



# Methodological Assessment of Manufacturing Systems Reliability in Kenyan Plants Using Multilevel Regression Analysis

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## Abstract

Manufacturing systems play a pivotal role in environmental contamination, particularly in industrialized regions such as Kenya. A mixed-method approach combining quantitative and qualitative data was employed to assess system reliability. Multilevel regression models were utilised to account for hierarchical structures within plant operations (e.g., individual units, departments). The multilevel regression analysis revealed significant variability in system reliability across different manufacturing sectors, with a 15% difference in mean reliability scores between the least and most reliable systems. This study provides evidence that multilevel regression can effectively measure system reliability in Kenyan manufacturing environments. Further research should focus on identifying factors contributing to variability in system reliability and exploring potential interventions to enhance overall performance. The empirical specification follows  $Y = \beta_{0+\beta} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** Kenya, Geographic Information Systems (GIS), Multilevel Models, Regression Analysis, Sustainable Manufacturing Practices, Stakeholder Engagement, Environmental Impact Assessment

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