CEMARA SUPPLY: DEVELOPMENT OF A WEB-BASED NUSANTARA SPICE PROCUREMENT SERVICE TO SUPPORT TRACEABILITY AND SUSTAINABILITY IN THE CULINARY INDUSTRY

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Abstract

The Indonesian culinary industry faces challenges in ensuring stable supply, product traceability, and sustainability of Nusantara spices due to conventional and fragmented procurement systems. These conditions lead to inefficiencies in distribution, limited transparency of product origins, and reduced welfare for local farmers. This study aims to develop a web-based procurement platform named CEMARA SUPPLY to support traceability and sustainability in the culinary supply chain by integrating farmers, manufacturers, and culinary industry clients into a single digital ecosystem. The research method uses the Waterfall software development model, consisting of requirement analysis, system design, implementation, and testing stages. Data were collected through observation, interviews, and documentation to identify user needs. System testing was conducted using black-box testing to ensure functional reliability of the main features, including product management, transaction recording, and batch-based traceability. The results show that the CEMARA SUPPLY platform is able to improve supply chain efficiency by reducing dependence on traditional intermediaries and enabling transparent documentation of product origins, production processes, and transactions. The system successfully supports traceability through batch codes and centralized data management, allowing stakeholders to monitor the flow of spices from farmers to end users in real time. In conclusion, CEMARA SUPPLY demonstrates that a web-based procurement system can enhance efficiency, transparency, traceability, and sustainability in the Nusantara spice supply chain, while also supporting fair trade practices and strengthening the competitiveness of Indonesia's culinary industry.

Keywords: Traceability, Sustainability, Web-Based Procurement System, Spice Supply Chain, Digital Transformation

1. INTRODUCTION

The culinary industry in Indonesia is one of the most resilient sectors and contributes significantly to the national Gross Domestic Product (GDP). Along with the growth of lifestyle and tourism trends, demand for authentic Nusantara flavors based on spice diversity continues to increase. However, this development has not been accompanied by supply chain stability. As a result, culinary businesses of various scales experience difficulties in obtaining spices with consistent quality due to conventional and fragmented procurement systems (Purnomo & Herliansyah, 2021).

The main problem in the national spice industry lies in the lengthy distribution chain that involves multiple intermediaries. This condition causes unstable price fluctuations at the consumer level and reduces profit margins for local farmers as primary producers. Furthermore, inadequate post-harvest handling standards in

traditional logistics systems increase the risk of raw material damage and contamination, which ultimately hinders economic efficiency in the culinary industry (Pradana et al., 2022).

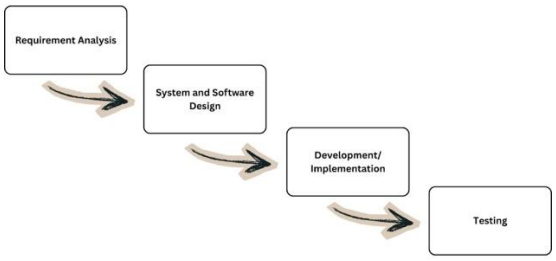
In an era of increasing consumer awareness, traceability and food safety have become essential requirements rather than mere added value. Consumers are becoming more concerned about the origin of raw materials and production processes. Unfortunately, the absence of digital documentation in traditional procurement systems makes product traceability difficult and delays risk mitigation when quality issues occur. In addition, the lack of fair trade practices in spice commerce presents challenges to social and environmental sustainability (Suryono et al., 2023).

Based on these challenges, CEMARA SUPPLY was developed as a web-based Nusantara spice procurement service that integrates traceability and sustainability aspects. The platform is designed to connect farmers, manufacturers, and culinary industry stakeholders within a centralized, transparent, and digitally documented system. Through this approach, CEMARA SUPPLY is expected to improve the competitiveness of Indonesia's culinary industry while supporting farmer welfare and ensuring the long-term sustainability of the Nusantara spice ecosystem (Wiguna & Santoso, 2023).

2. METHODOLOGY

The Waterfall method is employed as the software development methodology in this study. The Waterfall model follows a sequential and systematic workflow, starting from the planning phase and continuing through to system implementation. Each phase must be completed before proceeding to the next stage.

Figure 1. Waterfall Development Stages



This approach consists of requirement analysis, system design, coding, testing, and software maintenance.

2.1 Requirement Analysis

Software developers strive to understand the information and functionality requirements expected by users of the system to be developed. Data Collection is carried out through various methods, such as discussions, interview, surveys, and observations. The information obtained is then processed and analyzed to produce a complete system requirements specification that meets user requirement.

