 0.18$ ,  $p < 0.01$ ).
- A one-standard-deviation increase in skilled technician density improves mean output by 12%.
- Panel-data estimation effectively controls for unobserved heterogeneity across depots.
- The framework provides empirical evidence for data-driven performance benchmarking.

### Methodological Contribution

Develops and applies a novel panel-data econometric framework to quantify determinants of operational yield in transport maintenance depots, controlling for unobserved heterogeneity.

*This study provides the first empirical evidence quantifying key operational drivers for depot yield in Sub-Saharan Africa.*

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