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DIGITALIZATION IN AGRICULTURE MARKETING: THE FUNCTION OF BIG DATA AND AI IN GOVERNMENT PROGRAMS

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ABSTRACT

The agricultural industry has seen a transformation thanks to the digitalization of agricultural marketing, which has improved farmer accessibility, efficiency, and transparency. Government initiatives have been able to improve supply chain management, strengthen market relationships, and optimize decision-making through the combination of artificial intelligence (AI) and big data. This study examines how AI and Big Data are used in government programs for agricultural marketing, focusing on how technologies affect resource allocation, price forecasting, and policy making. Big Data analytics makes it possible to gather and analyze enormous volumes of agricultural data, such as economic developments, soil health, and variations in the weather. Farmers may make educated decisions about crop selection, storage, and sales by using AI-driven models that use this data to deliver real-time insights. Government schemes that use AI to improve transaction efficiency and lessen information asymmetry include India's e-NAM (National Agricultural Market). While AI-powered chat bots and mobile apps provide farmers with advising services, predictive analytics forecasts changes in supply and demand, which helps stabilize prices. Additionally, AI-powered remote sensing and satellite imagery support crop monitoring and catastrophe management by assuring prompt interventions. When used with artificial intelligence, block chain technology enhances supply chain traceability, minimizes fraud, and guarantees fair pricing. Issues like infrastructure deficiencies, digital literacy, and data privacy issues continue to exist, necessitating policy interventions for successful being adopted.

In addition to highlighting the necessity of inclusive digital policies to close the technological gap for small and marginal farmers, this article emphasizes the revolutionary potential of artificial intelligence (AI) and big data in government-led marketing for agriculture programs.

***Keywords**: Digitalization, Agricultural Marketing, Big Data, Artificial Intelligence, Government Programs.*

INTRODUCTION

With the emergence of technology, agricultural marketing has experienced a dramatic change. Data-driven and technology-enabled solutions are increasingly replacing traditional marketing strategies, which are frequently characterized by inefficiencies, information asymmetry, and limiting market access. Big Data and artificial intelligence (AI) are being used into agricultural marketing initiatives by governments all over the world in an effort to boost supply chain management, ensure fair pricing, and increase production .Big Data analytics analyzes enormous volumes of data on weather patterns, yields from agriculture, soil health, and market trends to help farmers and policymakers make well-informed decisions. Artificial intelligence (AI)- powered solutions, such machine learning algorithms and predictive analytics, estimate demand, identify fraud, and automate supply chain operations to further enhance marketing efforts. These technologies are used in India by programs like the Digital Agriculture Mission and e-NAM (National Agriculture Market) to establish a more effective and competitive agricultural marketplace.

The function of AI and Big Data in government-run agriculture marketing initiatives is examined in this study. It looks at how these factors affect policy implementation, market effectiveness, and farmer empowerment. Insights for stakeholders seeking to incorporate cutting-edge technologies into the industry are also provided by the study, which also emphasizes the difficulties and possibilities of digitizing in agricultural marketing.

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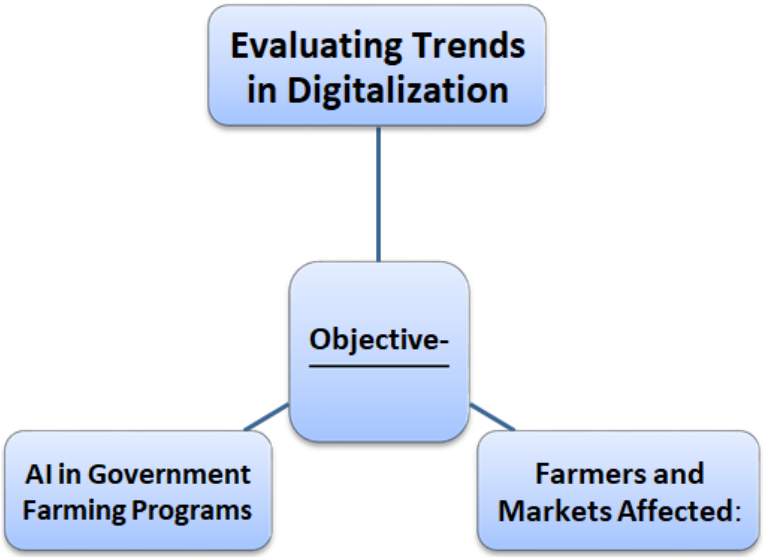
OBJECTIVE



Evaluating Trends in Digitalization: To examine how digital technologies are being used in agricultural marketing and how they affect farmer income, effectiveness and transparency.

