African Applied Statistics (Pure Science)

Solar-Powered Irrigation and Agroecological Resilience in Kenyan Drylands: An Impact Analysis on Farmer Livelihoods

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Abstract

Solar-powered irrigation systems have become increasingly important in mitigating water scarcity in Kenyan drylands, where traditional irrigation methods often fail to sustain crops due to erratic rainfall and limited groundwater resources. A mixed-method approach was employed, combining quantitative data from surveys conducted among farmers ($n = 150$) with qualitative insights gathered through focus group discussions $\wedge$ interviews ($n = 20$). Data were analysed using SPSS for descriptive statistics and thematic analysis to interpret farmer narratives. Solar-powered irrigation systems have demonstrated significant potential in enhancing agricultural productivity by up to 30% compared to conventional methods, particularly among smallholder farmers who rely on rain-fed agriculture. Farmers reported increased crop yields of staple crops such as maize and beans, with notable improvements in water usage efficiency. The adoption of solar-powered irrigation systems appears to bolster agroecological resilience by reducing the dependency on unpredictable rainfall and enabling more sustainable agricultural practices, thereby supporting farmer livelihoods in Kenyan drylands. Given the positive outcomes observed, policymakers should prioritise the deployment of solar irrigation technology as a key strategy for enhancing food security and economic stability in arid regions. Additionally, further research is needed to explore cost-effective financing mechanisms that could facilitate wider adoption by smallholders. solar-powered irrigation, agroecological resilience, farmer livelihoods, Kenyan drylands

Keywords: *Kenyan, Drylands, Agroecology, Sustainability, Adaptation, Renewable Energy, Resilience Studies*

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