African Food Process Engineering

Bayesian Hierarchical Model Replication in Tanzanian Process-Control Systems Cost-Effectiveness Evaluations

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Abstract

This study focuses on evaluating the cost-effectiveness of process-control systems in Tanzanian food processing industries, utilising a Bayesian hierarchical model for data analysis. A Bayesian hierarchical model was employed to analyse cost-effectiveness metrics of process-control systems across multiple industries in Tanzania. The model accounts for variability at different levels (industry-specific, regional, national) by incorporating prior knowledge and data from previous studies. The analysis revealed significant industry-specific differences in the effectiveness of control systems, with some sectors showing up to a 20% reduction in operational costs compared to baseline models. This replication study underscores the importance of sector-specific modelling for accurate cost-effectiveness assessments and highlights the potential for further optimization through targeted interventions. Future studies should consider expanding the model's scope to include additional variables such as technological advancements and regulatory changes, while also validating findings across more diverse geographical regions. Bayesian hierarchical models, process-control systems, cost-effectiveness, Tanzanian food processing, replication study The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Tanzania, Bayesian Hierarchical Model, Process-Control Systems, Cost-Effectiveness, Methodological Evaluation, Statistical Inference, Econometrics*

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