# Time-Series Forecasting Model for Evaluating Cost-Effectiveness in Kenyan Smallholder Farm Systems,

**Eliza Mutua-Njugur**[1]**, James Muthomi-Mwakisina**[2,3]**, Abraham Ochieng-Kioni**[3]**, Katherine Wanjiku-Nyamu**[4]

[1] University of Nairobi

[2] Department of Research, African Population and Health Research Center (APHRC)

[3] Department of Research, Kenya Agricultural and Livestock Research Organization (KALRO)

[4] Department of Interdisciplinary Studies, University of Nairobi

**Author notes**

*Eliza Mutua-Njugur is affiliated with University of Nairobi and focuses on Environmental Science research in Africa.*
*James Muthomi-Mwakisina is affiliated with Department of Research, African Population and Health Research Center (APHRC) and focuses on Environmental Science research in Africa.*
*Abraham Ochieng-Kioni is affiliated with Department of Research, Kenya Agricultural and Livestock Research Organization (KALRO) and focuses on Environmental Science research in Africa.*
*Katherine Wanjiku-Nyamu is affiliated with Department of Interdisciplinary Studies, University of Nairobi and focuses on Environmental Science research in Africa.*

## Abstract

This study addresses a current research gap in Environmental Science concerning Methodological evaluation of smallholder farms systems in Kenya: time-series forecasting model for measuring cost-effectiveness in Kenya. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of smallholder farms systems in Kenya: time-series forecasting model for measuring cost-effectiveness, Kenya, Africa, Environmental Science, theoretical This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The empirical specification follows $Y = \vec{\beta}_{0+\beta} \, p \, X + varepsilon,$ and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *African geography, Smallholder farming systems, Time-series analysis, Cost-effectiveness, Econometric models, Sustainability indicators, Agricultural productivity*

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