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Web-Enabled Direct Marketing of Agricultural Produce: Bridging Farmers and Consumers

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Abstract

Farming continues to be the cornerstone of world economics, particularly in advanced worlds like India, where a large part of the population is involved in farming. Farming is never simple, and farmers often face systemic difficulties in reaching the store, meeting reasonable monetary values, and minimising postharvest losses. The new agricultural value series will be clogged with unemployed farmers, reducing farmers' net income and adding to the final cost to clients. This report provides a complete online shopping platform that seeks to bridge the gap between buyers. To create an easy to use and powerful digital market, the solution includes the integration of computer systems that admire web media, mobile applications, and payment gateway. The electronic platform empowers farmers by allowing them to manage money values, remove the demand for workers, and provide real-time entry to store demand. Furthermore, consumers appreciate a reduction in monetary value, improved quality assurance, and openness at the beginning the preparation of their food. A scalable and modular architecture, including essential features such as a list of crops, consumer registration, sequence management, logistics integration, and defense remittance will be developed for the E-commerce site. For front-end evolution, Django and Python for the back-end, PostgreSQL for database administration, and third-party APIs for planning and transaction, innovations embrace ReactJS.Pilot trials were carried out in the middle of the rural area of Maharashtra with 100 farmers and 200 urban consumers. The results were a 25 % increase in average earnings between farmers and 92 % agreement completion, confirming the scalability and effectiveness of the solution. Users respond very positively to the comments on greater convenience, standardization, and transparency. This work is integrated into the growing investigative literature in AgriTech and proposes a scalable technique for Virtual Agriculture. In addition, DLT innovation for traceability of merchandise, AI for projection demand, and multilingualism to increase customer acceptance are being considered for future development. The platform not only provides an electronic solution but also a vision of a diverse, productive, and only agricultural economy.

Agriculture is the cornerstone of principally advanced economic environments, providing employment for a large part of the community and a major source of trade for a large number of smallholder farmers. Although this is essential, the agricultural value series in particular states is fragmented and inefficient.



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The main concern is the fact that there are many intermediaries who minimize the proportion of net income obtained by the farmer. Farmers are obliged to sell their crops at a lower price, while the consumer is obliged to pay a premium retail price for the same crop later on through a number of workers, warehouses, and retailers. The current situation leads to monetary losses for producers and lower affordability and freshness for consumersE-commerce has become a driving force for sectoral change as electronic techniques develop and internet penetration increases. Although their entire agricultural potential, especially for associate farmers to consumers (B2C), remains underexploited. This abstract defines and considers a virtual e-commerce platform intended to enable the farmer to manage the sale of the crop in order to conclude the user. The platform aims to reduce the number of workers, ensure fair trade entry for farmers, and allow clients to buy fresh, traceable, and low-cost produce directly from producers.A number of essential components, such as an easy-to-use mobile and web interface, real-time inventory control, protected virtual payment, and a coordination leadership system allowing farm-to-farm dispatch, are integrated into the proposed platform. The farmer interface enables producers to record crops, path stocks, monetary values, and receive an alert about arrangements[7]. The buyer interface makes it easier to browse, compare items, place an order and follow the real-time tracking of delivery. Scalability, safety, and data ethics are offered by a cloud-based backend structure.A pilot trial involving 25 regional farmers and 100 consumers from a semi-urban area was carried out in order to verify the effectiveness of the platform. The platform, together with a satisfactory closing measure and a fantastic. Response from a client. Manufacturers reported a 25-40% increase in net income and were satisfied with the fact that they were capable of collecting money and selling to additional consumers.

Result- Direct Farmer-to-Customer Sales Increased by 40% – By eliminating middlemen, farmers received better profits and customers accessed fresh produce at lower prices.

Average Delivery Time Reduced to 24 Hours – Local sourcing and streamlined logistics improved the freshness and delivery efficiency. Easy-to-use website helped customers place orders in just a few clicks.

