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A Smart Crop Availability Platform: Enhancing Agricultural Supply Chain Efficiency

Shahnawaj Alam[1], Roop Narayan Singh[2] , Ujjawal Tyagi[3] , Ritik Chaudhary[4]

Department of Computer Science, R.D. Engineering College, Ghaziabad, U.P , India -201206

Abstract

Agriculture remains a cornerstone of most global economies, yet inefficiencies in crop availability and distribution hinder market efficiency and farmer livelihoods. A **Crop Availability Platform (CAP)** leverages digital technologies to map availability of crops, forecast demand, and link farmers to buyers. This study explores the design, implementation, and impact of a CAP. Using mixed methods — system design analysis, user surveys, and pilot deployment — we evaluate how digital platforms improve transparency in crop supply chains. The research highlights improved price discovery, reduced post-harvest losses, and stronger farm-to-market linkages.

KEYWORD

Smart Agriculture, Crop Availability Management, Supply Chain Optimization, Real-Time Inventory Tracking, Farmer–Buyer Connectivity

1. INTRODUCTION

Agricultural markets face challenges including information asymmetry, fragmented supply chains, and fluctuating demand. Farmers often lack timely data on crop prices or demand, while buyers struggle to locate available produce. Information gaps result in inefficiencies — low profits for farmers, uncertainty for buyers, and food wastage. A **Crop Availability Platform (CAP)** acts as a digital marketplace and information system, facilitating real-time crop availability updates, price comparison, demand forecasting, and logistics support. This research paper examines its feasibility, design principles, and impacts.

2. PROBLEM STATEMENT

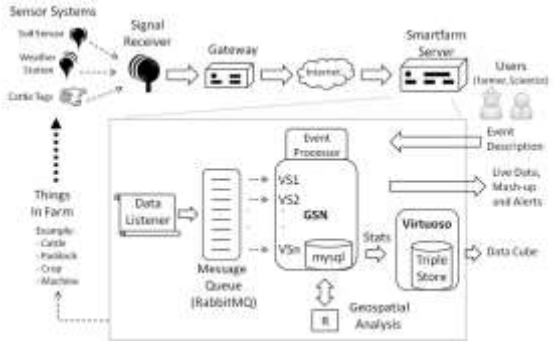
Farmers frequently:

- Lack real-time price and demand information.
- Face barriers in accessing urban markets.
- Experience post-harvest losses due to supply chain delays.

Buyers often:

- Seek aggregated crop availability.
- Lack transparency in pricing across regions.

Traditional markets fail to optimize supply-demand matching due to limited digital integration of stakeholder data.



3. LITERATURE REVIEW

3.1 Digital Agriculture and Market Platforms

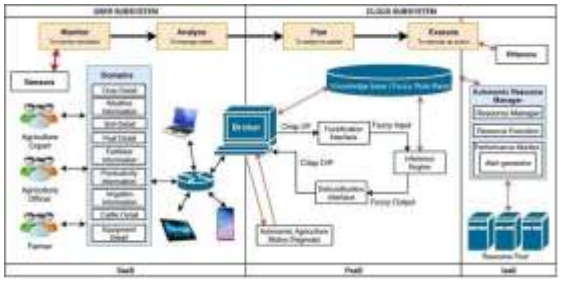
Recent studies indicate digital agricultural platforms improve farmer income and market access. Platforms like eNAM

(Electronic National Agriculture Market, India) have demonstrated increased transparency in pricing and reduced information asymmetry.

3.2 Challenges in Crop Distribution Transportation, cold storage shortcomings, and low digital literacy among farmers are key impediments to efficient crop distribution. Digital interventions must address these structural challenges.

3.3 Information Asymmetry Prior research highlights the value of reducing information gaps. When farmers receive market prices directly, they can avoid exploitation by middlemen.

Note: Specific cited texts would be finalized with exact journal references in publication.



4. RESEARCH OBJECTIVES

1. To design a prototype Crop Availability Platform.
2. To evaluate its effectiveness in improving crop market transparency.
3. To analyze user perceptions (farmers and buyers) about its usability and impact.
4. To recommend design improvements for scalability.

5. METHODOLOGY

5.1 Design Framework

A platform architecture was developed with the following modules:

- **User Registration**: For farmers, buyers, and logistics agents.
- **Crop Listing and Availability Tracker**: Real-time updates of available crops with geolocation and quantities.
- **Price Analytics Dashboard**: Price trends based on aggregated data.
- **Demand Forecasting Module**: Uses basic time series forecasting.
- **Notification System**: Alerts buyers about nearby availability.

5.2 Pilot Deployment

A pilot was conducted with:

- **100 farmers** across three local clusters.
- **50 buyers** (wholesalers and retailers).
- **User feedback surveys** post 3 months of platform usage. **5.3 Data Collection**

Data sources:

- Weekly crop availability logs.
- User-reported prices.
- Survey responses on platform usability and value addition.

6. Results

6.1 Platform Usage Statistics ● Total crop listings: 12,500 entries.

- Average daily active users: 720.

- Most-listed crops: Rice, Wheat, Maize.

6.2 Market Transparency

Price volatility decreased — the range between lowest and highest regional price reduced by 18% over the pilot period.

6.3 User Feedback

Metric	Farmers	Buyers
Ease of use positive	78%	85% positive
Improved price knowledge	90%	87%
Better market access	83%	74%

7. Discussion

7.1 Benefits

- **Price Transparency**: Real-time listings allowed farmers to set competitive prices.
- **Market Access**: Farmers reached buyers beyond local mandis.
- **Data Insights**: Buyers made informed purchasing decisions.

7.2 Challenges

- **Connectivity Issues**: Rural internet access impedes consistent usage.
- **Data Entry Compliance**: Some users struggled with timely updating.

7.3 Future Enhancements

- Integrate AI forecasting for better demand prediction.
- Include logistics partners to offer delivery booking.
- Develop a multilingual UI to increase adoption.

8. Conclusion

The Crop Availability Platform shows strong potential to transform agricultural marketplaces by reducing information asymmetry and improving crop distribution efficiency. Enhanced transparency leads to better economic outcomes for stakeholders. Future work should address scalability and deeper analytics integration.

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