



Designing Economically Viable Irrigation Systems for Drought-Prone Mali Terrains

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Abstract

Irrigation systems are crucial for sustainable agriculture in Mali's arid regions, where rainfall is unpredictable and water scarcity is a significant challenge. A combination of economic analysis, hydrological modelling, and field trials was employed to evaluate the effectiveness and cost-effectiveness of various irrigation systems under different climatic conditions in Mali. Field trials demonstrated that a gravity-fed drip irrigation system achieved water savings of 18% compared to traditional flood irrigation methods, with an operational cost reduction of 25% over three years. Economic models predicted a payback period of less than two years for the proposed systems. The designed low-cost irrigation systems are economically viable and environmentally sustainable, offering significant benefits in terms of water savings and reduced operational costs. Government agencies should prioritise funding for the implementation of these systems to support small-scale farmers, leading to improved food security and economic stability in Mali's arid regions. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \varepsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Agroecology, EconomicEvaluation, Hydrology, SystemsEngineering, WaterHarvesting, Low-CostInfrastructure*

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