Economic Enhancement Through Solar-Powered Irrigation Systems in Yemeni Agriculture: A Nigerian Methodological Exploration

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Abstract

Yemeni farmers in Nigeria are facing significant challenges in agriculture due to water scarcity and unreliable power supply, which limits their ability to implement solar-powered irrigation systems effectively. A mixed-method approach combining quantitative data analysis (using regression models) and qualitative interviews with farmers was employed to gather comprehensive insights into the effectiveness of solar-powered irrigation systems under local conditions. Data from 50 randomly selected farms were analysed using a linear regression model to estimate system performance, with robust standard errors accounting for measurement uncertainties. The analysis revealed that solar-powered irrigation systems significantly increased crop yields by an average of 25% compared to conventional methods, although variability in results was observed across different regions due to varying climatic conditions and soil types. The methodological framework developed provides a robust basis for future research and policy interventions aimed at promoting sustainable agricultural practices in resource-limited settings. Farmers should be encouraged to participate in solar-powered irrigation systems through subsidies, training programmes, and incentives. Policy-makers must also consider integrating solar power into national agricultural development plans. solar-powered irrigation, economic enhancement, Nigeria, Yemen, mixed-method approach The empirical specification follows $Y = \vec{\beta}_{0+\beta} \, p \, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, geospatial analysis, photovoltaics, econometrics, renewable energy systems, Monte Carlo simulation, GIS*

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