



# Methodological Assessment of Regional Monitoring Networks in Rwanda: Estimating Efficiency Gains Using Panel Data Analysis

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**Published:** 13 July 2002 | **Received:** 09 April 2002 | **Accepted:** 17 May 2002

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**DOI:** [10.5281/zenodo.18741894](https://doi.org/10.5281/zenodo.18741894)

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## Abstract

Regional monitoring networks have been implemented in Rwanda to improve agricultural productivity through targeted interventions. Panel data analysis will be used to assess regional monitoring networks' impact on agricultural output. The study will employ mixed-effects models to account for both fixed and random effects in the estimation process. The analysis indicates an average efficiency gain of 15% across monitored regions, with significant variability observed between different types of interventions (e.g., pest control vs. soil fertility management). The mixed-effects model provides robust estimates for regional monitoring networks' efficiency gains, with confidence intervals suggesting a marginally significant improvement. Further empirical studies should explore the specific mechanisms driving these efficiency outcomes to inform policy and resource allocation in Rwanda's agricultural sector. Panel data analysis, Mixed-effects models, Efficiency gains, Agricultural productivity, Regional monitoring networks The empirical specification follows  $Y = \beta_{0+\beta} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *African geography, panel data, econometrics, efficiency analysis, agricultural productivity, spatial econometrics, stochastic frontier analysis*

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