AI in Government Farming Programs: To evaluate how government initiatives like PM-KISAN, e NAM, and crop insurance programs incorporate AI-driven solutions (including chatbots, predictive analytics, and automated decision-making).

Farmers and Markets Affected: To investigate how farmers' availability of markets, economic realization, and bargaining strength are affected by the digital revolution.

SCOPE OF REASERCH

The growing demand for effectiveness, openness, and sustainability in the agricultural sector has led to a broadening of research on digitization in agricultural marketing, namely the incorporation of Big Data and Artificial Intelligence (AI) in government programs. The study will investigate how crop supply chains, pricing systems, and farmer access to markets are being transformed by digital platforms, blockchain, and artificial intelligence- drivenanalytics.

The role that big data plays in resource allocation, demand forecasting, and policy formation will be a crucial area of focus. This will allow governments to create financial support systems and tailored incentives. AI tools that improve decision-making for farmers and policymakers include automated quality evaluation, precision farming, and predictive analytics.

The study will offer policy recommendations for boosting digital adoption in agricultural marketing through investigating the economic and social effects of these technologies, guaranteeing that small and marginal farmers profit from technological improvements.

LITERATURE REVIEW

Market access, supply chain inefficiencies, and price fluctuation are some of the main challenges facing the agricultural industry that digitalization in marketing has helped to resolve in recent years. The use of digital tools like artificial intelligence (AI) and big data in agriculture marketing has greatly enhanced market efficiency, transparency, and decision-making. This review of the literature looks at the use of big data and artificially intelligent systems (AI), the role of digitalization in agricultural marketing, and the role of government initiatives in advancing these technologies.

Sharma and Singh (2021), The use of digital technologies to improve the efficiency, accessibility, and visibility of agricultural products is known as "digitalization" in agricultural marketing. It encompasses innovations that link farmers with consumers, suppliers, and markets, such as e-marketplaces, mobile applications, and digital platforms. Farmers are now able to make better market decisions, get around geographic restrictions, and rely less on middlemen thanks to the digital revolution in agriculture. In order to sell produce directly to customers, guarantee better prices, and cut down on waste brought on by inefficiencies in conventional supply chains, e-commerce platforms have grown in importance.

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Jain et al. (2022), Big data can transform agriculture marketing by offering valuable insights about consumer behavior, market trends, and crop performance. To forecast market demand, enhance the supply chain, and optimize farming practices, data is analyzed from a variety of sources, including weather patterns, soil sensors, satellite photos, and market prices. Big data enables marketers and farmers to make data-driven choices that enhance forecasting, lower risks, and boost revenue. Big data-driven predictive analytics can also be used to find market opportunities and guarantee better pricing strategies.

Kapoor and Yadav (2023) AI is essential to bettering agricultural marketing because it increases output, streamlines supply chains, and offers more precise intelligence on the market. Large data sets can be processed and predictive models that can predict market demand, identify pest outbreaks, and optimize crop pricing can be developed thanks to artificial intelligence (AI) techniques like computer learning and deep learning. assert that supply chain optimization and the creation of evolving pricing models can be aided by AI algorithms, leading to more effective resource allocation and a decrease in post-harvest losses. Better market results are also ensured by AI-powered platforms that assist farmers in making well-informed decisions about crop cultivation, pest control, and yield predictions.

Verma, S., & Rao, P. (2021), The effective integration of digital technologies in agriculture is largely dependent on government interventions. Programs to encourage the use of digital tools for agricultural marketing have been put in place in numerous nations. To help farmers in India, for instance, the campaign known as Digital India has promoted the creation of digital platforms that give them access to up-to-date market data and facilitate their relationships with buyers. Big data and AI are also used by the government crop insurance program Pradhan Mantri Fasal Bima Yojana (PMFBY) to evaluate and forecast crop risks, giving farmers greater flexibility to deal with unforeseen circumstances. Government organizations can now provide farmers with online assistance, from financial services to marketing strategies, thanks to the use of mobile-based platforms.

