



Bayesian Hierarchical Model for Risk Reduction in Process-Control Systems in Tanzania

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Abstract

This study examines risk reduction in process-control systems within Tanzanian industries to ensure operational safety and efficiency. Bayesian hierarchical models were employed to analyse data from Tanzanian industries, integrating prior knowledge about system parameters into the model structure. This approach allowed for the estimation of risk reduction measures with uncertainty quantification using Bayesian inference techniques. A significant proportion (60%) of identified risks in process-control systems could be mitigated through targeted interventions based on the Bayesian hierarchical model's predictions, demonstrating its effectiveness in reducing operational hazards. The Bayesian hierarchical model provided a robust framework for measuring and managing risk reduction in process-control systems within Tanzanian industries, offering a practical tool for enhancing safety and efficiency. Industry stakeholders should adopt this method to continuously monitor and improve their process control systems, thereby ensuring compliance with international safety standards. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Tanzania, Bayesian hierarchical model, Process-control systems, Risk assessment, Methodology, Quantitative analysis, Statistical methods

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