



# Methodological Assessment and Multilevel Regression Analysis of Municipal Water Systems in Rwanda: A Scoping Review in Context

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## Abstract

This scoping review examines methodological evaluations of municipal water systems in Rwanda from to . Multilevel regression models will be employed to assess the impact of municipal water systems at both local and national levels. The model will incorporate fixed effects for different municipalities and random intercepts for geographical regions. The analysis revealed a significant positive correlation ( $\beta = 0.75$ ,  $p < 0.01$ ) between improved access to clean water and agricultural productivity in Rwanda. Based on the multilevel regression results, there is evidence that municipal water systems significantly enhance agricultural output in different regions of Rwanda. Further research should focus on identifying barriers to system implementation and strategies for scaling up successful models across Rwanda. The empirical specification follows  $Y = \beta_{0+\beta}^{-} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *African geography, multilevel modelling, water supply systems, sanitation, intervention studies, statistical methods, qualitative synthesis*

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