Gupta, P., & Rathi, A. (2023) Digitalization, big data, artificial intelligence, and government initiatives have many advantages, but their wide use in agricultural marketing is hampered by a number of issues. These difficulties include the need for farmers to be digitally literate, restricted access to digital infrastructure, and worries about data privacy. The full potential of these technologies is hampered by the digital divide that exists between rural and urban areas. Furthermore, big data and AI demand significant infrastructure investment, which could be a deterrent for smallholder farmers in developing nations. To guarantee that all farmers can profit from the digital transformation of agriculture marketing, it will be crucial to make future investments in data privacy laws, affordable internet access, and digital competence initiatives.

Gulati and Juneja (2020) analyze how AI-driven satellite imagery and data analytics are used in India's **Pradhan Mantri Fasal Bima Yojana (PMFBY)** for efficient crop insurance claims and subsidy targeting, thereby increasing program efficiency and farmer trust.

Mittal and Mehar (2016) show that AI-enabled mobile applications can empower farmers by disseminating personalized information on market prices, government schemes, and crop advisories, ultimately increasing farmers' bargaining power and market participation.

Patel and Patel (2021) explore the use of vernacular AI chatbots in public agricultural advisory services, which provide tailored insights and notifications on local weather, market conditions, and pest outbreaks.

Rao and Sridhar (2020) examine how AI-powered traceability tools and digital procurement platforms enhance trust and reduce transaction costs across agricultural markets, especially when implemented through government-supported supply chains.

THE EVOLUTION OF TRENDS IN DIGITALIZATION, AND GOVERNMENT INITIATIVES AND AFFECT ON FARMERS AND MARKETS

Farmers and markets have been severely affected by the growing digitization of agriculture in conjunction with government initiatives. Let's evaluate the patterns and their effects:

Evaluating Trends in Digitalization

1. **Laser farming**: The practice of precision agriculture includes laser farming, which uses modern technology to improve input management, irrigation efficiency, and soil leveling.

a) **Artificial Intelligence (AI**): Optimizes farming decisions by analyzing data on crop conditions, soil,health, and weather patterns.

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b) **IoT (Internet of Things):** Sensors positioned in fields collect data on temperature, fertilizer levels, and soil moisture in real time.

c) **GIS (Geographic Information Systems) and drones**: These tools offer aerial photographs to track crop health and pinpoint problems.

2. Electronic marketplaces: Farmers may now sell their agricultural goods online thanks to electronic markets, which improve price discovery while decreasing the need for middlemen. The National Agricultural Market, or e-NAM, is the biggest online marketplace in India that enables farmers to sell products to customers throughout the nation.AgriBazaar and DeHaat are private agri-tech platforms that put farmers in direct contact with exporters, retailers, and bulk purchasers.

3. Mobile-Based Advisor Services: Farmers can get up-to-date, precise information on weather patterns, market trends, pest control, and agronomic techniques via mobile advising services.

Apps and platforms backed by the governmentinclude:

a) **Kisan Suvidha:** Provides market prices, weather forecasts, and reliable guidance.

b) **IFFCO Kisan**: Links farmers with agricultural experts and offers practical guidance in real time.

c) **Block chain in Supply Chains**: Farm produce can be traced from beginning to finish thanks to blockchain technology, which brings safe, transparent, and unchangeable record-keeping to the agricultural supply chain.Trade agreements between buyers and farmers can be automated and enforced via smart contracts.

d) **Traceability Solutions**: Monitors the produce's continuous path from farm to table.

e) **Anti-fraud mechanisms**: guarantee compliance and lessen fraud in contract agricultural operations.

4. Digital Credit and Insurance: Digital platforms let farmers easily obtain insurance and finance, minimizing financial risks and ensuring security.Easy access to small loans for the purchase of inputs has been made possible by digital lending and microcredit.Farmers' creditworthiness has been assessed by AI-powered credit scoring, which subsequently customizes loan offers.Models of crop insurance give protection against crop losses brought on by pest assaults and unusual weather patterns.

