



Methodological Assessment of Industrial Machinery Fleet Systems in Ghana Using Panel Data for Efficiency Analysis

Yaw Asaredujo¹, Kofi Adomakoh^{2,3}

¹ University of Ghana, Legon

² Department of Electrical Engineering, University of Ghana, Legon

³ Water Research Institute (WRI)

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Correspondence: yasaredujo@hotmail.com

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Author notes

*Yaw Asaredujo is affiliated with University of Ghana, Legon and focuses on Engineering research in Africa.
Kofi Adomakoh is affiliated with Department of Electrical Engineering, University of Ghana, Legon and focuses on Engineering research in Africa.*

Abstract

Industrial machinery fleets play a crucial role in Ghana's manufacturing sector, influencing productivity and economic growth. However, little systematic analysis has been conducted to assess their operational efficiency. The methodology employed a stochastic frontier analysis (SFA) approach, utilising panel data from across multiple industrial sectors in Ghana. Robust standard errors were applied to account for potential heteroscedasticity and autocorrelation within the dataset. A clear direction of efficiency gains was observed with significant improvements in operational efficiency, particularly among machinery fleets that utilised more advanced maintenance protocols. The study underscores the importance of adopting systematic performance evaluation methods to enhance industrial machinery fleet operations in Ghana. The findings contribute to a better understanding of sector-specific inefficiencies and provide actionable insights for stakeholders. Stakeholders are encouraged to implement predictive maintenance strategies, optimise resource allocation, and invest in employee training programmes to drive further efficiency improvements. The maintenance outcome was modelled as $Y_{it} = \beta_0 + \beta_1 X_{it} + u_i + v_t \epsilon_{it}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Panel data, Efficiency analysis, Ghana, Spatial econometrics, Econometric models, Stochastic frontier, Geospatial methods*

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