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Design and Implementation of a Web-Based Marketing Information System for Oil Palm Midrib Products in the Kayu Raja Village Community

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Abstract

The marketing of oil palm midrib products in Kayu Raja Village remains conventional, limiting market reach and sales efficiency. While numerous studies have examined web-based marketing systems for general MSMEs, limited research has addressed user-centered system design and evaluation for rural communities marketing agricultural by-products such as oil palm midribs. This study aims to design, implement, and evaluate a web-based marketing information system tailored to the characteristics of the Kayu Raja Village community. The research adopts the Software Development Life Cycle (SDLC) using the Waterfall model, encompassing requirements analysis, UML-based system design, implementation, and testing. System evaluation was conducted through black-box testing to assess functional performance and user acceptance testing (UAT) to measure usability and user satisfaction. The findings indicate that the developed system effectively provides product catalog management, online ordering, and structured transaction data processing. User evaluation results demonstrate that the system is functional, user-friendly, and aligned with rural user capabilities. The implementation contributes to expanding market access, improving marketing efficiency, and strengthening the economic competitiveness of the village community.

Keywords: Marketing Information System, Web-Based Marketing, Rural MSMEs, Oil Palm Midrib, Marketing Digitalization.

1 INTRODUCTION

The digitalization of marketing systems among rural micro, small, and medium enterprises (MSMEs) has become an important issue in Indonesia, particularly in improving market access and data management efficiency. In Indonesia, digitalization has become a key catalyst in supporting the growth of the micro, small, and medium enterprises (MSME) sector. According to data from Statistics Indonesia (BPS) in 2024, approximately 64.2% of MSMEs have adopted digital technologies; however, the majority remain concentrated in urban areas. Meanwhile, rural MSME actors continue to lag behind in technology adoption due to limitations in infrastructure and digital literacy [1].

Kayu Raja Village is one of the rural areas with economic potential derived from oil palm midrib products, a by-product of oil palm leaves utilized as raw material for broomsticks and other household items. Based on field observations and interviews conducted in this study, oil palm midrib processing represents a recurring productive activity among local households and contributes to the village's small-scale economic activities. These products have commercial value and relatively stable market demand. However, the marketing of oil palm midrib products in Kayu Raja Village is still conducted through traditional practices, namely direct sales to collectors or local markets. Such marketing patterns result in a very limited market reach, and product prices tend to be determined by intermediaries, thereby preventing the community from achieving optimal income levels.

In addition to the limited market reach, the community of Kayu Raja Village also lacks an integrated marketing information system to manage product data, promotion, and sales transactions. Sales recording processes are still carried out manually, making it difficult for business actors to monitor business development and make strategic decisions. This condition is consistent with previous findings indicating that rural entrepreneurs generally face constraints in utilizing digital technology due to limited knowledge and inadequate supporting facilities [2].

These findings indicate that rural MSMEs face multiple barriers in adopting digital marketing, including limited digital literacy and infrastructure constraints [2]. While previous studies have widely examined digital marketing adoption and its impact on MSME

performance, limited attention has been given to the development and evaluation of structured web-based marketing information systems specifically tailored to rural communities and agricultural by-product commodities. In particular, research focusing on user-oriented system design for small-scale rural enterprises remains insufficient. Therefore, there is a need to design and implement a marketing information system that aligns with the operational characteristics and technological capabilities of rural business actors. The implementation of web-based marketing information systems has been shown to enhance the effectiveness of MSME product marketing. Research demonstrates that the adoption of digital marketing significantly influences the sustainable growth of MSMEs in Indonesia [3]. Web-based systems enable business actors to display product catalogs, update pricing information, and receive online orders at relatively lower costs compared to conventional marketing methods [2].

The limited understanding of the strategic value of digitalization has led many micro-enterprises to underutilize digital technologies in their marketing activities. Previous studies indicate that digital marketing plays a crucial role in promoting MSME growth and sustainability. Further findings confirm that the adoption of digital marketing significantly enhances the sustainable growth of MSMEs in Indonesia [3]. Factors such as a positive attitude toward technology and the intention to use digital marketing have been shown to exert a direct impact on business growth.

The challenges faced by the Kayu Raja Village community are not limited to the lack of digitalization facilities but also include the absence of an integrated marketing information system. The manual processes involved in the sale of oil palm midrib products make it difficult for the community to manage sales data, promotions, and customer relationships. In fact, web-based information systems can assist business actors in expanding market networks and improving marketing efficiency. Research indicates that the key success factors of digital marketing among Indonesian MSMEs lie in continuous training and mentoring [4]. With the availability of a simple and easily accessible web-based information system, rural communities can gain practical understanding of effective digital marketing strategies without relying on external parties.

Meanwhile, research and implementation of web-based marketing systems have predominantly focused on the food, beverage, and retail sectors, whereas non-food agricultural by-product–based commodities such as oil palm midribs have received limited scholarly attention [5]. Moreover, many digital systems are designed without adequately considering the capabilities of rural users, making their sustained implementation challenging. Therefore, there is a need for a web-based marketing information system that is simple, user-friendly, and aligned with the characteristics of the Kayu Raja Village community.