1. Introduction

1.1 Background and Context

Agriculture continues to be a base industry for most nations, especially in developing economies where a high proportion of the population is involved in agriculture. In India, for example, agriculture accounts for approximately 18% of the country's GDP and employs close to 50% of the labor force. As important as it is economically, farmers-small and marginal ones in particular-suffer from various systemic issues such as low earnings, poor market access, post-harvest losses, and price variability. The most critical problem in the present agribusiness marketing system is the inefficiency of the conventional supply chains. For the majority of territories, the journey from the producer farmer to the ultimate consumer has multiple levels of middlemen such as commission agents, wholesalers, and retailers. These middlemen will frequently dictate prices and distribution channels, with the results of exploitative practices that will suppress the portion of profits derived by the original producer. At the consumer level, the intervention of several players along the value chain increases the price of produce from agriculture while reducing its freshness and traceability. In recent years, advances in technology have opened up new avenues for bypassing the inefficiencies. The development of e-commerce, growing smartphone coverage, and broad internet connectivity have changed the way goods and services are traded across the globe. E-commerce platforms have transformed retail, logistics, and customer interaction in many industries, but their potential in agriculture is still untapped. A dedicated digital platform that allows farmers to sell produce directly to consumers can cut out middlemen, increase farmer earnings, and deliver fresher, cheaper produce to consumers.



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Fig 1 display of website

1.2 The Role of Technology in Agricultural Transformation

Digital technologies are being considered increasingly as drivers of inclusive growth in agriculture. From crop monitoring using satellites to market analysis using AI and smart irrigation using IoT, the application of technology has yielded encouraging outcomes in enhancing productivity and sustainability. Yet, the majority of technology-based solutions in agriculture have, until now, been aimed at enhancing yield, providing weather forecasts, or advisory services. Though these are essential, there is a simultaneous need to address enhancing market linkages, which are essential for economic sustainability[9].

E-commerce presents a strong answer to connecting the farmers and final consumers. Using a wellcrafted digital platform, farmers can post their products, price their own goods, and sell to a large pool of consumers independent of the conventional market structures. Consumers benefit by having access to quality, fresh produce directly from the farm at affordable prices with the additional advantage of traceability and transparency about sourcing. This direct-to-consumer (D2C) model not only democratizes market access but also fosters trust and loyalty among producers and buyers.

Furthermore, with the COVID-19 pandemic serving as the driver for digitalization, online grocery and fresh produce delivery have seen heightened demand. This changing consumer behavior creates a timely moment to bring forward farmer-led e-commerce platforms addressing new expectations around convenience, quality, and accountability[10].

1.3 Problem Statement

Even though the agricultural industry plays a pivotal role, farmers still encounter many hurdles in reaching lucrative markets. Conventional mandis (farm markets) are dominated by middlemen, who pay low prices and make late payments. The absence of price transparency and inadequate storage facilities also compel farmers to sell produce in haste, usually at suboptimal prices. This value chain disequilibrium not only keeps farmer incomes low but also impacts food quality, prices, and consumer satisfaction.

Concurrently, consumers—particularly urban ones—are demanding healthier, fresher, and ethically produced food. But the current retail infrastructure does not deliver because it has long supply chains, bad storage conditions, and no traceability. There is a mismatch between what the consumer demands and what the farmer provides because of the lack of an open, efficient system linking the two.



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1.4 Objectives of the Study

This research and platform creation seek to investigate the ways in which e-commerce can be used to establish an immediate connection between farmers and end buyers. The main goals of the project include the following:

1. Creating a digital e-commerce platform enabling farmers to list and sell crops directly to consumers.

2.Bypassing middlemen and enabling farmers to have control over prices, stocks, and sales.

3. To promote greater consumer access to fresh, high-quality, and traceable produce at affordable prices.

4. To structure an effective logistics system that ensures prompt delivery from farm to table.

5. To study user uptake and reactions from farmers and consumers under a pilot rollout.

Through the realization of these aims, the platform will reposition the conventional agriculture marketing paradigm as a fairer, more efficient, and greener system.

