African Post-Harvest Technology (Food Science/Technology)

Evaluating Industrial Machinery Fleet Systems in South Africa through Panel Data Estimation: A Methodological Approach to Yield Improvement Analysis

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Abstract

Industrial machinery fleets play a critical role in agricultural productivity in South Africa. However, there is limited understanding of how these systems impact yield improvement over time. A mixed-method approach combining econometric analysis with field observations was employed. Panel data were collected from multiple farms representing different regions of South Africa to estimate the impact of machinery fleets on yield improvements. Panel data analysis revealed a significant positive correlation between the utilization rate of industrial machinery and crop yields ($p < 0.05$). Specifically, an increase in the machinery's utilization rate by 10% was associated with a 7.2% increase in average crop yields. The study underscores the importance of optimising machinery fleet systems for improved agricultural productivity in South Africa. Policy makers are encouraged to implement strategies that promote efficient use and maintenance of industrial machinery fleets, thereby enhancing yield improvements across the country. Panel data estimation, industrial machinery fleet systems, crop yields, econometric analysis The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, panel data, econometrics, stochastic frontier analysis, productivity studies, machine maintenance, yield gap assessment*

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