Agri-Tech Breakthroughs: Catalysts for Sustainable Agricultural Advancement in Nigeria

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Introduction

Agriculture contributes 21% to Nigeria's GDP (19% from crop production), yet faces challenges like low productivity, climate vulnerabilities, and reliance on rain-fed practices, threatening food security. Ensuring economic sustainability which involves balancing growth with resource preservation is critical for Nigeria, whose population is projected to reach 400 million by 2050.AgTech innovations can boost productivity, align with UN SDGs, and support policies like NATIP 2022–2027.

In Ogun state, agriculture drives food security and growth but struggles with low Ag-Tech adoption due to high costs, poor infrastructure (electricity, internet), and inadequate training. Limited use of improved seeds, mobile advisories, and precision tools hampers progress, compounded by institutional gaps.

Research Purpose:

This study examines how AgTech innovations (precision farming, biotechnology, automation) enhance economic sustainability in Ogun State. It aims to identify adoption trends, impacts, and barriers, providing actionable insights for policymakers and stakeholders to leverage Ag-Tech for resilience, poverty reduction, and SDG alignment.

Research Goals:

i. Assess the impact of precision farming on economic sustainability.
ii. Evaluate how biotechnology influences economic outcomes.
iii. Investigate the role of automated farming in enhancing economic viability.

Materials and Methodology

Precision Farming (PF) optimizes resource use (water, fertilizer), boosts crop yields, and reduces environmental harm. It enhances sustainability by minimizing waste and improving climate resilience.Biotechnology Farming addresses soil degradation, pests, and climate impacts to improve crop resilience, productivity, and food security.Automated Farming enhances efficiency, reduces labor costs, and improves resource management.Economic Sustainability is the process of balancing long-term economic growth with environmental stewardship and social equity.Ecological Modernization Theory (EMT): Proposed by Huber and Mol, EMT argues that technological innovation and market-driven solutions can decouple economic growth from environmental degradation, enabling sustainable development.

The study used a mixed-methods approach (convergent parallel design) in Yewa South Local Government, Ogun state, Nigeria, focusing on maize and cassava farmers. Quantitative surveys and qualitative interviews were conducted with 341 farmers adopting Cochran sampling method from a population of 792. Data analysis combined descriptive and inferential statistics to assess Ag-Tech adoption trends, impacts, and barriers.

Results and discussion

Reliability: Cronbach's Alpha = 0.941 confirms excellent internal consistency for the measurement scale, ensuring the items reliably captured the intended constructs. Model Summary: The regression model explains 46.9% of the variance in ES ($R^2 = .469$), representing a moderate-to-strong predictive effect. Regression Results: Precision Farming (PF) is the strongest positive predictor of ES ($\beta = .687$, $p < .001$), underscoring its critical role in enhancing sustainability through optimized resource use and productivity, Biotechnology Farming (BF) has a moderate positive effect ($\beta = .196$, $p = .002$), while Automated Farming (AF) shows a negative effect ($\beta = -.296$, $p < .001$).

Conclusions

The study concluded that Ag-Tech has a significant relationship with economic sustainability in Ogun state, Nigeria. The study recommends that the government and private sector invest in AgTech to improve rural infrastructure, promote farmer training, provide financial support, and strengthen economic resilience in Ogun State.

Keywords: Agri-Technology, Automated, Biotechnology, Economic Sustainability, Precision,