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Methodological Evaluation of Quasi-Experimental Design in Assessing Risk Reduction Across Municipal Infrastructure Asset Systems in Senegal

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Abstract

Municipal infrastructure assets in Senegal are critical for environmental sustainability and economic development, but their resilience to risks varies widely. A quasi-experimental design was employed, including pre- and post-assessments with control and treatment groups to measure changes in risk levels over time. The analysis revealed a significant reduction of 30% in infrastructure damage severity scores in the treated municipalities compared to controls ($p < 0.05$). Quasi-experimental methods offer a robust approach for assessing and measuring risk reduction in municipal infrastructure asset systems. Implementing continuous monitoring and maintenance programmes based on findings is recommended to further improve resilience. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, quasi-experimental design, econometrics, risk analysis, asset management, sustainability metrics, spatial statistics*

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