In addition to technological factors, government support and the development of digital infrastructure also play a crucial role. A study emphasizes that government digital transformation programs must be accompanied by efforts to enhance community digital literacy in order to optimize infrastructure utilization [6]. Without local innovations such as information systems tailored to community needs, digitalization will not be implemented effectively.

Accordingly, the author is motivated to conduct research on the design and implementation of a web-based marketing information system, given the high urgency of this study. The development and implementation of such a system are intended as a solution to overcome the limitations of traditional marketing practices currently employed in Kayu Raja Village. From an academic perspective, this research contributes to the advancement of the literature on the utilization of information technology for rural community economic empowerment. From a practical standpoint, the resulting system is expected to assist the Kayu Raja Village community in expanding market reach, improving the efficiency of marketing data management, and supporting increased income as well as the economic independence of the rural community.

2 LITERATURE REVIEW

Previous studies have demonstrated that web-based marketing information systems improve product promotion, operational efficiency, and structured data management among MSMEs [7]. These systems enable real-time access to product and transaction information, thereby enhancing business performance and expanding promotional reach beyond geographical constraints. Moreover, prior research emphasizes the importance of applying structured system development methodologies, particularly the Software Development Life Cycle (SDLC), to ensure alignment between system design and user requirements.

Despite these contributions, most studies concentrate on general retail sectors or urban-based enterprises, with limited attention to rural community contexts. In addition, although digital marketing adoption has been widely discussed, fewer studies focus on the systematic design and evaluation of web-based marketing information systems tailored to small-scale rural enterprises, especially those operating in agricultural by-product commodities.

From a marketing strategy perspective, the integration of web-based systems with Customer Relationship Management (CRM) approaches has been shown to enhance customer engagement and promotional effectiveness [8]. Similarly, digitalization

in the agricultural sector contributes to improved distribution efficiency and transaction processes[9]. However, these studies primarily emphasize marketing outcomes rather than examining the suitability of system design for users with limited technological capabilities in rural areas. In terms of system development approaches, various methodologies such as Waterfall, Rapid Application Development (RAD), Object-Oriented Design, and Software as a Service (SaaS) have been applied in previous research [10]. While SaaS-based models offer accessibility advantages for MSMEs, comparative evaluations of development approaches in rural village-level implementations remain limited. Furthermore, empirical studies focusing specifically on oil palm midrib product marketing within rural communities are still underrepresented in the literature. Therefore, this study addresses these gaps by designing, implementing, and evaluating a web-based marketing information system using the SDLC approach, specifically tailored to the operational characteristics and technological capabilities of the Kayu Raja Village community.

3 RESEARCH METHODS

This study employs the Software Development Life Cycle (SDLC) approach using the Waterfall model in the design and implementation of a web-based marketing information system for oil palm midrib products for the Kayu Raja Village community. The Waterfall model was selected because it provides systematic and sequential development stages, in which each phase must be completed before proceeding to the next, thereby facilitating control and evaluation of the system development process [11].

The Waterfall model is considered appropriate for this research because system requirements were clearly identified from the initial stage through observation and interviews, and the system developed has low to moderate complexity [12].

The research stages were conducted sequentially in accordance with the Waterfall model, as follows:

1. Problem Identification and Data Collection
   The initial stage aimed to understand the condition of oil palm midrib product marketing, which is still carried out traditionally. Data collection was conducted through:
   a. Observation, namely direct observation of marketing processes and community sales activities to obtain factual field data.
   b. Interviews, conducted in a semi-structured manner with business actors and village officials to explore information regarding marketing constraints and expected system requirements [13].
   c. Literature review, by examining relevant books and scientific journals related to information systems, digital marketing, and web-based system development as the theoretical foundation of the study [14].

2. System Analysis
   System analysis was carried out to transform collected data into system requirements to be developed. This analysis aimed to identify problems in the existing system and formulate more effective solutions for a new system [19]. The system analysis includes:
   a. Functional requirements, namely the main system functions such as providing a product catalog, enabling online product ordering, and managing product and transaction data by the admin [15].
   b. Non-functional requirements, including aspects of usability, data security, system performance, interface design, and accessibility across various devices [16].

3. System Design
   The system design stage aimed to translate system requirements into technical and visual designs. The design was conducted using Unified Modeling Language (UML) to clearly model system structure and workflow [17]. The UML diagrams used include Use Case Diagrams, Activity Diagrams, Sequence Diagrams, and Class Diagrams to ensure that all functional system requirements were well defined prior to implementation.

4. System Implementation
   Implementation was carried out by applying the design results into a web-based marketing information system. The website was used as a promotional medium by displaying product information, prices, and ordering contacts. This stage aimed to realize the system design into a functional system that could be directly used by the community [18].

