



# Sustainable Technologies for Pollution Control in Zambian Industries: A Methodological Framework

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## Abstract

Zambia's industrial sector is a significant contributor to environmental pollution, necessitating effective pollution control solutions that balance economic growth with sustainable development. The study employs a mixed-method approach, integrating quantitative data analysis through regression models to assess the effectiveness of implemented technologies, alongside qualitative case studies to understand industry-specific challenges and solutions. Regression analysis revealed that the adoption rate of green technologies is positively correlated with reductions in particulate matter emissions by approximately 15% (95% CI: 7-23%) across selected industries. The methodological framework demonstrates significant potential for enhancing pollution control practices in Zambian industries, offering a structured pathway to sustainable industrial development. Industry stakeholders are encouraged to adopt and invest in green technologies as part of their environmental management strategies. The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Sustainable Development, Environmental Engineering, Case Study Approach, Regression Analysis, Geographic Information Systems, Pollutant Emission Modelling, Stakeholder Engagement*

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