



Methodological Evaluation of Off-Grid Communities Systems in Tanzania Using Time-Series Forecasting Models for Yield Improvement Assessment

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Abstract

Off-grid communities in Tanzania face challenges in agriculture yield due to unreliable power supply, necessitating the development of robust systems for forecasting and improving yield. A time-series analysis was conducted on historical yield data from off-grid communities across Tanzania. ARIMA models were applied for forecasting yield improvements under varying conditions of power supply reliability (e.g., daily fluctuations). Uncertainty in forecasts was assessed using robust standard errors. The model revealed significant trends in yields over the last decade, with an average annual increase of 5% in power-supply-stable areas compared to 2% in less stable regions. The ARIMA models accurately predicted these trends within a confidence interval of $\pm 3\%$. Time-series forecasting models have been successfully employed to analyse and predict yield improvements in off-grid agricultural settings, with robust uncertainty quantification. The findings suggest the need for continuous monitoring and adjustment of power supply systems to optimise agricultural yields in Tanzania's off-grid communities. Further research should consider additional factors such as climate variability and soil quality. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, off-grid communities, time-series analysis, forecasting models, yield measurement, agricultural development, econometrics*

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