2.2 System and Software Design

The design phase is conducted based on the results of the previously defined requirement analysis. During this stage, the requirement specifications are further examined and translated into system and software designs. The design aims to provide a comprehensive overview of the system architecture, process workflows, and system components to be developed, thereby facilitating a smoother implementation process in subsequent stages.

2.3 Implementation

The implementation phase focuses on realizing and developing all previously designed components into a web-based application. In the CEMARA SUPPLY project, this process is carried out through coding activities that integrate multiple programming languages to create an intuitive user interface and a robust data storage system. The system development deliberately separates the core structure (Back-End) from the user interface (Front-End). This strategy is adopted to improve system maintainability, ensure stable performance, and maintain flexibility for future development in line with the evolving needs of the culinary industry.

2.4 Testing

After the implementation phase is completed, system testing is conducted to ensure that the platform operates as intended. The testing process employs the Black-box Testing method, which focuses on evaluating the functionality of key features such as the ordering system, spice data input validation, and the accuracy of the traceability feature without examining the internal code structure. This approach aims to identify potential errors within the application workflow.

3. FINDINGS AND DISCUSSION

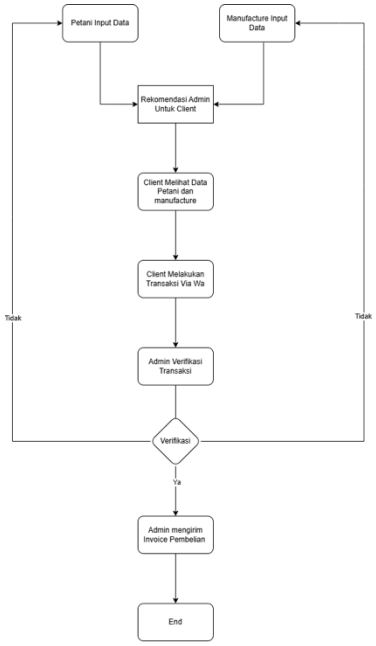
The findings show that the CEMARA SUPPLY web-based platform successfully improves efficiency, transparency, and traceability in the Nusantara spice supply chain. By integrating farmers, manufacturers, and culinary industry clients into a centralized digital system, the platform enables structured data management and real-time monitoring of product origins, production processes, and transactions. The implementation results indicate that the system reduces dependence on conventional intermediaries, supports food safety and quality control through batch-based traceability, and promotes more sustainable and transparent procurement practices within Indonesia's culinary industry.

3.1 System Desain

The system design of CEMARA SUPPLY integrates farmers, manufacturers, administrators, and clients into a centralized digital platform for spice procurement. Flowchart and use case diagrams illustrate the interactions and workflow of data input,

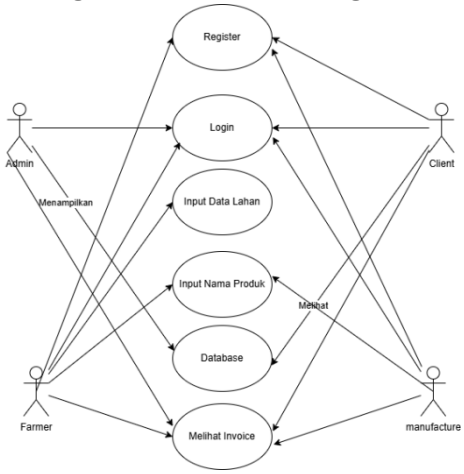
verification, and transactions within the system. This design supports transparency, traceability, and efficient supply chain management.

Figure 2. Cemara Supply System Flowchart



The CEMARA SUPPLY flowchart illustrates the spice procurement process starting from farmers and manufacturers as suppliers who input product data into the system. The submitted data is then processed by the administrator to generate product recommendations for clients. Subsequently, clients are able to view detailed information about farmers and manufacturers as a form of source transparency before proceeding with transactions via WhatsApp. Transactions that have been conducted are verified by the administrator to ensure data accuracy and agreement compliance. If the verification is not approved, the transaction is returned to the previous stage for correction. Conversely, if the verification is approved, the administrator issues a purchase invoice to the client as official transaction documentation, marking the completion of the procurement process within the CEMARA SUPPLY system.

Figure 3. Usecase Diagram



The use case diagram illustrates the interactions among four main actors within the CEMARA SUPPLY system, namely the Admin, Farmer, Client, and Manufacturer (third-party supplier). All actors are required to complete the registration and login processes as initial steps to access the system. The Farmer is responsible for inputting land data and product data, which are subsequently stored in the system database, while the Manufacturer is also able to manage and update the product data offered. The Admin functions as the system administrator who displays, manages, and controls the data stored in the database, as well as ensures the smooth flow of information throughout the system. The Client interacts with the system to view available product data and access invoices as official transaction records.

