Methodological Evaluation of Industrial Machinery Fleets in Rwanda Using Multilevel Regression Analysis for Cost-Effectiveness Assessment

Kabugho Gaspard[1], Hutu Kigeli[2,3], Inganabo Innocent[4]

[1] African Leadership University (ALU), Kigali

[2] Rwanda Environment Management Authority (REMA)

[3] Department of Civil Engineering, African Leadership University (ALU), Kigali

[4] University of Rwanda

Author notes

Kabugho Gaspard is affiliated with African Leadership University (ALU), Kigali and focuses on Engineering research in Africa.

Hutu Kigeli is affiliated with Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

Inganabo Innocent is affiliated with University of Rwanda and focuses on Engineering research in Africa.

Abstract

Industrial machinery fleets play a critical role in Rwanda's economic development, particularly in sectors such as manufacturing and construction. A multilevel regression model will be employed to analyse data from multiple levels, including individual machines within fleets and overall fleet operations. Uncertainty in estimates will be addressed through robust standard errors. The analysis reveals that operational maintenance costs significantly influence the cost-effectiveness of machinery fleets, with a proportion as high as 40% attributed to these expenses. This study provides insights into optimising industrial machinery fleet operations for better financial outcomes in Rwanda. Based on the findings, targeted improvements in maintenance strategies and possibly the integration of predictive maintenance systems are recommended to enhance cost-effectiveness. Industrial Machinery Fleets, Multilevel Regression Analysis, Cost-Effectiveness, Maintenance Costs, Rwanda The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African economies, multilevel modelling, cost-effectiveness, industrial maintenance, regression analysis, spatial econometrics, GIS applications*

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