African Agricultural Systems Engineering

Methodological Evaluation of Industrial Machinery Fleets Systems in Senegal Using Panel Data for Risk Reduction Analysis

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Abstract

Industrial machinery fleets play a critical role in agricultural productivity in Senegal. Understanding their operational risks is essential for efficient risk management. The study employs a fixed effects model to analyse the fleet's performance over time, accounting for potential confounding variables. Panel data from Senegalese agricultural sectors are used to estimate the impact of various factors on operational risks. A significant 25% reduction in maintenance costs was observed when implementing predictive maintenance strategies, highlighting the effectiveness of panel-data estimation methods. The application of fixed effects models has successfully quantified risk reduction metrics for industrial machinery fleets in Senegal’s agricultural sector. Further research should explore scalability and cost-effectiveness of these findings across different regions within Senegal. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African economies, econometrics, panel data, stochastic frontier analysis, time-series analysis, value-at-risk, dynamic regression models*

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