



A Multilevel Regression Framework for Evaluating Industrial Machinery Fleet System Reliability in Ethiopian Contexts

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Abstract

Industrial machinery fleet systems are integral to Ethiopia's industrial development, yet their reliability remains poorly understood due to limited data and methodological approaches. A multilevel regression analysis will be applied to examine the factors influencing fleet system reliability. The approach accounts for both fixed and random effects within and between different industrial sectors. This theoretical framework provides a robust method for assessing and improving the reliability of industrial machinery fleets in Ethiopia, offering insights that can inform policy and practice. The model should be validated with empirical data from at least three different industrial sectors to enhance its generalizability. 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, multilevel modelling, reliability engineering, industrial systems, stochastic processes, hierarchical analysis, predictive analytics*

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