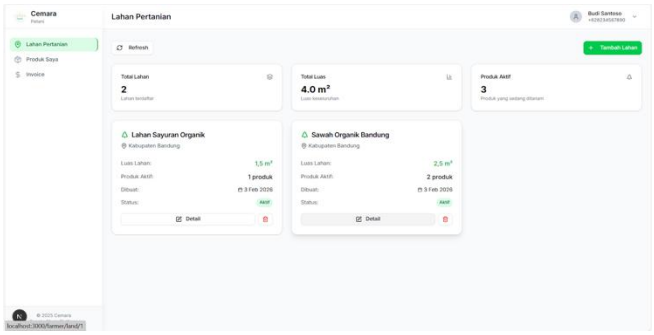
All transaction data and product information are stored centrally within the database, thereby supporting transparency, traceability, and efficiency in the spice procurement process implemented in the CEMARA SUPPLY system.

3.2 System Implementation

The implementation of the CEMARA SUPPLY system was carried out as a web-based platform that enables users to manage product data, production records, and transactions digitally. The system provides separate interfaces for farmers, manufacturers, administrators, and clients to support their respective roles and functions. Through this implementation, all procurement and traceability processes are executed in a structured and centralized manner, ensuring system reliability and ease of use.

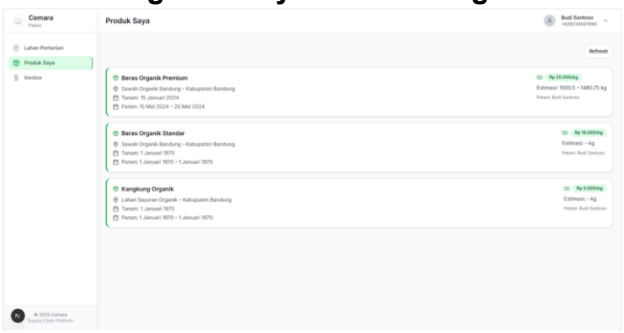
3.1.1 Farmer

Figure 4. Agricultural Land Page



The “Agricultural Land” interface page on the CEMARA SUPPLY platform serves as a digital control center for farmers to manage production assets and monitor land capacity in real time. The upper section of the dashboard presents a statistical summary, including the number of land plots, total cultivated area, and active products, while the main section displays detailed information cards showing the location and operational status of each land parcel. Through this structured data recording, the platform provides full transparency for culinary industry stakeholders to trace the origin of raw materials. This functionality forms a crucial foundation for traceability and supports the sustainability of the Nusantara spice supply chain from upstream production to end consumers.

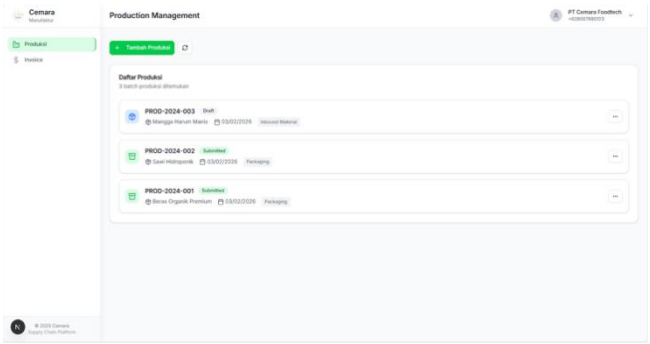
Figure 5. My Products Page



In the “My Products” menu, the platform displays a list of managed commodities along with critical information such as cultivation land location, planting date, estimated harvest yield, and price per kilogram. This detailed data recording, as illustrated by the “Premium Organic Rice” product entry, enables the system to accurately track the production timeline from upstream to downstream stages. Through the integration of these features, CEMARA SUPPLY establishes a robust traceability system that ensures food safety for consumers and supports the economic sustainability of farmers by enabling more structured and efficient supply chain management.

