African Nanotechnology in Engineering

# Designing Affordable Irrigation Solutions for Mali's Drought-Prone Regions

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## Abstract

Mali faces significant challenges in agriculture due to recurrent droughts, which threaten food security and economic stability. A participatory approach was employed to tailor the irrigation solutions based on local needs. A mixed-methods study combining surveys with focus group discussions was conducted to gather insights from farmers and experts. The design of low-cost pumps and drip irrigation systems showed promising results, increasing crop yields by an average of 20% in semi-arid regions compared to traditional rain-fed methods. The study demonstrated the feasibility of deploying these affordable irrigation solutions across Mali's drought-prone areas, potentially reducing agricultural dependency on rainfall. Government support and stakeholder engagement are recommended for scaling up the adoption of designed irrigation systems. Irrigation Design, Drought Mitigation, Low-Cost Solutions, Agricultural Sustainability The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *African geography, Participatory design, Low-cost engineering, Sustainable agriculture, Irrigation systems, Rural development, Drought adaptation*

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