



Methodological Assessment and Cost-Efficiency Analysis of Transport Maintenance Depots in South Africa: A Multilevel Regression Study

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Abstract

Transport maintenance depots (TMDs) play a crucial role in ensuring food safety during transit from farms to urban markets in South Africa. A mixed-method approach was employed, integrating quantitative data on operational costs and qualitative insights from field visits. Multilevel regression models were utilised to analyse the impact of various factors on the cost-effectiveness of TMDs in South Africa. The analysis revealed that the presence of a regional hub significantly reduced transportation time by approximately 15% compared to decentralized depots, leading to lower operational costs and improved food safety standards. This study underscores the importance of strategic deployment of TMDs for enhancing both cost-effectiveness and reliability in South African agricultural supply chains. Policy recommendations include prioritising the establishment of regional hubs where feasible, alongside continuous monitoring to ensure optimal operation under varying conditions. Transport Maintenance Depots, Multilevel Regression Analysis, Cost-Effectiveness, Food Safety, Agricultural Supply Chain. The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \varepsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, multilevel regression, cost-effectiveness analysis, maintenance depots, supply chain management, logistic modelling, geographic information systems*

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