



# Bayesian Hierarchical Model for Measuring Adoption Rates in Industrial Machinery Fleets of Rwanda: An Empirical Study

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### Abstract

Industrial machinery fleets in Rwanda face challenges related to adoption rates of new technologies. A Bayesian hierarchical model was applied to analyse data from industrial machinery fleets, considering sector-specific factors and incorporating uncertainty through robust standard errors. The analysis revealed that adoption rates varied significantly between agricultural and manufacturing sectors in terms of the rate of new technology uptake (e.g., 45% for agriculture vs. 30% for manufacturing). The Bayesian hierarchical model provided a nuanced understanding of adoption dynamics, with sector-specific insights enhancing its utility for policy-making. Policy-makers should tailor interventions to specific sectors based on the identified adoption patterns. Bayesian Hierarchical Model, Industrial Machinery Adoption, Rwanda, Uncertainty Quantification The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + v_i \epsilon_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Bayesian statistics, hierarchical modelling, econometrics, adoption analysis, industrial development, Rwanda, geographic information systems

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