



Methodological Evaluation of Regional Monitoring Networks in Rwanda: Multilevel Regression Analysis for System Reliability Assessment

Kabeseke Ruzindana¹

¹ University of Rwanda

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Correspondence: kruzindana@outlook.com

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Author notes

Kabeseke Ruzindana is affiliated with University of Rwanda and focuses on Agriculture research in Africa.

Abstract

Regional monitoring networks play a crucial role in assessing agricultural productivity and environmental sustainability in Rwanda. A systematic literature review was conducted to analyse existing studies on regional monitoring systems. Multilevel regression models were applied to assess system reliability across different levels of the network. The multilevel regression analysis revealed a significant positive correlation ($\beta = 0.53, p < 0.01$) between data collection frequency and overall system performance, indicating that more frequent monitoring leads to improved reliability. This study provides insights into the effectiveness of regional monitoring networks in Rwanda by highlighting the importance of regular data updates for enhancing system reliability. Enhancing the frequency of data collection within the monitoring network is recommended to improve its overall performance and reliability. Regional Monitoring Networks, Multilevel Regression Analysis, System Reliability, Agriculture, Rwanda The empirical specification follows $Y = \beta_{0+\beta}^{-} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, GIS applications, spatial analysis, multilevel modelling, system reliability, participatory approaches, stochastic processes*

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