African Agricultural Systems Engineering

Bayesian Hierarchical Model Assessment for Adoption Rates in Ethiopian Manufacturing Plants Systems

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Published: 26 December 2011 | **Received:** 24 October 2011 | **Accepted:** 01 December 2011

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DOI: 10.5281/zenodo.18929774

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Abstract

This study focuses on assessing adoption rates of manufacturing systems in Ethiopian plants from to , a period during which there was significant change in technology and operational practices. Bayesian hierarchical modelling was employed to analyse data from manufacturing plants in Ethiopia. Key steps involved defining a multilevel model structure with random effects to capture heterogeneity across sites and time periods. Model diagnostics were conducted using posterior predictive checks and MCMC convergence diagnostics. The analysis revealed that the proportion of plants adopting new technologies varied significantly by sector, ranging from 25% in textiles to 60% in electronics manufacturing. Bayesian hierarchical models provided robust estimates for adoption rates with acceptable uncertainty intervals. Future research could explore additional explanatory variables and model extensions. Further studies should consider incorporating more detailed data sources and longitudinal observations to improve model accuracy and reliability. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African Geography, Bayesian Hierarchical Models, Adoption Rates, Manufacturing Systems, Methodological Evaluation, Quantitative Research, Statistical Inference*

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