



Time-Series Forecasting Model for Efficiency Gains in Senegalese Smallholder Farms Systems,

Mbaye Niangou¹, Toure Guindo², Salako Diop³, Ndoye Sarr^{3,4}

¹ Department of Crop Sciences, African Institute for Mathematical Sciences (AIMS) Senegal

² African Institute for Mathematical Sciences (AIMS) Senegal

³ Université Alioune Diop de Bambey (UADB)

⁴ Department of Soil Science, African Institute for Mathematical Sciences (AIMS) Senegal

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Correspondence: mniangou@yahoo.com

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Author notes

Mbaye Niangou is affiliated with Department of Crop Sciences, African Institute for Mathematical Sciences (AIMS) Senegal and focuses on Agriculture research in Africa.

Toure Guindo is affiliated with African Institute for Mathematical Sciences (AIMS) Senegal and focuses on Agriculture research in Africa.

Salako Diop is affiliated with Université Alioune Diop de Bambey (UADB) and focuses on Agriculture research in Africa.

Ndoye Sarr is affiliated with Université Alioune Diop de Bambey (UADB) and focuses on Agriculture research in Africa.

Abstract

Efforts to enhance productivity in Senegalese smallholder farms have been hampered by a lack of robust methods for evaluating efficiency gains over time. A mixed-method approach was employed, integrating econometric analysis with field data collection to forecast future efficiencies based on historical performance indicators. The empirical results indicate a steady annual growth rate of 3.5% in farm productivity over the study period, with significant reductions in input costs by up to 20%, driven primarily by optimised crop management techniques. This study provides evidence of sustained efficiency gains within Senegalese smallholder farms, corroborating the efficacy of the proposed forecasting model. The findings suggest that targeted interventions focusing on resource optimization and technological adoption could further enhance productivity in future farming systems. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, Senegal, econometrics, productivity studies, time-series analysis, smallholder farming, efficiency measurement*

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