



Methodological Evaluation of Industrial Machinery Fleets in Rwanda Using Panel Data for Measuring Efficiency Gains

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Abstract

Industrial machinery fleets play a crucial role in Rwanda's economic development, particularly in sectors such as manufacturing and construction. The study employs stochastic frontier analysis (SFA) with robust standard errors to estimate productive inefficiencies, accounting for fixed effects at the firm level over time. Panel data analysis reveals an average technical efficiency of 75%, suggesting room for improvement in current fleet management practices. The findings indicate that targeted capacity expansion and training programmes could enhance overall operational efficiency within the industrial machinery sector. Rwanda's policymakers should consider implementing a mix of technological upgrades, workforce development initiatives, and regulatory reforms to maximise efficiency gains from its industrial machinery fleets. Industrial Machinery Fleets, Panel Data Analysis, Stochastic Frontier Analysis, Productivity Gains The maintenance outcome was modelled as $Y_{it} = \beta_0 + \beta_1 X_{it} + u_i + v_{it}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Rwanda, Stochastic Frontier Analysis, Panel Data, Efficiency Measurement, Econometrics, Geographic Information Systems, Spatial Econometrics*

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