Methodological Evaluation of Manufacturing Plant Systems in Ethiopia Using Multilevel Regression Analysis for Risk Reduction Assessment

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Abstract

Manufacturing plants in Ethiopia face various operational challenges that can lead to increased risk of accidents and disruptions. A comprehensive methodological approach was employed, including data collection from multiple levels (facility-level and process-level) of the manufacturing plants. Multilevel regression analysis was applied to assess the impact of different variables on system performance and risk factors. The multilevel regression analysis revealed that facility size and operational procedures had significant impacts on reducing risks within the manufacturing systems, with an estimated reduction in risk levels by up to 30% when stringent safety protocols were implemented. This study provides a robust framework for risk reduction in Ethiopian manufacturing plants through evidence-based multilevel regression analysis. The findings suggest that systematic implementation of best practices can significantly enhance system performance and operational reliability. Manufacturing plant managers are encouraged to adopt the recommended strategies, including enhancing safety protocols and improving facility management systems, based on this study's recommendations for risk reduction. Multilevel regression analysis, manufacturing plants, Ethiopia, risk reduction, engineering The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Manufacturing Systems, Multilevel Analysis, Regression Modelling, Risk Assessment, Quality Control, Supply Chain Management*

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This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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