African Infrastructure Development Studies
(Interdisciplinary -

# Bayesian Hierarchical Model for Cost-Efficiency Assessment in Ethiopian Process-Control Systems

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## Abstract

Process-control systems are integral to ensuring efficient operations in industrial processes across Ethiopia. A Bayesian hierarchical model was developed and applied to assess the cost-effectiveness of process-control systems. The model accounts for variability across different sectors and incorporates prior knowledge to estimate parameters with uncertainty. The model revealed that investment in advanced control technologies led to a reduction in operational costs by approximately 15% on average, indicating significant potential savings. The Bayesian hierarchical model demonstrated its effectiveness in measuring cost-effectiveness of process-control systems, providing actionable insights for policymakers and industry practitioners. Policymakers should prioritise the adoption of advanced control technologies to enhance efficiency and reduce operational costs, while industry stakeholders should consider implementing these models to optimise their processes. Bayesian hierarchical model, cost-effectiveness, process-control systems, Ethiopian industries The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Ethiopia, Bayesian hierarchical model, process-control systems, cost-effectiveness, econometrics, stochastic modelling, optimization techniques*

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