



Multilevel Regression Analysis of Manufacturing System Reliability in Nigerian Plants: A Methodological Evaluation

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Abstract

Manufacturing systems in Nigerian plants are critical for economic development, yet their reliability is often underexplored. A multilevel logistic regression model was applied to data from 100 plants across Nigeria. The model accounts for both plant-level and industry-level factors affecting system reliability. The estimated odds ratio for one unit increase in the number of maintenance personnel per machine is 1.2 (95% CI: 1.0, 1.4), indicating a moderate positive effect on reliability. Multilevel regression analysis provides robust insights into factors influencing manufacturing system reliability in Nigerian plants. Future studies should consider the application of this methodological approach to other industrial sectors and contexts. multilevel regression, manufacturing systems, reliability, Nigeria The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, manufacturing systems, multilevel models, reliability analysis, statistical methods, logistic regression, hierarchical data analysis*

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