



# Designing Cost-Efficient Irrigation Solutions for Drought-Prone Mali Fields

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## Abstract

This study addresses a current research gap in Engineering concerning Design of Low-Cost Irrigation Systems for Drought-Prone Areas in Mali in Mali. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Design of Low-Cost Irrigation Systems for Drought-Prone Areas in Mali, Mali, Africa, Engineering, working paper This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as  $Y \{\} = \beta_0 + \beta_1 X \{\} + u_i + \text{varepsilon}$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Mali, Sub-Saharan, Hydrology, Modelling, Precision Engineering, Sustainable Development, Water Management*

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