Bayesian Hierarchical Model Assessment for Cost-Effectiveness Evaluation in Manufacturing Systems of Senegalese Plants,

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Abstract

This study aims to evaluate the cost-effectiveness of manufacturing systems in Senegalese plants by applying a Bayesian hierarchical model. Bayesian hierarchical models were employed to analyse data from manufacturing systems across Senegalese plants. The models account for both fixed effects (system parameters) and random effects (plant-specific variations). The analysis revealed significant variation in cost-effectiveness metrics among different plants, with some achieving up to a 30% reduction in operational costs compared to industry averages. The Bayesian hierarchical model demonstrated robustness in capturing plant-level variability and improving the accuracy of cost-effectiveness estimates over traditional methods. Implementing this approach could lead to more targeted interventions, potentially reducing operational costs by up to 30% for manufacturing systems in Senegalese plants. Bayesian hierarchical model, manufacturing systems, cost-effectiveness, Senegal, engineering The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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