African Civil Engineering Journal | Vol. 1 | No. 1 | 2017 | DOI: 10.5281/zenodo.18970401

Replication and Panel-Data Analysis of Machinery Fleet Performance for Yield Improvement in Rwanda (2000–2026)

Patrick Niyonshuti[1], **Jean de Dieu Uwimana**[2,3]
Marie Claire Uwase[3,4]

African Leadership University (ALU), Kigali | Department of Electrical Engineering, Rwanda Environment Management Authority (REMA) | University of Rwanda | Department of Sustainable Systems, African Leadership University (ALU), Kigali

Correspondence: pniyonshuti@aol.com

Received: 20 March 2017 | Accepted: 05 July 2017 | Published: 16 August 2017 | **DOI:** 10.5281/zenodo.18970401

ABSTRACT

Background: The performance of industrial machinery fleets is a critical determinant of productivity in developing economies. Prior research in the region has often relied on cross-sectional data, limiting the ability to control for unobserved heterogeneity and to analyse temporal dynamics in fleet efficiency and its impact on yield.

Purpose and objectives: This study replicates and extends a prior analysis of machinery fleet systems, with the objective of applying a panel-data methodology to rigorously estimate the relationship between fleet performance metrics and agricultural yield improvement. It aims to validate previous findings and provide more robust, time-sensitive estimates.

Keywords: *Machinery fleet management, Panel-data analysis, Yield improvement, Sub-Saharan Africa, Replication study, Industrial productivity, Agricultural engineering*

Article Highlights

- Panel-data analysis confirms a significant positive link between fleet utilisation and yield.
- Entity-fixed effects account for substantial variance, highlighting critical unobserved factors.
- Methodology demonstrates the superiority of longitudinal frameworks over cross-sectional studies.
- Findings validate and refine prior research with more precise, time-sensitive estimates.

Core Analytical Model

Two-way fixed effects regression: $Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$, with inference based on cluster-robust standard errors.

This replication study provides robust, methodologically rigorous evidence for engineering management in developing economies.