



# Methodological Evaluation of Water Treatment Facilities in Ghana: Panel Data Estimation for Yield Improvement Assessment

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### Abstract

Water treatment facilities in Ghana are essential for ensuring safe drinking water access across various regions. Despite significant investments, yield improvement remains a challenge due to varying operational conditions and technological inefficiencies. A mixed-method approach was employed, combining quantitative econometric analysis with qualitative case studies. Panel data from 15 treatment plants over a five-year period were analysed using a fixed effects model ( $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$ ), where  $Y$  represents yield,  $X_1$  is plant age, and  $X_2$  includes operational parameters such as temperature. The panel data analysis revealed that plant age had a significant negative impact on yield, with older plants generally yielding less water. Temperature fluctuations were also found to affect yield variability, though the proportion of this effect was smaller than expected based on initial hypothesis (90% lower CI: -15%, 3%). The fixed effects model provided robust estimates of parameters, indicating that controlling for unobserved heterogeneity is crucial in accurately measuring treatment plant performance. Future research should explore additional factors and potential interventions to enhance yield. Based on the findings, it is recommended that water utilities prioritise regular maintenance of older plants and implement more stable operational procedures to improve yield efficiency. Additionally, further studies are needed to validate these results and inform policy decisions. Water treatment facilities, Ghana, panel data estimation, yield improvement, fixed effects model

**Keywords:** *Geographic, Panel Data, Econometrics, Time Series, Stochastic Frontier Analysis, Water Supply Systems, Geographic Information Systems (GIS)*

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