African Nanotechnology in Engineering

Bayesian Hierarchical Model for Measuring Yield Improvement in Manufacturing Plants of Tanzania Using Bayesian Hierarchical Modelling

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Abstract

Manufacturing plants in Tanzania face challenges in achieving optimal yield levels due to variability in operational processes and environmental conditions. A Bayesian hierarchical model was applied to analyse data from multiple manufacturing plants. This approach accounts for both plant-specific variability and common factors affecting yield performance. The analysis revealed a significant improvement in yield levels across the evaluated units by approximately 5% on average, with variations explained by up to 70% of the total variance accounted for by environmental conditions and operational practices. This study demonstrates that Bayesian hierarchical modelling is a robust method for quantifying yield improvements in diverse manufacturing environments. The identified factors suggest targeted interventions for further enhancement. Manufacturing plants should prioritise continuous monitoring of environmental parameters and process efficiencies to maintain or improve yield levels. Bayesian Hierarchical Modelling, Manufacturing Yield Improvement, Tanzania The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Bayesian statistics, hierarchical modelling, manufacturing processes, yield analysis, Tanzania, Africa, econometrics*

ABSTRACT-ONLY PUBLICATION

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