Methodological Evaluation of Process-Control Systems in South Africa: Multilevel Regression Analysis for Risk Reduction Assessment

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Abstract

This study examines process-control systems in South Africa to assess their effectiveness in reducing engineering-related risks. A comparative study design was employed, involving field data collection and multilevel regression analysis. The analytical framework includes robust standard errors for uncertainty assessment. The multilevel regression model showed a significant reduction in risk by 20% (95% CI: -18%, -23%) when process-control systems were implemented at both managerial and operational levels, indicating their effectiveness in mitigating risks across different scales. Multilevel regression analysis proved to be an effective tool for measuring the impact of process-control systems on risk reduction in South Africa's engineering context. Future studies should expand this model to include more diverse industries and geographical regions to enhance its generalizability. Process-Control Systems, Multilevel Regression Analysis, Risk Reduction, Engineering, South Africa The maintenance outcome was modelled as $Y\{\}=beta\,0+beta\,1\,X\{\}+ui+varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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