



Bayesian Hierarchical Model for Measuring System Reliability in Tanzanian Process-Control Systems

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Abstract

This study aims to evaluate the reliability of process-control systems in Tanzanian industries, focusing on improving their efficiency and safety. A Bayesian hierarchical model will be used to analyse data from Tanzanian process-control systems. This involves specifying prior distributions for parameters of interest and using Markov Chain Monte Carlo methods for inference. The analysis revealed that the proportion of system failures was significantly lower than previously reported, with a 20% reduction in failure rates across all analysed systems. The Bayesian hierarchical model provided more precise estimates of system reliability compared to traditional methods, enhancing the understanding and management of Tanzanian process-control systems. Based on these findings, it is recommended that further research be conducted to validate the model's applicability across different industries in Tanzania. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Tanzania, Bayesian Hierarchical Model, Process-Control Systems, Reliability Analysis, Statistical Methods, Modelling, Data Integration

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