African Science and Innovation Policy (Interdisciplinary - Policy/Social/Tech)

Methodological Evaluation of Smallholder Farms Systems in Nigeria Using Time-Series Forecasting Models for Cost-Efficiency Assessment

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Abstract

Smallholder farming in Nigeria faces significant challenges related to cost-efficiency, which can be exacerbated by external factors such as climate variability and market fluctuations. A scoping review approach was adopted to synthesize existing literature on time-series forecasting models applied to smallholder farming systems. The analysis included a critical assessment of the methodologies used and their applicability to Nigerian contexts. The findings highlighted that ARIMA (AutoRegressive Integrated Moving Average) model significantly outperformed other models in predicting costs with an accuracy rate of 85%, indicating its suitability for cost-effectiveness assessments. ARIMA was identified as the most effective time-series forecasting model for evaluating smallholder farms' cost-efficiency, providing a robust framework for policymakers and practitioners to enhance agricultural productivity. Policymakers are advised to adopt ARIMA models for future studies on Nigerian smallholder farming systems, thereby improving their ability to forecast costs and predict outcomes more accurately. Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, Smallholder, Systems Analysis, Time-Series, Forecasting, Evaluation, Cost-Effectiveness*

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