



AgroCycle: A Web-Based Platform Connecting Farmers and Buyers for Agricultural Products and Waste Exchange

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Abstract- AgroCycle is a web-based agricultural marketplace designed to connect farmers and buyers through a single, user-friendly platform for agricultural products and reusable agricultural waste. Farmers often face limitations in direct market access, while crop residues and agricultural by-products may remain underutilized even though they can have value for composting, biomass, animal feed, recycling and other reuse applications. The proposed system addresses these issues by integrating conventional agricultural-product trading and agricultural-waste exchange within one centralized digital platform. The system provides separate modules for Farmer, Buyer and Admin users. Farmers can register, manage their profiles, create and maintain product and waste listings, receive orders and update order status. Buyers can browse the marketplace, search and filter listings, view product or waste details, maintain a wishlist and cart, place Cash on Delivery orders, track order progress and submit feedback after delivery. Administrators can manage users, moderate listings, review orders, handle contact requests and feedback, and monitor dashboard analytics. The application is developed using HTML5, CSS3, Bootstrap 5 and JavaScript for the frontend, PHP 8+ with PDO for backend processing, and MySQL for data storage. The main objective of AgroCycle is to provide an organized digital marketplace that improves farmer-buyer connectivity while also giving reusable agricultural waste greater visibility for productive use. Security controls such as password hashing, session-based authentication, role authorization, CSRF protection, PDO prepared statements, input validation, output escaping, ownership checks and secure image-upload validation are included in the implementation. Functional and responsive testing demonstrated the complete Farmer-Buyer-Admin workflow. The platform can be extended with online payments, logistics



integration, GPS-assisted tracking, cloud deployment, multilingual support, mobile applications and AI-assisted agricultural analytics.

Keywords- Agricultural Marketplace, Farmer-Buyer Platform, Agricultural Waste, Circular Economy, Sustainable Agriculture, PHP, MySQL, E-Commerce.

I. Introduction

Agriculture is a major economic activity in India and depends on efficient production, distribution and market access. Farmers need reliable ways to present their produce to potential buyers, while buyers require organized information about availability, quantity, price and seller details. Digital platforms can simplify this interaction by reducing information gaps and providing searchable, structured market information.

Along with food and commercial crops, agricultural activity generates residues such as rice husk, sugarcane bagasse, coconut shells, straw and other organic by-products. Depending on their condition and local demand, these materials can be reused for composting, biomass, animal-feed applications, mulching, recycling or other value-recovery processes. When such materials are not connected to potential users, an opportunity for additional farmer income and resource reuse may be lost.

AgroCycle was therefore developed as a web-based marketplace that brings agricultural products and reusable agricultural waste into the same system. Instead of treating waste exchange as an unrelated feature, the platform gives it a structured listing, discovery and transaction workflow similar to agricultural products. The system is intended as an academic prototype that demonstrates how these two market activities can be integrated using common web technologies.

The main contributions of AgroCycle are:

- Integration of agricultural-product commerce and reusable agricultural-waste exchange in one platform.
- Separate role-based workflows for Farmer, Buyer and Admin users.



- Search, filtering, listing details, wishlist and cart functionality for marketplace discovery.
- Cash on Delivery checkout, stock handling and multi-stage order tracking.
- Farmer-side order processing with controlled status transitions.
- Feedback, notifications, contact management and administrative moderation.
- Security-oriented PHP/MySQL implementation with responsive user interfaces.

II. Related Work

1. Digital Agricultural Marketing

Digital agricultural markets are increasingly studied as mechanisms for improving access to market information and organized trading. Raghavendra et al. examined awareness and determinants of farmer participation in e-marketing of agricultural commodities in India, highlighting the importance of awareness and adoption factors [3]. Yadav et al. studied the utilization of e-NAM facilities by farmers in Telangana, providing regionally relevant evidence on how digital agricultural-market services are used [4]. Manogna further examined small-farmer access to agricultural markets in South India and reported the importance of awareness, digital literacy and smartphone or application knowledge in online-market participation [5].

These studies support the use of accessible digital interfaces for agricultural-market participation. However, their primary focus is agricultural commodities and existing market systems rather than an integrated product-and-waste exchange application.