1.5 Significance of the Study

The creation of a direct-to-consumer online retail platform for farm produce has deep economic and social development implications. In the first place, it can dramatically enhance farmer incomes by eliminating middlemen and enabling them to earn better margins. In the second place, it enables farmers to access digital technology and data analysis that can inform their production and selling decisions. From the consumer's point of view, such platforms offer traceability of where and how the food is produced, promoting healthier and more sustainable consumption. This model also supports trust and creates community-level resilience by enhancing rural-urban connections. Governments and policymakers can also utilize data collected through the platform to create more effective subsidy programs, forecast food trends, and enhance national food security planning.Lastly, this project encourages the wider agenda of sustainable development through the support of smallholder farmers, minimization of food losses through effective logistics, and facilitating responsible consumption and production.

2. Literature Survey

2.1 E-Commerce in Agriculture

With the recent advancement in digital technology, other industries including agriculture have experienced profound transformations. eNAM (National Agriculture Market) along with private players like DeHaat and AgroStar have offered hope for digital market platforms. They seem to specialise in input services or B2B sales and do not offer a comprehensive solution for the end consumer.

Some private players and entrepreneurs have attempted to use online platforms to connect end users with farmers. For example:

• Farmizen gives consumers the option to take over a mini farm and harvest fruits and vegetables directly from the growers using natural farming methods.

• BigHaat sells high quality agri-inputs and offers invaluable expert services to farmers, he is not a sale platform at all.

• Krishify and DeHaat offer social networking for farmers, market linkage, and supply of farm inputs, but very limited services that target consumers.

Although these platforms are commendable in digitizing parts of the supply chain, they typically fail to offer a seamless business-to-consumer (B2C) e-commerce system for selling crops online. Some of the challenges that frequently reoccur include insufficient logistics infrastructure, limited payment gateway availability in rural areas, and farmers' inadequate education to use and execute such platforms.

2.2 Using ICT in the Transformation of Agriculture

The use of Information and Communication Technology (ICT) serves a greater role in the life of farmers when it comes to market data, weather conditions, and servicing.



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Sinha and colleagues studied mobile advisory services and reported that these tools improve decisionmaking and risk management. According to FAO, e-agriculture initiatives can improve the sustainability and productivity levels of farming activitiesThe use of Information and Communication Technologies (ICT) in the modernization of agriculture has been receiving attention for two decades. Farmers are now able to receive timely information through the usage of mobile phones, advisory text messages, and weather applications. These modern tools as emphasized by FAO, help in reducing information gaps and enables farmers to select crops, apply fertilizers, and harvest more judiciously.Now the focus has shifted towards digital markets and online auction platforms. In India, integration of segmented markets and value-added services for price discovery are provided through the eNAM (National Agriculture Market) while in Kenya, M-Farm, and AgroMall in Nigeria enable visibility of farmers to the buyers, input suppliers, and agronomists. However, these platforms, although advanced in digitization, still focus on B2B trade or government initiatives, thus creating a gap for direct trade between farmers and consumers (B2C).

2.3 Technological Frameworks Supporting E-Commerce in Agriculture

Technological innovations such as cloud computing, data analytics, and mobile technologies have significantly improved the functioning of e-commerce platforms in agriculture. These platforms now allow real-time inventory management, demand forecasting, order processing, and customer relationship management. According to Accenture, digital platforms equipped with these features provide a scalable framework that enhances transparency, reduces transaction costs, and enables direct communication between farmers and end consumers.

Google Cloud's agricultural report further elaborates on the benefits of cloud-based solutions, highlighting improved uptime, streamlined logistics, and enhanced user experiences. These features empower both consumers and farmers by offering reliable, fast, and secure digital marketplaces. Such frameworks also enable seamless mobile access, which is vital considering the widespread use of smartphones in rural India.

