

Intelligent Agricultural Structure for Direct Engagement between Farmers and Consumers

Deepika S. Wankhed

Department of Information Technology, Shri S'ad Vidya Mandal Institute of Technology, Bharuch 392-001, Gujarat, India

Abstract: The Family Farmer project is an intelligent, web-based agricultural framework that aims to link farmers directly with consumers, effectively removing intermediaries. The agricultural system in India suffers from inefficiencies, where farmers receive minimal profits while consumers incur high costs for non-organic produce. This research advocates for an integrated digital platform that promotes transparent trading, fair pricing, and efficient logistics. The system allows farmers to register and display organic products, consumers to search and buy directly, and transporters and distributors to oversee logistics. Technologies including PHP, MySQL, HTML, CSS, JavaScript, and GPS integration are employed to facilitate secure and scalable operations. The system enhances sustainability, encourages digital agriculture, and connects rural producers with urban consumers [1][2][3]. Experimental analysis and earlier studies demonstrate that digital agricultural systems can boost farmer income and operational transparency by up to 30% [4][5].

Keywords: Smart Agriculture, Farmers, Consumers, Supply Chain, Organic Produce, Web-Based Platform, Digital Farming, E-Agriculture.

I. INTRODUCTION

Agriculture remains a primary source of livelihood in many developing nations, yet farmers often receive only a small fraction of the final market price due to the presence of intermediaries in the supply chain. Traditional agricultural marketing systems involve wholesalers, commission agents, distributors, and retailers, which increase product cost while reducing farmers' profit margins. Moreover, lack of transparency, price manipulation, delayed payments, and inefficient logistics further affect rural economic stability.

The emergence of digital technologies, Internet of Things (IoT), cloud computing, mobile applications, and data analytics offers opportunities to restructure agricultural markets. A Smart Agricultural Framework for Direct Farmer–Consumer Interaction aims to eliminate unnecessary intermediaries by enabling real-time communication, price transparency, demand forecasting, and secure digital transactions between farmers and consumers. This framework integrates smart farming technologies with an e-commerce platform to create a sustainable, transparent, and efficient agricultural ecosystem.

Agriculture is the backbone of India's economy, sustaining a large portion of the population [1]. Despite its importance, farmers face challenges such as exploitation by intermediaries,

unfair pricing, and lack of direct market access [2]. Consumers also experience higher costs without guarantees of freshness or quality. The Family Farmer project addresses these issues by providing a unified platform where farmers can sell produce directly to consumers [3]. This initiative promotes fair trade, organic farming, and transparency through a digital interface. The approach aligns with national goals for smart agriculture and digital transformation [4][5].

II. LITERATURE SURVEY

Various digital initiatives have emerged to enhance agricultural market efficiency. The National Agriculture Market (eNAM) facilitates transparent agricultural trading [1]. Farm2Table and similar models encourage direct farmer–consumer communication [2]. Studies published in the International Journal of Agricultural Systems emphasize that removing intermediaries increases profitability [3]. The FAO reports that digital agriculture, when combined with supply chain optimization, boosts farmer income by up to 30% [4]. Recent IEEE studies highlight how blockchain and IoT can ensure transparency in agricultural trade [6][7]. However, many existing systems focus on wholesale markets, excluding small-scale farmers [8]. The Family Farmer system bridges this gap by providing a localized, user-friendly, and sustainable solution

[9][10].

Several researchers have explored digital transformation in agriculture, particularly focusing on smart farming and agricultural e-commerce systems.

Early studies on e-agriculture platforms demonstrated that mobile-based market information systems significantly improved farmers' bargaining power by providing real-time market prices. However, these systems mainly offered price information without enabling direct transactions.

Research on IoT-based smart farming systems emphasized monitoring soil moisture, temperature, humidity, and crop health to optimize productivity. While these systems improved yield, they did not directly address post-harvest marketing challenges.

Blockchain-based agricultural supply chain models have been proposed to ensure traceability and transparency. These systems enhance trust between stakeholders but often require high computational resources and complex infrastructure.

Recent works introduced digital marketplaces for farmers, yet many platforms still rely on aggregators or are limited to regional operations. Additionally, issues such as digital literacy, infrastructure gaps, and data security remain concerns.

The proposed framework differentiates itself by integrating:

- Smart crop monitoring
- Direct digital marketplace
- Secure payment gateway
- AI-based demand forecasting
- Logistics coordination system

This holistic integration bridges the gap between production and consumption through a unified smart platform.

III. OBJECTIVES

The main objectives of this research are as follows:

1. Develop a web-based platform connecting farmers directly with consumers [11].
2. Eliminate intermediaries to ensure fair trade and transparent pricing [3].
3. Promote sustainable and organic farming practices [4].
4. Implement digital tracking and logistics management using

GPS [6].

5. Evaluate the system's impact on income and consumer satisfaction [9].

IV. ALGORITHM / WORKFLOW

The workflow ensures transparency and efficiency in the system's operation [12]:

Step 1: Farmer Registration – Farmer creates an account and submits verification details.

Step 2: Product Listing – Farmer lists products with pricing and availability.

Step 3: Consumer Registration – Consumers sign up and browse available items.

Step 4: Order Placement – Consumers select products and place orders.

Step 5: Payment Processing – Secure digital payment is processed.

Step 6: Transporter Allocation – System assigns transporters based on routes.

Step 7: Delivery Tracking – Consumers and farmers track orders in real-time.

Step 8: Feedback & Rating – Post-delivery feedback helps improve service.

V. THEORY AND CONCEPT

5.1 Theoretical Foundation

The framework is built upon three theoretical pillars:

(1) Disintermediation Theory

Disintermediation refers to removing intermediaries in the supply chain to improve efficiency and reduce costs. By enabling direct farmer-to-consumer transactions, value retention increases at the production level.

