African Computational Statistics (Technology/Maths)

Bayesian Hierarchical Model for Measuring Cost-Effectiveness of Process-Control Systems in Uganda

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Abstract

The cost-effectiveness of process-control systems (PCs) in manufacturing environments is a critical issue for industries aiming to optimise resource utilization and reduce operational costs. A Bayesian hierarchical regression model was employed to analyse data from multiple Ugandan manufacturing sites. The model accounts for both site-specific and shared effects among processes. The analysis revealed that the cost-effectiveness of PCs varied significantly across different factories, with some showing a reduction in costs up to 30% compared to conventional control methods. This study provides evidence supporting the use of Bayesian hierarchical models for assessing process-control systems' economic impacts in Ugandan settings. The findings suggest that localized implementation and continuous monitoring are necessary for realising full cost-effectiveness benefits from PCs. Process-Control Systems, Cost-Effectiveness Analysis, Bayesian Hierarchical Model, Manufacturing Industries, Uganda The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, Bayesian hierarchical model, Process-control systems, Cost-effectiveness analysis, Markov Chain Monte Carlo, Decision theory, Econometrics*

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