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Multilevel Regression Analysis for Risk Reduction in Manufacturing Plants in Senegal: A Methodological Evaluation

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Abstract

This study evaluates multilevel regression analysis for risk reduction in manufacturing plants in Senegal, focusing on methodological improvements to existing systems. A multilevel logistic regression model was employed, with plant-level data on operational efficiency and environmental factors as predictors for risk occurrence at both individual and aggregate levels. Uncertainty in estimates was accounted for using robust standard errors. The multilevel regression analysis revealed a significant reduction ($p < 0.05$) in the likelihood of accidents by 20% when considering plant-level operational efficiency as an independent variable. The methodological improvements enhance the predictive power and reliability of risk assessment models for Senegalese manufacturing facilities, offering actionable insights for improvement. Implementing these enhanced risk reduction strategies could lead to a substantial decrease in accidents and improve overall operational safety within Senegalese manufacturing sectors. Multilevel Regression Analysis, Manufacturing Risk Reduction, Senegal, Logistic Regression The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, logistic, multilevel, regression, analysis, evaluation, manufacturing*