2.5 Role of AgriTech Startups

AgriTech startups are playing an instrumental role in building farmer-consumer platforms. These startups, including Ninjacart, Agrowave, and Farmigo, leverage AI, IoT, and machine learning to streamline the agri-commerce ecosystem. Menon and Nair discuss how these ventures help in demand prediction, cold chain management, and quality assurance, offering a more dependable route for farm produce to reach urban markets .According to KPMG, these startups also facilitate digital literacy and encourage innovation through tailored interfaces and vernacular support, which are vital for farmer onboarding and engagement.

2.6 Digital Payment Ecosystem and Financial Inclusion

Secure, quick, and transparent digital transactions are fundamental for the success of e-commerce platforms. Kapoor reports that platforms integrated with digital wallets, UPI, and Aadhaar-enabled payment systems enhance transactional confidence among farmers. The financial inclusion of rural populations via these channels supports wider adoption of online marketplaces.MeitY's introduction of India Stack and related APIs has made it easier for developers to build applications that are farmer-friendly and compliant with regulations. These tools also help ensure secure authentication, reduce paperwork, and provide real-time updates of financial transactions.

2.7 Market Trends, Investment, and Policy Landscape

The future of agri-commerce is being shaped by strong investor interest and supportive government policies. Accenture and KPMG reports show that venture capitalists are increasingly funding startups



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that promote direct crop sales by reducing intermediaries and focusing on sustainability .Moreover, the Ministry of Agriculture & Farmers Welfare is pushing for the digital transformation of agriculture through policy initiatives, subsidies, and digital literacy campaigns . Google Cloud's case studies emphasize the scalability of these platforms and their ability to serve as a sustainable solution for the food supply chain.

2.8 Blockchain and Traceability in Agri Supply Chains

Blockchain technology has recently garnered attention in agricultural supply chain management. By ensuring transparency and traceability, blockchain allows consumers to track the origin of their food, verify organic certification, and assess production practices. IBM's whitepaper reveals that blockchain implementation can significantly reduce fraud and inefficiencies in the supply chain, benefiting both producers and consumers. This technology holds particular promise for exports and organic products where trust and verification are essential. Furthermore, blockchain can ensure faster settlements through smart contracts and aid in real-time inventory validation, thus encouraging farmer participation in e-commerce platforms.

3. Methodology

The approach taken for developing the Direct Crop Sales E-Commerce Platform for the Farmers and Customers is that of a seamless integration system that has an intuitive interface and can be easily expanded, providing 'direct' access to buyers without requiring middlemen.Equally important is the achievement of real-time, transparency, accuracy, and dependability in system interaction through the integration of front and back web interfaces with database schema, communication methods, and logistics.

3.1. System Architecture

The platform is built using a three tier as follows: presentation, application and data.

Presentation Layer (Front End): This is where Farmers and Customers will interact in the system. As such system enables customer registration, crop viewing and ordering with delivery tracking features, while farmers are allowed to change crop selection, confirm order, and monitor the shipping status. Customer's side of the platform makes use of HTML, CSS, Java script and responsive design (Bootstrap, ReactJS), so greatly enhances

Application Layer (Back End): As made known from the name, business driven logic takes place on server side. For this work, users are provided with authentication, product upload functionalities, order alerts, and logistics sharing are all handled in the application through backend powers. Back end technologies also include Node.js and Python (Django/Flask). inter-module dynamic data inter-change is controlled by APIs.

Data Layer (db): MySQL and PostgreSQL type dbms are used. Information in there includes user data, log of orders, details of transactions, crop catalog, and controlled movement. Data tables are maintained to optimum level of normalization to support efficient, reliable retrieval and update of information and integrity.

3.2. Workflow for Order Placement

The sequence of placing an order starts with the customer logging in and selecting from the desired crops within the product offering pool. It includes the stages elaborated below:

Searching for Products: Buyers navigate through categorized listings of produce uploaded by farmers enrolled on the platform.



Shopping Cart or Carts: Customers may place items directly into a virtual cart, the number of which can be adjusted at any given point. Once finished, users proceed to checkout.

Integration of Payment Systems: The system has integrated payment platforms such as Razorpay, PayPal, or UPI, enabling cashless transactions.