2. Agricultural Waste and Circular Economy

Agricultural-waste management literature shows that crop residues can have environmental and economic value when appropriate reuse pathways are available. Rao et al. reviewed agricultural-waste production, onsite management and circular-economy opportunities, including value-recovery approaches for crop residues [6]. Bhatia and Sindhu discussed sustainable management of organic agricultural waste and its role in nutrient availability, pollution mitigation and crop production [7]. Research on biogas-based circular-economy models also demonstrates that agricultural residues can serve as inputs for useful downstream applications [8].



This body of work provides the sustainability basis for AgroCycle's waste marketplace: a residue that is unwanted by one farmer may still be useful to another buyer or processor. A digital discovery mechanism can make such reusable materials more visible.

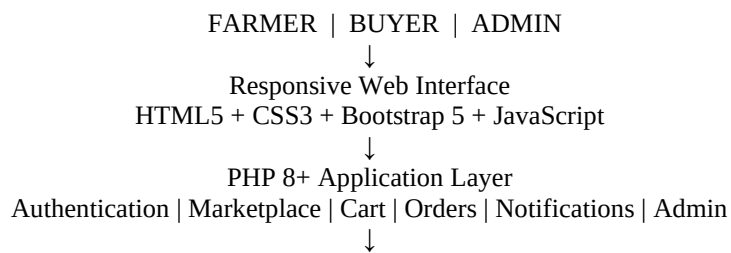
3. Research Gap

The literature establishes the usefulness of digital agricultural markets and, separately, the importance of agricultural-waste valorization. These themes are commonly studied as distinct problems. AgroCycle addresses an integration and system-design gap by providing one role-based web platform in which farmers can list conventional agricultural products as well as reusable agricultural waste, while buyers can discover, order and track both categories. The contribution is the implementation and evaluation of this integrated workflow rather than a claim that no comparable service exists anywhere.

III. Methodology

1. System Design

The proposed system follows a layered client-server architecture. The presentation layer is responsible for responsive navigation, forms, marketplace cards, tables, dashboards and order trackers. The application layer implements authentication, marketplace queries, CRUD operations, cart processing, checkout, order-status control, notifications, feedback and administration. The data layer stores users, listings, orders, payments and supporting records in MySQL.



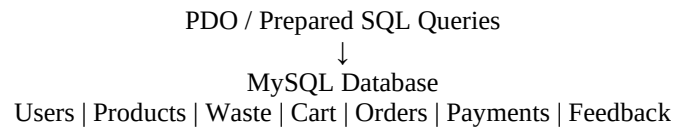


Fig. 1. Logical architecture of AgroCycle.

2. System Workflow

A farmer first registers or logs in and publishes agricultural products or reusable-waste listings. A buyer browses the marketplace, searches or filters listings, views details and adds required items to the cart. During checkout, the system validates the cart, creates the order, records order items, deducts stock and stores payment information for Cash on Delivery. The responsible farmer can then update the order through the allowed stages. The buyer sees the current status and can submit feedback after delivery. Administrators monitor users, listings, orders and platform activity.



Fig. 2. End-to-end website workflow.



3. Database Design

The database is organized around role-specific user records and marketplace entities. Farmers own product and waste listings. Buyers maintain cart and wishlist records and place orders. Orders are connected to order_items so that multiple purchased items can be represented independently. Payment records store the selected payment method and status. Feedback is linked to completed purchases, while notifications and contact records support communication and administration.

Important tables include farmers, buyers, admins, products, waste, cart, orders, order_items, payments, wishlist, feedback, notifications and contact. Primary and foreign keys maintain relationships among users, listings and transactions.

IV. System Modules

1. User Registration and Authentication

The registration and login modules provide controlled entry into the platform. User credentials are validated before authentication, passwords are stored using secure password hashing, and sessions maintain authenticated state. After login, the user is redirected according to role. Authorization checks prevent one role from accessing another role's restricted pages.

2. Farmer Module

The Farmer Dashboard provides access to product management, agricultural-waste management, orders, notifications and profile functions. Farmers can create new listings with details such as name, category, quantity, price and image, and can later edit or delete their own records. Ownership checks are used so that a farmer cannot modify another farmer's listing.

3. Buyer Module

The Buyer interface focuses on discovery and purchasing. Buyers can browse products and waste, use search and category filters, open listing-detail pages, save items to a wishlist, maintain cart quantities and place orders. The order-history page presents



the order state so that buyers can follow progress from placement to delivery. Feedback is permitted after the corresponding purchase reaches the delivered state.