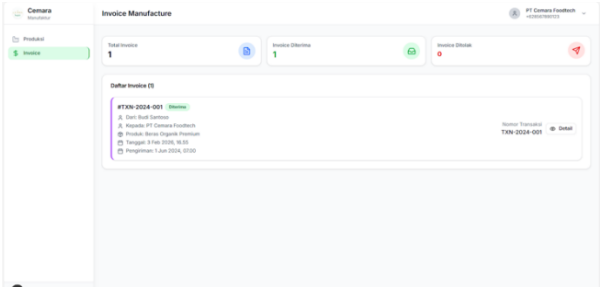
3.1.2 Manufacture

Figure 6. Production Management Page



In the Production Management module, the system tracks the transformation process of raw materials into distribution-ready products using unique batch codes. This module documents each processing stage, starting from material receipt (inbound) to packaging, with real-time status updates. The integration of data between farmers and manufacturers ensures that every product has a complete digital traceability record. This approach supports food safety and strengthens a sustainable culinary supply chain ecosystem.

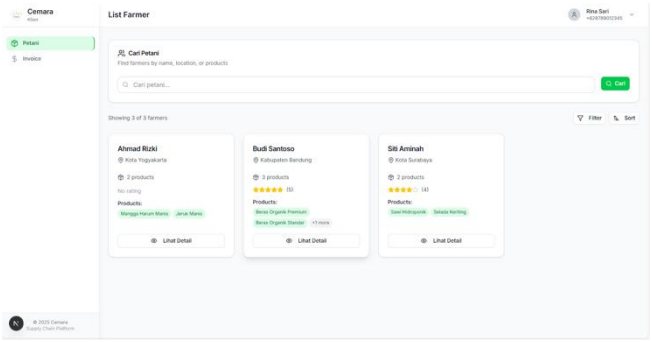
Figure 7. Invoice Manufacture Page



This page functions as a centralized transaction documentation hub, featuring a dashboard that highlights invoice status summaries, such as the number of accepted and rejected invoices, displayed through informational cards at the top of the interface. The transaction list is presented with detailed records, including transaction numbers, sender identity (farmer), recipient party (manufacturer), product type, and delivery time details. This structured format ensures that all financial and logistical transaction evidence is systematically documented, supporting audit requirements and end-to-end traceability within the system.

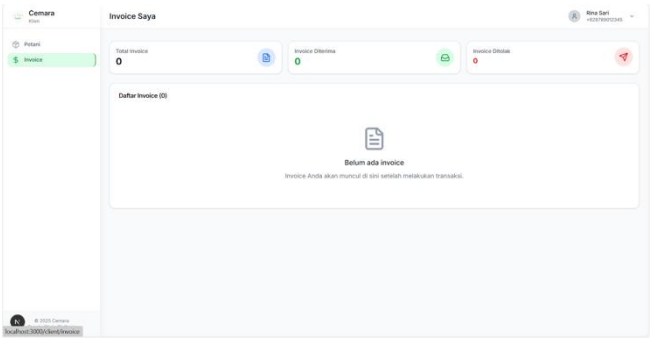
3.1.4 Client

Figure 8. List Farmer Page



This interface is designed for clients in the culinary industry to discover supplier partners through an intuitive search and filtering feature. The page displays a list of informative farmer profiles, including the farmer's name, city or district location, number of available products, and a star-based rating system provided by previous buyers. Each profile card also highlights the farmer's featured products, such as "Harum Manis Mango" or "Curly Lettuce", enabling clients to transparently select suppliers based on product quality and supplier reputation.

Figure 9. My Invoice Page



This page serves as a centralized transaction documentation hub, highlighting invoice status summaries such as the total number of invoices. The transaction list is presented with detailed records to ensure clarity and completeness. This format ensures that all financial and logistical transaction evidence is systematically documented, supporting audit requirements and traceability.

4. CONCLUSION

This study concludes that the development of CEMARA SUPPLY as a web-based Nusantara spice procurement platform effectively addresses key challenges in the Indonesian culinary supply chain, particularly in terms of procurement efficiency, information transparency, traceability, and sustainability. The digitalization of the procurement process through an integrated system enables direct connectivity among farmers, manufacturers, and culinary industry clients within a structured ecosystem.

The implementation results demonstrate that CEMARA SUPPLY improves supply chain efficiency by reducing reliance on lengthy and fragmented conventional distribution systems. Batch-based data recording, production process documentation, and centralized transaction management enable accurate end-to-end traceability from upstream to downstream stages. These features contribute to enhanced food safety, consistent raw material quality, and increased trust among stakeholders in the culinary industry.

In addition to improving traceability and efficiency, CEMARA SUPPLY supports sustainability principles by promoting transparency in raw material sourcing and fairer trade practices for local farmers. The application of the Waterfall software development method ensures a systematic development process and results in a stable application. Future research is recommended to examine the implementation of the system on a larger scale and explore its integration with advanced technologies to further strengthen the Indonesian culinary supply chain ecosystem

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