African Transport Economics (Economics/Engineering crossover)

Multilevel Regression Analysis for Measuring System Reliability in South African Manufacturing Plants Systems

Zanele Khumalo[1,2], **Sipho Magwaza**[2,3]

[1] Department of Civil Engineering, SA Medical Research Council (SAMRC)

[2] Cape Peninsula University of Technology (CPUT)

[3] SA Medical Research Council (SAMRC)

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Correspondence: zkhumalo@yahoo.com

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Author notes

Zanele Khumalo is affiliated with Department of Civil Engineering, SA Medical Research Council (SAMRC) and focuses on Engineering research in Africa.

Sipho Magwaza is affiliated with SA Medical Research Council (SAMRC) and focuses on Engineering research in Africa.

Abstract

Manufacturing plants in South Africa face complex challenges related to system reliability that impact productivity and efficiency. A multilevel regression model was employed to analyse data from South African manufacturing plants, considering both plant-level and industry-level variables. The multilevel regression analysis revealed that plant size (proportion of employees) significantly influenced system reliability, with a coefficient of -0.349 (CI: -0.512, -0.186). Multilevel regression provides a robust framework for measuring and understanding system reliability in manufacturing plants. Further research should explore the implications of these findings on plant management strategies and industry-wide policy development. Manufacturing, System Reliability, Multilevel Regression Analysis, South Africa The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, Multilevel modelling, System reliability, Hierarchical analysis, Statistical methods, Regression analysis, Predictive analytics*

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