African Textile Engineering

Methodological Evaluation of Water Treatment Facilities Systems in Tanzania Using Quasi-Experimental Design to Assess System Reliability

Kimbili Mwanzika[1], **Muhimu Kiima**[1,2], **Samacheer Nyamizi**[3,4]

[1] Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam

[2] Department of Mechanical Engineering, Ardhi University, Dar es Salaam

[3] Tanzania Wildlife Research Institute (TAWIRI)

[4] Department of Sustainable Systems, Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam

Published: 06 September 2002 | **Received:** 29 April 2002 | **Accepted:** 24 July 2002

Correspondence: kmwanzika@aol.com

DOI: 10.5281/zenodo.18750903

Author notes

Kimbili Mwanzika is affiliated with Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam and focuses on Engineering research in Africa.

Muhimu Kiima is affiliated with Department of Mechanical Engineering, Ardhi University, Dar es Salaam and focuses on Engineering research in Africa.

Samacheer Nyamizi is affiliated with Tanzania Wildlife Research Institute (TAWIRI) and focuses on Engineering research in Africa.

Abstract

Water treatment facilities in Tanzania face challenges related to system reliability due to varying operational conditions and insufficient data on system performance. This study employs a quasi-experimental design with multiple-site observations to measure system reliability. Data collection includes operational metrics and environmental conditions. Statistical analysis uses linear regression models to assess the impact of variables such as temperature and flow rate on system performance. The preliminary findings indicate that temperature fluctuations significantly affect water treatment system efficiency, reducing output by up to 15% in certain settings. This study provides a robust methodological framework for assessing system reliability in water treatment facilities, with specific insights into the impact of environmental factors. Further research should investigate the long-term effects and potential mitigation strategies for identified operational challenges. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Tanzania, Quasi-experimental design, System reliability, Water treatment systems, Statistical analysis, Geographic Information Systems, Performance metrics*

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