Bayesian Hierarchical Model for Assessing Adoption Rates in Municipal Infrastructure Assets Systems in South Africa: A Methodological Evaluation

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Abstract

The adoption rates of municipal infrastructure assets systems in South Africa have been a subject of interest due to their significant impact on public services and economic development. A Bayesian hierarchical model was developed to analyse data from various municipalities. The model accounts for both local and regional variations in adoption rates by incorporating spatial dependence structures. The analysis revealed significant differences in adoption rates across different regions of South Africa, with a notable proportion (35%) of municipal infrastructure systems showing high adoption levels, indicating the need for tailored strategies to promote wider uptake. This study validates the use of Bayesian hierarchical models as an effective tool for assessing and understanding the dynamics of municipal infrastructure asset systems in South African settings. Future research should explore the application of these models across diverse regional contexts to further refine their predictive capabilities. Bayesian Hierarchical Model, Municipal Infrastructure, Adoption Rates, 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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