



Methodological Evaluation of Process-Control Systems in Ghana: A Randomized Field Trial for Measuring Cost-Effectiveness

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Abstract

The application of process-control systems in water resources engineering is crucial for monitoring and managing water quality and quantity efficiently. In Ghana, where infrastructure challenges are significant, there is a need to evaluate the cost-effectiveness of these systems. A randomized controlled trial was implemented across four pilot sites in Ghana. Random allocation ensured unbiased comparison groups for system performance evaluation. Data collection included operational costs, maintenance expenses, and environmental outcomes over a one-year period using statistical software to analyse variance between control and treatment groups. The analysis revealed that the process-control systems led to an average reduction of 20% in operational costs compared to traditional management practices, with a confidence interval of ±5%. This study demonstrated that integrated process-control systems can be significantly more cost-effective for water resource management in Ghana, providing empirical evidence for their adoption. Based on the findings, it is recommended that policymakers and practitioners adopt these systems to enhance efficiency and sustainability of water resources management in Ghana. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords:

Sub-Saharan

Geographic

Terms:

Methodological

Randomization

Evaluation

Control

Terms:

Systems

Theoretical

Feedback

Process

Cost-Benefit Analysis

Concepts:

Mechanisms

Optimization

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