(2) Digital Platform Economy

Digital platforms facilitate two-sided markets by connecting producers and consumers. Network effects increase

platform value as user participation grows.

(3) Smart Agriculture Theory

Smart agriculture integrates IoT sensors, data analytics, and automation to enhance productivity, sustainability, and decision-making.

5.2 Conceptual Framework

The proposed system consists of five interconnected layers:

Sensing Layer – IoT sensors monitor soil conditions, crop growth, and environmental parameters.

Data Processing Layer – Cloud servers analyze collected data using AI algorithms.

Application Layer – Web/mobile interface for farmers and consumers.

Transaction Layer – Secure payment gateway and digital wallet integration.

Logistics Layer – Delivery scheduling and real-time tracking system.

This integrated architecture ensures seamless interaction from crop cultivation to final delivery.

VI. DETAILED EXPLANATION OF THE FRAMEWORK

6.1 Farmer Module

- Upload crop details (type, quantity, price).
- Receive AI-based price recommendations.
- Monitor consumer demand trends.
- Manage orders and dispatch details.
- IoT integration allows farmers to provide verified crop quality data, increasing consumer trust.

6.2 Consumer Module

- Browse available farm products.
- View real-time farm information.
- Compare prices transparently.
- Place orders and track delivery.
- Consumers gain access to fresh produce at lower costs.

VII. EXPECTED OUTCOMES

- The Family Farmer system aims to achieve multiple socio-economic benefits [13]:
- Improved farmer income through reduced dependency on middlemen.
- Direct consumer access to fresh and organic produce.
- Promotion of sustainable farming and rural digitization.
- Real-time data for better decision-making.
- Enhanced trust between farmers and consumers.

VIII. CHALLENGES AND LIMITATIONS

Despite its advantages, the platform faces several challenges [14]. Ensuring consistent product quality requires verification and certification. Rural areas often experience low internet connectivity, limiting adoption. Additionally, many farmers lack digital literacy, requiring training programs. Future versions can integrate AI-based route optimization and predictive analytics to improve logistics and scalability [15][16].

IX. CONCLUSION AND FUTURE WORK

The Family Farmer project demonstrates how digital transformation can reshape India's agricultural sector [17]. By providing a direct interface between farmers and consumers, it promotes fair pricing and transparency [18]. The system's modular design ensures scalability and adaptability. Pilot studies confirm improved farmer earnings and consumer satisfaction. Future work includes AI integration, multilingual support, and mobile application development for broader accessibility [19][20]. The Smart Agricultural Framework for Direct Farmer–Consumer Interaction represents a transformative approach to modern agriculture. By integrating IoT-based smart farming, AI-driven analytics, digital marketplace systems, and optimized logistics, the framework addresses critical inefficiencies in traditional agricultural supply chains. It enhances farmer profitability, improves consumer affordability, ensures transparency, and promotes environmental sustainability.

Future research may focus on blockchain integration, predictive crop disease modeling, and large-scale field deployment. With appropriate policy support and technological infrastructure, this framework can significantly contribute to achieving sustainable agricultural development and food security in both developing and developed economies.

REFERENCES

- [1] Government of India, National Agriculture Market (eNAM) Initiative, 2023.
- [2] International Journal of Agricultural Systems, 'Farm2Table: Direct Trade in Agriculture,' Vol. 4, No. 2, 2022.
- [3] FAO, 'Digital Agriculture Report,' Food and Agriculture Organization, 2021.
- [4] IEEE Xplore, 'Smart Agriculture using IoT and Cloud Computing,' 2023.
- [5] Ministry of Agriculture & Farmers Welfare, Government of India, 2023.
- [6] P. Jain and R. Sharma, 'AI-Driven Smart Farming Systems,' Int. J. of Computer Applications, Vol. 182, No. 21, 2021.
- [7] M. Gupta et al., 'Blockchain and IoT for Agricultural Traceability,' Springer Nature, 2022.
- [8] S. Dutta and A. Paul, 'Blockchain Applications in Agri Supply Chain,' IEEE Access, Vol. 10, 2022.
- [9] R. Kaur and M. Singh, 'Digital Agriculture in India: Challenges and Opportunities,' Elsevier, 2023.
- [10] T. Kumar, 'Role of E-Market Platforms in Rural Development,' IJITM, Vol. 15, No. 3, 2021.
- [11] OECD, 'Future of Digital Agriculture and Supply Chain Efficiency,' 2022.
- [12] N. Verma et al., 'Workflow Design for E-Market Systems,' IJCSIT, 2023.
- [13] A. Patel, 'Impact of E-Marketplaces on Farmer Income,' Int. J. of AgriTech, 2022.
- [14] P. Roy and D. Das, 'Barriers to ICT Adoption in Rural India,' Elsevier, 2021.
- [15] J. Brown, 'AI-Driven Logistics in Agriculture,' Springer, 2023.
- [16] IEEE Spectrum, 'Route Optimization for Smart Delivery Systems,' 2022.
- [17] C. Wang, 'Digital Platforms and Supply Chain Transparency,' IEEE Transactions on Systems, 2021.
- [18] M. Das and S. Ghosh, 'Smart Farming for Developing Nations,' IJEECS, 2022.
- [19] ResearchGate, 'AI and IoT Applications in E-Agriculture,' 2023.
- [20] World Bank Report, 'Digitization for Inclusive Rural Growth,' 2022.

Citation of this Article:

Deepika S. Wankhed. (2025). Intelligent Agricultural Structure for Direct Engagement between Farmers and Consumers. *Current Journal of Engineering and Science Research*. 2(10), 1-4. Article DOI: <https://doi.org/10.47001/CJESR/2025.210001>

*** End of the Article ***