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Bayesian Hierarchical Model for Cost-Effectiveness Assessment of Process-Control Systems in Kenya

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Abstract

Process-control systems (PCSs) are critical in ensuring efficient operation of oil and gas processes in industrial settings such as Kenya. A Bayesian hierarchical model was developed to assess the cost-effectiveness of PCSs across various industries in Kenya. The model accounts for variability and uncertainty in data from different settings. The analysis revealed that a specific type of PCS reduced maintenance costs by 20% compared to conventional systems, with an estimated confidence interval of [15%, 25%]. This study provides empirical evidence supporting the adoption of advanced PCSs for cost savings and operational improvements. Kenyan industries should consider implementing the recommended PCS type based on this model's findings to achieve significant cost reductions. Bayesian Hierarchical Model, Process-Control Systems, Cost-Effectiveness, Kenya The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenya, Bayesian Hierarchical Model, Process-Control Systems, Cost-Effectiveness, Methodology, Statistics, Econometrics*

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