African Agricultural Systems Engineering

Panel Data Estimation for Measuring System Reliability in Rwanda's Process-Control Systems

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Abstract

Rwanda's process-control systems are critical for agricultural productivity. However, their reliability and effectiveness remain underexplored. Panel data from multiple farms were collected over two years using a mixed-effects logistic regression model to estimate system reliability. Uncertainty was quantified with robust standard errors. The estimated probability of successful process-control implementation varied across different farm conditions, indicating the need for tailored interventions. Panel data analysis revealed significant variation in system performance which can inform targeted improvements and policy recommendations. Policy makers should consider implementing adaptive management strategies based on findings to enhance reliability of process-control systems. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African Geography, Panel Data Analysis, Econometrics, Time Series, System Reliability, Stochastic Processes, Agricultural Engineering*

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