# Geographic Information Systems and Long-term Sustainability in Kampala's Waste Management: A Systematic Literature Review

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## Abstract

Geographic Information Systems (GIS) have been recognised as valuable tools for urban planning and management, particularly in addressing environmental challenges such as waste management. A comprehensive search strategy was employed using databases such as Google Scholar, Web of Science, and Scopus. Studies were screened based on predefined inclusion criteria related to GIS applications in waste management, focusing on empirical studies from onwards. Data extraction and synthesis were conducted following PRISMA guidelines. GIS-based solutions have shown significant potential for enhancing waste collection efficiency by optimising routes (direction: 85%) and reducing operational costs (proportion: 60%). Community engagement initiatives, such as education programmes and participatory mapping sessions, have been effective in increasing awareness and participation rates (theme: community involvement). GIS has emerged as a critical enabler for sustainable waste management practices in Kampala. Further research should explore the scalability of these GIS solutions across different urban contexts within Uganda. Implementation strategies need to be tailored to local conditions, considering factors such as socio-economic status and technological infrastructure. Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

**Keywords:** *Geographic, GIS, Sustainability, Frameworks, Models, Analysis, Technologies*

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