

# Methodological Evaluation and Yield Diagnostics for Industrial Machinery Fleets

A Randomised Field Trial in Tanzania

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## ABSTRACT

{ "background": "Industrial machinery fleets in sub-Saharan Africa face persistent challenges in operational efficiency and yield optimisation. Current diagnostic frameworks often lack rigorous field validation, particularly within the region's specific infrastructural and operational contexts.", "purpose and objectives": "This data descriptor presents a methodological evaluation of a novel diagnostic protocol for yield improvement in industrial machinery fleets. The primary objective was to quantify the impact of a randomised intervention on operational yield metrics.", "methodology": "A randomised field trial was conducted with a fleet of 42 heavy earth-moving machines. The intervention group received a structured diagnostic and maintenance protocol, while the control group continued with standard practice. Yield was measured as productive output per fuel unit. The treatment effect was estimated using a linear model:  $Y_i = \beta_0 + \beta_1 T_i + \epsilon_i$ , where  $Y_i$  is the yield for machine  $i$ ,  $T_i$  is the treatment indicator, and robust standard errors were clustered at the depot level.", "findings": "The intervention group demonstrated a mean yield increase of 8.7% (95% CI: 5.2% to 12.1%) compared to the control group. Diagnostic data revealed that calibration inaccuracies in hydraulic systems were the most prevalent correctable fault, identified in over 60% of the intervened fleet.", "conclusion": "The randomised trial confirms that a systematic diagnostic protocol can significantly improve the operational yield of industrial machinery in this context. The methodology provides a replicable framework for evidence-based fleet management.", "recommendations": "Fleet operators should adopt structured diagnostic protocols with a focus on hydraulic system calibration. Further research should investigate the long-term sustainability of yield gains and cost-benefit analyses.", "key words": "fleet management, yield diagnostics, randomised controlled trial, field experiment, maintenance optimisation, industrial engineering", "contribution statement": "This paper provides the first publicly available dataset from a randomised field trial evaluating a yield diagnostic protocol for industrial machinery in East Africa

**Keywords:** *Industrial machinery diagnostics, Sub-Saharan Africa, Yield optimisation, Randomised field trial, Operational efficiency, Tanzania*

### Article Highlights

• Randomised trial shows 8.7% mean yield increase from

### Methodological Contribution

Presents the first publicly available dataset from a

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| <p>diagnostic protocol.</p> <ul style="list-style-type: none"><li>• Hydraulic system calibration inaccuracies identified in over 60% of intervened fleet.</li><li>• Provides a replicable framework for evidence-based fleet management in the region.</li></ul> | <p>randomised field trial evaluating a yield diagnostic protocol for industrial machinery in East Africa.</p> <p><i>This study offers a validated methodological framework for operational diagnostics.</i></p> |
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