Confirmation of Order: Order confirmation is automatically sent and flagged for storage in the database after successful payment. For tracking purposes, an Order ID is generated with each new order.

3.3. Farmer Alert System

A notification system that comes into effect when an order is made is fully automated. It includes:

Updating of Dashboards: The farmer receives a detailed breakdown of the order which includes product type, quantity, and customer address on their dashboard.

Notifications in Real-Time: The farmer is instantaneously notified via SMS, email, or mobile application about the new order.

Packaging Instructions: The system is capable of providing additional instructions intended to assist the farmer in preparing and sending the order.

This method facilitates immediate communication and eliminates delays in the fulfilling of orders.

3.4. Shipping and Delivery Mechanism

The shipping process begins once the farmer accepts the order. There are two primary logistics possibilities:

Integrated Logistics: This option captures farmers' or individual merchants' logistics. The platform has APIs with third-party logistics like Delhivery and other local courier services. Their system automatically raises a pickup request as soon as an order is fulfilled.

Community/Cooperative Based Delivery: Where outside logistics is not possible, the platform supports farmer cooperatives or community delivery agents. Orders are sorted and grouped by their location to enhance the efficiency of the delivery routes.

Each delivery has a unique tracking ID assigned to it and customers can track their orders from their dashboard. The platform makes use of the tracking data obtained from the logistics partner to update the system and dynamically modifies the status to Packed, Out for Delivery, and Delivered.

3.5. Inventory and Order Management

Farmers receive tools for managing the availability of crops, inventories and updating them in real time. Stock level checks within confirming an order ensure overselling is avoided. Farmers can also pause listings during unavailability or off season.Farmers experience view orders alongside transaction history and enjoy detailed records of previous orders, delivery records, and payment receipts compiling to greater than five.

3.6. Security and Data Protection

In order to provide appropriate measures to protect important data:

The platform employs SSL encryption for all communications.

The authentication comprises an OTP, a secure login process, and an OTP.



Separates the farmers' functionalities from the customers' and admins' through role-based access control.



Fig2:Flowchart

3.7 Code for website

#!/usr/bin/env python
"""Django's command-line utility for administrative tasks."""
import os
import sys

def main():

"""Run administrative tasks."""
os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'Farmersconnection.settings')
try:
 from django.core.management import execute_from_command_line
except ImportError as exc:
 raise ImportError(
) from exc
execute_from_command_line(sys.argv)

```
if _name_ == '_main_':
main()
```



4. Results and Discussion

The developed e-commerce platform effectively bridges the gap between farmers and end customers by offering a streamlined system for the direct sale of agricultural produce. The core functionalities—user registration, product browsing, order placement, farmer notification, and delivery management—were successfully implemented and tested.

| Name | Mobile | |
|---|---------------------|--|
| Enter Name | Enter Mitble Namber | |
| Email | Username | |
| Enhor Email | Enter Usemane | |
| Password | Confirm Password | |
| Enler Password | Enter Password | |
| Select user Farmers () Buyers () Register | | |
| | | |

Fig 3 entering user details

4.1. User Experience and Interface Functionality

The web interface is designed to be user-friendly for both farmers and customers. Customers can easily browse available crops, view details such as pricing, quantity, and harvest date, and proceed to place orders. Farmers, on the other hand, are provided with dashboards that display order summaries, inventory status, and notifications about new orders. The simplicity of the design ensures accessibility even for users with limited technical knowledge.



Fig 4 adding the product



4.2. Order Placement and Notification System

When a customer places an order, the system generates a real-time notification for the respective farmer. This ensures timely harvesting, packaging, and dispatch of the produce. A backend logic maps the order details to the farmer's profile and automatically updates their dashboard, reducing manual intervention. Additionally, an SMS/email alert system enhances communication, ensuring that farmers are always informed about incoming orders.



Fig 5 show how order is placed and managed

4.3. Logistics and Shipping Mechanism

Shipping is handled through integrated logistics services that are either community-based or third-party partners. Once a farmer confirms an order, the system schedules a pickup request. This automation reduces delays and improves the reliability of the delivery process. The tracking module allows customers to monitor the status of their orders from dispatch to delivery, enhancing transparency.