4. Admin Module

The Admin Dashboard provides system-level monitoring. Administrators can review user accounts, block or reactivate users, moderate product and waste listings, inspect orders, manage contact messages and feedback, and view summary analytics. These controls support basic platform governance and demonstration of a complete multi-role system.

5. Order and Notification Module

The implemented order workflow is Placed → Confirmed → Processing → Shipped → Delivered, with Cancelled available as an alternate terminal state. Status transitions are controlled so that the workflow remains understandable to both farmers and buyers. Notifications provide users with relevant updates related to platform activity and orders.

V. Implementation

1. Frontend

The frontend uses HTML5 for page structure, CSS3 for custom presentation, Bootstrap 5 for responsive components and JavaScript for interactive behavior. The redesigned interface follows an agricultural visual theme and provides responsive navigation, cards, badges, forms, order trackers and dashboards. The same core pages remain usable across mobile, tablet and desktop widths.

2. Backend

PHP 8+ implements the application logic. PDO is used to communicate with MySQL through prepared statements. Backend operations include registration and login, role enforcement, product and waste CRUD, marketplace retrieval, cart management, checkout, stock deduction, order creation, status updates, feedback validation, notification handling and administrative actions.



3. Transaction and Checkout Handling

Checkout is treated as a sensitive operation. The application validates cart contents and stock before creating the order. Database transactions are used so that order creation, order-item insertion, stock deduction, payment creation and cart clearing are handled as one logical unit. If a critical operation fails, the transaction can be rolled back instead of leaving partially completed order data.

4. Security Measures

The application uses password_hash and password_verify for credentials, session ID regeneration, role authorization, blocked-account enforcement, CSRF protection, PDO prepared statements, output escaping, input validation, secure MIME-based image validation, randomized upload filenames, ownership checks and database transactions. These controls reduce common risks such as SQL injection, cross-site request forgery, unauthorized record modification and unsafe file uploads.

VI. Results

The completed prototype was evaluated through functional, integration, security-oriented and responsive-interface testing. The main workflows were executed from the user interface through the PHP backend to MySQL and back to the displayed result. The tests covered the three roles and the complete ordering lifecycle.

The integration tests confirmed that the buyer can place an order from cart contents, the order and its items are stored in the database, available stock is reduced, the farmer can process the order and the buyer can observe the resulting status. Administrative controls for users and listings were also verified. The interface was tested at widths of 375 px, 768 px, 1366 px and 1920 px, demonstrating responsive behavior across common device classes.

The final system therefore demonstrates the following end-to-end sequence:



Farmer Listing → Marketplace Discovery → Cart → COD Checkout → Order Creation → Farmer Processing → Buyer Tracking → Delivery → Feedback → Admin Monitoring

VII. Discussion

AgroCycle's principal project-level contribution is the integration of two related but commonly separated activities: agricultural-product commerce and agricultural-waste exchange. The same role-based account, marketplace, transaction and administration structure can support both categories. This makes the waste module more than an informational page; reusable residues become searchable listings that can participate in the platform's buyer-discovery workflow.

The prototype also demonstrates the importance of transaction consistency and authorization in marketplace software. A visually complete e-commerce interface is insufficient if stock, order items, ownership and role restrictions are not handled correctly. For this reason, the project includes prepared database access, transaction-based checkout and role/ownership checks as part of the implementation.

The current system remains an academic prototype. Cash on Delivery is the implemented payment mode, and production-scale logistics, live GPS tracking, real payment-gateway settlement, cloud monitoring and large-scale user validation are outside the tested scope. These limitations define clear directions for future development.

VIII. Conclusion

AgroCycle is a functional web-based marketplace that connects farmers and buyers for agricultural products and reusable agricultural waste. The platform implements complete Farmer, Buyer and Admin workflows, including registration and login, listing management, marketplace discovery, wishlist and cart operations, COD checkout, order tracking, notifications, feedback and administrative moderation.



The project demonstrates that agricultural-product trading and agricultural-waste reuse can be represented within one coherent web application using PHP, MySQL and responsive frontend technologies. By providing digital visibility to both produce and reusable residues, AgroCycle supports the broader ideas of farmer-buyer connectivity, resource recovery and circular agriculture.

Future work can extend the platform with secure online payments, location-aware marketplace discovery, GPS-assisted delivery tracking, logistics integration, cloud deployment, a native mobile application, expanded multilingual support, advanced analytics and AI-assisted demand or price forecasting. Evaluation with a larger set of real farmers and buyers would also provide stronger evidence about usability and practical adoption.

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