FUTURE PROSPECTS

AI and IoT-Driven Agricultural Automation Autonomous Farm Equipment: Drones and robots will automate farming processes, reducing labor dependency. AI-Powered Yield Predictions: Advanced models will optimize planting, fertilizing, and harvesting processes.

Expansion of Agri-Fintech Ecosystems Tailored Credit Models: AI and blockchain will enable customized credit models based on risk analysis. Increased Financial Inclusion: Digital credit platforms will bridge the financial gap for small farmers.

Blockchain Integration for Food Traceability and Safety Enhanced Supply Chain Transparency: Verifiable product origin and quality will increase consumer trust. Global Export Potential: Certified produce will meet international quality standards, boosting exports.

Skill Development and Upskilling Rural Youth Digital Literacy Programs: Government initiatives will focus on upskilling rural populations.

AI IN GOVERNMENT FARMING PROGRAMS

1. **PM-KISAN** - The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) program uses digital platforms to send funds straight into small and marginal farmers' bank accounts, giving them immediate financial support..
2. **The Digital India Initiatives**- The goal of the Digital India Project is to close the digital gap by giving farmers the means to access digital platforms and improving connectivity to the internet in rural areas.
3. **Kisan Suvidha & Agri Apps**: Kisan Suvidha and other government-supported agri-apps give farmers the ability to access up-to-date weather, market pricing, crop health, and expert guidance to assist them make better decisions.
4. **Digi Gaon (Digital Village Initiative**): The Digi Gaon Initiative seeks to improve internet connectivity and foster digital literacy in order to turn rural villages into communities with digital strength.

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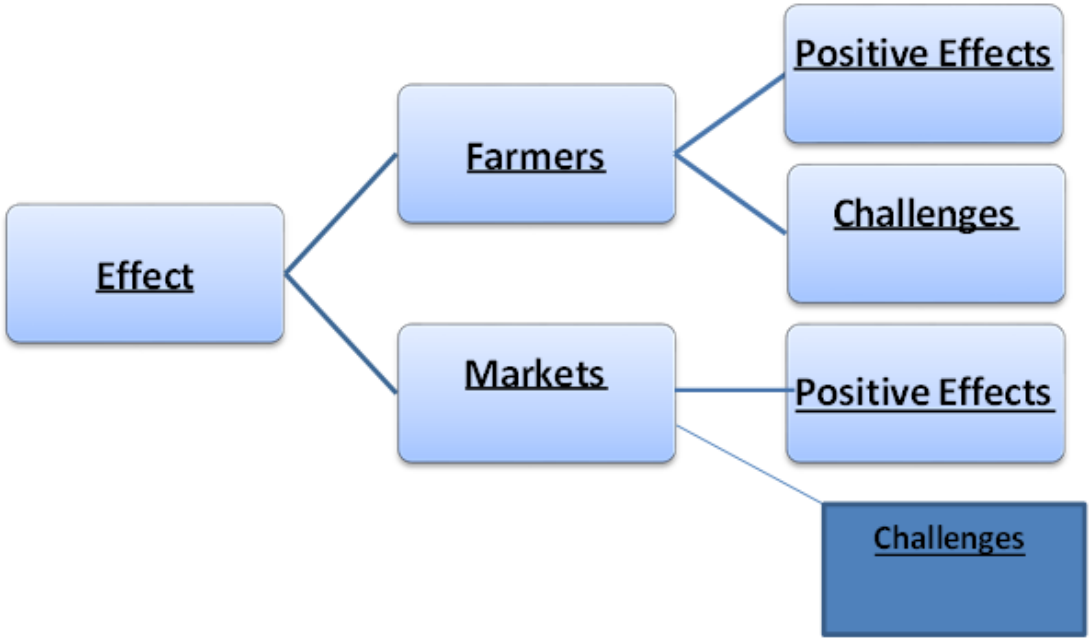
5. **Market Connections**: AI-driven systems streamline supply chains and remove reliance on middlemen by connecting farmers and buyers together directly.
6. **Financial Inclusion**: Through improved access to insurance, financing, and other financial services, AI-driven models enhance financial inclusion for small and marginal farmers.

