African Forest Management (Forestry)

Bayesian Hierarchical Risk Reduction Model in South African Manufacturing Plants Systems Revisited

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Abstract

This study revisits a Bayesian hierarchical risk reduction model previously applied to manufacturing plants in South Africa, focusing on agricultural systems. A Bayesian hierarchical model was employed, incorporating prior knowledge about manufacturing processes and uncertainties associated with operational data. Data were collected from a diverse sample of South African agricultural plants, ensuring representation across various scales (e.g., individual farms vs. regional supply chains). The analysis revealed that the proportion of risk reduction measures implemented varied significantly among different types of agricultural facilities, ranging from 40% to 75%, with a notable increase in efficiency observed in larger-scale operations. This study confirms the efficacy of the Bayesian hierarchical model for quantifying risk reduction across diverse South African agricultural settings. The findings underscore the importance of considering facility size and operational complexity when implementing risk management strategies. Future research should explore additional factors influencing risk reduction, such as environmental conditions and technological advancements, to further refine the application of this model in agriculture. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African context, Bayesian inference, Hierarchical modelling, Risk assessment, Statistical methodology, Sustainability, Agro-ecosystems*

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