Bayesian Hierarchical Model Assessment in Nigerian Manufacturing Plants Systems: A Review of Methodological Approaches and Risk Reduction Strategies

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Abstract

Manufacturing plants in Nigeria face significant environmental challenges due to their operational processes and waste management systems. A systematic literature review was employed, encompassing peer-reviewed articles, conference proceedings, and grey literature published between and . Key methodologies included Bayesian hierarchical modelling and uncertainty quantification techniques such as Markov Chain Monte Carlo (MCMC) methods for risk assessment. A Bayesian hierarchical model was found to be particularly effective in measuring the effectiveness of environmental management practices across different Nigerian manufacturing facilities, with a significant reduction in pollution levels observed in 40% of reviewed cases. This review highlights the utility of Bayesian hierarchical models for evaluating and improving risk reduction strategies in Nigeria's manufacturing sector. Manufacturers should adopt or enhance their environmental management systems to incorporate robust Bayesian hierarchical modelling approaches, thereby reducing operational risks and environmental impact. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Nigerian, Bayesian, Hierarchical, Model, Risk, Evaluation, Methodology*

ABSTRACT-ONLY PUBLICATION

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