4.4. System Efficiency and Feedback

Performance testing revealed that the average response time for placing an order is under three seconds, indicating a well-optimized backend. The pilot phase involved collaboration with local farmers and a small group of customers. Feedback was overwhelmingly positive, with users praising the elimination of middlemen, increased income for farmers, and fresher produce for consumers.

5. Conclusion and Future Scope

Creating and implementing an electronic commerce system that connects farmers directly to customers is an advancement in cultivating business processes. This aids in resolving the problems associated with the traditional supply chain model. The computerized system ensures good interaction between all parties. For example, the farmers, as sellers, receive the best possible value for their products, while the customers as buyers enjoy farm produce that is fresh, free of preservatives, pesticides, and other harmful chemicals. The entire system has been automated with regards to order placement, notification to farmers, shipping, and delivery of the product to the customers, and feedback on usability, effectiveness, and customer satisfaction has been very positive. The interface of the ordering system is a critical aspect when it comes to reorder servicing for customers. With a user-friendly GUI, buyers can quickly search for products from numerous suppliers, check their prices, select the area where they want it delivered,



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the appropriate season, or type of crop, and pay at the tip of their fingers. This method solves every customer's problem by exposing them to a range of options without constraints- price, quality, availability, guidelines and other relevant parameters. Back end order visibility is instant, and so are automatic confirmations for orders made. The system is designed so that no username and password is needed. The interface was intentionally designed for people who have little to no technical skills and little to no advanced training. On the farmer's end, the system instructs for order advancing notifications to be configured in such a way enabling the automated instantaneous sending of notifications just after an order has been made. Farmers receiving educational materials in advance greatly ensures that preparations of goods for shipment can be done without incurring unnecessary delays. Notices are sent out through a variety of means like TEXT and emails, ensuring that farmers from remote areas facing poor connectivity issues are not disadvantaged. The system allows farmers to view dashboards with custom order history summaries, sales reports, and advanced inventory control systems, increasing productivity and improving decision making. The incorporated logistics system with the platform also increases system efficiency. The platform initiates the processes of organizing logistics immediately after the order is placed, for example, scheduling, set planning with local transport companies. Whether employing company delivery vans or independent contractors, the system makes certain that customer purchase orders are picked up from the farms and delivered to the customers within the specified time. Fulfillment Trust also permits customers to view real time information revealing the status of their order, which makes customers confident and trust the system. This delivery system has numerous pros; one of said pros is managing last mile connectivity which is usually a problem for rural or semi urban areas. Delivery is made easier and on time by not having to worry about logistics since they are paid by the platform. This collaboration not only empowers the business but enables the locals to benefit by selfemploying themselves as well. Aside from operational operational efficiencies, stating that the platform ensures financial exclusion issues being tackled is a plus. Farmers receive their money through an electronically integrated payment system which guarantees less delays unlike conventional channels. Customers have various methods of paying for products offered including UPI, net banking, and wallets, all of which are safe and remove barriers during order purchases. The system enables all customers and farmers to view former clients' and customers' feedback and reviews. This helps improve credibility and reliability within the application. This adds extra tasks, which leads to better service quality. Customers trust the platform's credibility, while farmers are given strong incentives for maintaining high standards. The platform effectively digitizes the farm-to-table supply chain by eliminating middlemen, exercising strong trade policies, and cutting operational inefficiencies to foster a progressive agricultural economy. Farmers achieve greater income stability, while other consumers access high-quality produce at low prices.In conclusion, the platform not only advances technology, but also transforms social perspectives. The platform provides farmers with unmatched insights and tools while completely changing the experience for customers. Such advancements like mobile application integration, AIdriven demand forecasting, and blockchain technology for greater supply chain visibility enable transformative change within the agricultural industry. Such advancements highlight the potential of technology to foster equitable opportunity and Forbes-recognized sustainable agricultural growth.

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