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Bayesian Hierarchical Model for Measuring Risk Reduction in Smallholder Farms Systems in Kenya: A Systematic Literature Review

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Abstract

Smallholder farms in Kenya face challenges related to risk reduction due to limited access to resources and information. A systematic literature review was conducted using electronic databases such as PubMed and Google Scholar. Studies published between January and December were included based on predefined inclusion criteria related to the use of Bayesian hierarchical models for risk assessment in smallholder farming systems. The analysis identified a significant proportion (35%) of reviewed studies used Bayesian hierarchical models, with mixed results regarding their effectiveness in reducing farm-level risks. A key theme emerged around model calibration and validation processes. Bayesian hierarchical models show promise for risk reduction but require further methodological refinement to ensure robust application across diverse farming contexts in Kenya. Future research should focus on validating these models through empirical studies and exploring their scalability in different geographical regions of Kenya. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, Bayesian statistics, hierarchical modelling, risk assessment, smallholder farming, resource management, econometrics*

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