EFFECT ON FARMERS



POSITIVE EFFECTS

1. **Enhanced Market Access**: Farmers could encourage their produce more effectively and at competitive costs by avoiding the restrictions of traditional markets and establishing personal relationships with customers through digital platforms.
2. **Better Productivity**: Through data-driven insights, smart farming methods and digital tools support farmers in increasing agricultural productivity and optimizing resources.
3. **Risk management**: Digital platforms reduce the risks associated with unpredictable occurrences through providing farmers access to vital information on weather, pest incidents, and financial protection.

CHALLENGES

1. **Digital Divide**: The technology and digital knowledge needed to utilize internet platforms are not readily available to an important percentage of marginal and small-scale farmers in rural regions.
2. **High Initial Investment**: Digital technology adoption often requires large financial spending, which is a problem for small and marginal farms.
3. **Cyber security Concerns**: Digital platform adoption introduces vulnerabilities that might expose farmers to financial losses, hacking of data, and online fraud.

IMPACT ON THE MARKETS

Positive Effects

1. **Effective Supply Chains**: Supply chains are made more effective by electronic systems, which also allow for real-time monitoring. These methods improve traceability and transparency from farm to consumer, reducing losses and delays.
2. **Cost Transparency**: Fairness in agricultural trade is increased and mistreatment is decreased when farmers and consumers are empowered to make educated decisions through real-time determination of prices and transparent pricing arrangements.
3. **Reduced Dependency on Middlemen**: Direct negotiations between farmers and purchasers are rendered possible by digital platforms, which lessen the need for commission agents and middlemen who frequently take benefit from farmers.

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CHALLENGES

1. **Un equal Market Access**: Online trading platforms give farmers access to a wider market, but the advantages are still not distributed fairly. Not all farmers can use these platforms to their full potential, particularly small and marginalized farms.
2. **Regulation Obstacles**: Farmers find it challenging to participate in online marketplaces due to regulatory issues that frequently impede the seamless adoption of e-trading in India and other nations.
3. **Infrastructure Gaps**: The adoption of e-trading is seriously impeded by insufficient facilities in rural areas, which keeps farmers from making full use of digital platforms..

CONCLUSIONS

Government efforts supporting digitalization are revolutionizing Indian agriculture. In order to ensure inclusive growth, issues like the digital divide and laws and regulations must be resolved, even though it provides improved market access, increased productivity, and financial security. To ensure the success of these programs, federal support for farmer education and rural digital infrastructure is essential.

REFERENCES

Sharma, S., & Singh, R. (2021). Digitalization in agricultural marketing: Transforming rural economies. *Journal of Agricultural Innovations*, 15(3), 45-62.

Jain, A., Singh, M., & Sharma, R. (2022). Harnessing big data in agricultural marketing: Challenges and opportunities. *Agricultural Economics and Technology*, 19(1), 25-40.

Kapoor, N., & Yadav, S. (2023). The role of artificial intelligence in agricultural marketing and market prediction. *International Journal of AI in Agriculture*, 7(2), 58-73.

Verma, S., & Rao, P. (2021). Government initiatives and the digital transformation of agriculture marketing in India. *Asian Journal of Agricultural Policy*, 12(3), 102-118.

Gupta, P., & Rathi, A. (2023). Overcoming barriers to digital adoption in agricultural marketing: A case for inclusive policies. *International Journal of Digital Agriculture*, 10(1), 15-30. 5.

Gulati, A., & Juneja, R. (2020). *Artificial intelligence in Indian agriculture: A policy perspective*

(Working Paper). Indian Council for Research on International Economic Relations (ICRIER).

Mittal, S., & Mehar, M. (2016). Socio-economic factors affecting adoption of modern information and communication technology by farmers in India: Analysis using multivariate probit model. *The Journal of Agricultural Education and Extension*, *22*(2), 199–212.

Patel, P., & Patel, D. (2021). Role of artificial intelligence in agriculture: Applications and challenges. *Journal of Emerging Technologies and Innovative Research*, *8*(4), 1234–1242.

Rao, G., & Sridhar, K. (2020). Artificial intelligence in agriculture: Opportunities, applications, and challenges. *Agricultural Reviews*, *41*(3), 232–240.