African Structural Geology (Earth Science)

Bayesian Hierarchical Model Assessment for System Reliability in Ugandan Manufacturing Plants

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Abstract

Manufacturing plants in Uganda require robust reliability assessments to ensure optimal performance and safety. Current methods often fail to account for the hierarchical nature of system components and their interactions. A Bayesian hierarchical model was developed to assess system reliability across different plant components. The model incorporates prior knowledge about component failure rates and their interactions within the larger system. The model revealed significant variation in component failure rates among plants, with some exhibiting higher than expected failure rates by up to 30% compared to industry averages. Bayesian hierarchical modelling provides a more nuanced understanding of manufacturing systems' reliability and can inform targeted interventions to improve system performance and safety. Manufacturers should use the proposed model for ongoing monitoring and improvement, with specific focus on areas identified as having elevated failure rates. manufacturing systems, reliability assessment, Bayesian hierarchical models, Ugandan factories The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, Bayesian inference, Hierarchical modelling, Monte Carlo simulation, Reliability engineering, System reliability, Uncertainty quantification*

ABSTRACT-ONLY PUBLICATION

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