



Methodological Assessment of Quasi-Experimental Design in Enhancing Water Treatment Facility Efficiency in Nigeria: A Case Study

Ezeani Omenakare¹, Obiora Anyasogo², Olukaye Adekanye², Uzochukwu Ekeobojo^{2,3}

¹ University of Jos

² University of Abuja

³ University of Benin

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Correspondence: eomenakare@gmail.com

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Author notes

Ezeani Omenakare is affiliated with University of Jos and focuses on Engineering research in Africa. Obiora Anyasogo is affiliated with University of Abuja and focuses on Engineering research in Africa. Olukaye Adekanye is affiliated with University of Abuja and focuses on Engineering research in Africa. Uzochukwu Ekeobojo is affiliated with University of Abuja and focuses on Engineering research in Africa.

Abstract

Water treatment facilities in Nigeria often face challenges related to efficiency and reliability due to varying water quality inputs. A quasi-experimental design was employed, incorporating pre- and post-treatment data from multiple facilities to measure efficiency gains without controlled random assignment. Statistical analysis included regression models accounting for variability in input parameters. Treated water quality improved by an average of 15% with a standard deviation of $\pm 2\%$, indicating significant effectiveness of the intervention strategy. The quasi-experimental design proved to be effective in enhancing water treatment facility efficiency, providing a replicable methodology for other Nigerian facilities and beyond. Facility managers should consider implementing the identified operational improvements based on this study's findings to enhance overall system performance. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geographics, water quality variability, quasi-experimental design, randomized controlled trials, impact evaluation, statistical analysis, urban infrastructure enhancements*

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