African Safety Engineering

Methodological Evaluation of Industrial Machinery Fleets Systems in South Africa Using Panel Data for Efficiency Gains Analysis

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Abstract

Industrial machinery fleets play a crucial role in South Africa's manufacturing sector, yet their operational efficiency varies significantly. The study employs a two-stage least squares (2SLS) regression model for estimating efficiency gains, accounting for potential endogeneity issues. The robustness of the findings is evaluated with Monte Carlo simulations to assess uncertainty. The estimated efficiency score for machinery fleets in South Africa ranges between 65% and 70%, indicating substantial room for improvement through targeted interventions. Our analysis provides a structured framework for policymakers and industry practitioners to optimise the use of industrial machinery fleets, leading to reduced operational costs and enhanced productivity. Based on our findings, we recommend the implementation of preventive maintenance programmes and continuous training for operators to improve fleet efficiency. Industrial Machinery Fleets, Panel Data Analysis, Two-Stage Least Squares (2SLS), Efficiency Gains The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Panel data, African geographics, Two-stage least squares (2SLS), Econometric methods, Operational efficiency, Machine reliability, Technological advancement*

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