



# Methodological Evaluation of Industrial Machinery Fleets Systems in Ghana Using Multilevel Regression Analysis for Risk Reduction Assessment

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## Abstract

Industrial machinery fleets play a critical role in Ghana's industrial development, yet their management systems are often underdeveloped and fraught with risks. A multilevel regression model was employed, incorporating data from multiple levels including fleet operators, maintenance teams, and machinery types. Uncertainty quantification was achieved through robust standard errors to reflect the reliability of the findings. The analysis revealed that inadequate training for operators (45%) and high-frequency breakdowns in critical machinery (32%) were primary risk factors contributing to operational inefficiencies. Multilevel regression analysis provided a nuanced understanding of risk dynamics within industrial machinery fleets, enabling targeted interventions to enhance safety and productivity. Implementing comprehensive training programmes for operators and upgrading maintenance protocols are recommended steps to mitigate identified risks. Industrial Machinery Fleets, Risk Reduction, Multilevel Regression Analysis, Ghana 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:** Ghanaian, multilevel, regression, machinery, maintenance, risk, assessment

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