



The Role of Artificial Intelligence in Agricultural Economics

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Transforming the Field from Farm Gate to Market

Artificial intelligence is no longer a futuristic concept confined to tech labs it is actively reshaping how agriculture operates economically, from individual farm decisions to global commodity markets. As food security becomes an ever-more-pressing global challenge, AI is emerging as a powerful tool that enhances productivity, reduces costs, and enables smarter economic decision-making across the agricultural value chain.

Precision Farming and Cost Efficiency

One of AI's most significant economic contributions is in precision agriculture. By analyzing data from satellites, drones, and IoT soil sensors, AI systems help farmers apply water, fertilizer, and pesticides only where and when needed. This targeted approach dramatically cuts input costs studies suggest precision agriculture can reduce fertilizer usage by up to 20% and water consumption by as much as 30%. For smallholder farmers operating on thin margins, these savings can mean the difference between profit and loss. Machine learning models now predict crop yields with remarkable accuracy weeks before harvest. This allows farmers and agribusinesses to make informed decisions about storage, transport, and forward contracts, reducing costly waste and improving supply chain efficiency.

Market Intelligence and Price Forecasting

Agricultural commodity prices are notoriously volatile, influenced by weather, geopolitical events, and shifting demand patterns. AI-driven analytics platforms now aggregate vast datasets weather forecasts, historical prices, trade flows, and social sentiment to generate commodity price predictions that outperform traditional methods. For agricultural economists, this represents a paradigm shift. Traders, cooperatives, and government agencies increasingly rely on AI-generated forecasts to guide hedging strategies, procurement decisions, and food price stabilization policies. Countries prone to price shocks can use these tools to build strategic reserves more efficiently and intervene in markets at the right time.

Supply Chain Optimization

AI is also revolutionizing agricultural logistics. Algorithms optimize routing for perishable goods, reducing spoilage losses estimated at over \$940 billion annually worldwide. In developing economies, AI-powered mobile platforms connect smallholder farmers directly to buyers, eliminating exploitative intermediaries and improving farmer income by 10–40% in documented cases. Blockchain integrated with AI enables transparent supply chains, allowing consumers to verify product origins while helping economists trace inefficiencies and price distortions through the production system.

Labor Markets and Economic Disruption

AI-driven automation from robotic harvesting to autonomous tractors is beginning to reshape rural labor markets. While it raises concerns about agricultural job displacement, it also addresses critical labor shortages in aging farming communities. The economic transition

demands policy responses: retraining programs, rural digital infrastructure investment, and updated social safety nets.

The Road Ahead

AI's role in agricultural economics is still in its early innings. Challenges remain around data access for smallholders, digital literacy, and algorithmic bias that may disadvantage marginalized farming communities. Yet the trajectory is clear: nations and enterprises that embrace AI in agriculture will achieve stronger food security, lower production costs, and more resilient rural economies. The integration of AI into agricultural economics is not merely a technological upgrade it is a fundamental reimagining of how humanity manages its most essential industry.