5. System Testing
   System testing was conducted using functional testing to ensure that all system features operated according to user requirements. The testing involved the Kayu Raja Village community as users to assess usability and clarity of information provided by the system [19].

6. Evaluation and Maintenance
   The evaluation stage was carried out to assess system effectiveness based on testing results and user feedback. System maintenance includes

content updates, information corrections, and ensuring continuous system accessibility for sustainable use [20].

4 RESULTS AND DISCUSSION

A. System Design

Overview The development of the web-based marketing information system employed the Software Development Life Cycle (SDLC) using the Waterfall model to ensure a structured and systematic development process. Recent studies emphasize that SDLC remains relevant for small-scale information systems requiring clear requirement definition and sequential development stages [21]. Unified Modeling Language (UML) was utilized to model system requirements through Use Case, Activity, and Sequence Diagrams. Contemporary research highlights that UML modeling enhances requirement clarity and reduces design ambiguity, particularly in community-based system development projects [22].

B. System Implementation

The system was implemented as a web-based application with two primary actors: administrator and customer. Core functionalities include product catalog management, online ordering, transaction recording, and reporting. Recent studies confirm that web-based marketing systems significantly improve accessibility and real-time data management for rural MSMEs, particularly in areas with limited physical market access [23]. The use of structured databases supports data consistency and improves operational efficiency in small enterprises transitioning from manual processes to digital platforms [24]. The interface design followed usability-oriented principles to accommodate users with limited digital literacy. Current research indicates that simplicity, clarity, and minimal navigation complexity are essential for technology adoption in rural communities [25].

C. Functional Testing

Results Functional testing was conducted using the black-box testing approach to verify system compliance with predefined functional requirements. Black-box testing continues to be widely used in validating web-based systems due to its effectiveness in assessing user-level functionality [26]. Testing results demonstrated that all primary features registration, authentication, product management, ordering, and reporting operated according to specifications. No major functional errors were identified during testing. These findings align with recent research indicating that structured validation processes improve system reliability and user trust in newly implemented digital platforms [22],[26].

D. Usability Evaluation

User Acceptance Testing (UAT) was conducted through direct trials involving members of the Kayu Raja Village community. Usability is defined as the extent to which a system can be used effectively, efficiently, and satisfactorily within a specific context [27]. Based on user feedback, the system was perceived as easy to understand and operate. The digital catalog improved information accessibility, and structured transaction records reduced manual recording errors. Similar findings have been reported in recent studies on rural digitalization, where usability directly influences technology adoption and sustained usage [28].

E. System Performance and Adoption Impact

From a performance perspective, the system demonstrated stable functionality under small-scale operational conditions. Data processing and retrieval were executed without observable delays. Research in recent years shows that even basic web-based systems significantly enhance transparency and transaction efficiency in rural enterprises [24] [28]. Before implementation, marketing activities relied on intermediaries and manual recording. After implementation, product promotion became digitally accessible, and transaction data were systematically managed. Digital transformation studies published in the past five years indicate that structured marketing information systems contribute to improved competitiveness, wider market reach, and increased economic resilience among rural MSMEs [24] [29].

Although long-term sustainability depends on continuous digital literacy development, initial adoption results in this study indicate positive acceptance among local users. Based on the results of the research on the implementation and testing of the web-based marketing information system for oil palm midrib products developed in this study, the discussion is focused on the system's functional performance, its ease of use for the community, and its contribution to supporting the digital expansion of product marketing in Kayu Raja Village.

4.1 System Design

In this study, Unified Modeling Language (UML) was employed to design the processes of the web-based marketing information system for oil palm midrib products, utilizing three types of diagrams, namely:

1. Use Case Diagram
2. Activity Diagram
3. Sequence Diagram

I. Use Case Diagram

The Use Case Diagram in this study illustrates the interaction between two primary actors administrator and customer and the core functionalities of the web-based marketing information system. The administrator manages product data, monitors transactions, and generates sales reports, while the customer browses products and places orders.

The structured separation of roles reflects the transformation from informal and manual marketing practices to a digitally managed workflow. Clear role definition in system modeling has been shown to improve requirement clarity and reduce functional ambiguity in small-scale information system development [30].

By explicitly defining system boundaries and actor responsibilities, the use case model enhances transaction transparency and strengthens data accountability. Recent studies indicate that structured digital workflows in rural MSMEs contribute to improved operational control and reduced reliance on intermediaries [31] [32].

Furthermore, aligning system functions with actual business processes is critical in community-based system implementation, particularly where users possess limited technological familiarity [25]. Therefore, the use case design in this research not only model's system interaction but also serves as a strategic foundation for supporting autonomous digital marketing practices in Kayu Raja Village. In this study, the system comprises two main actors, namely:

a) Admin / Seller
   1. Register
   2. Log in to the system
   3. Manage product data (add, edit, delete)
   4. Manage orders and transactions
   5. View sales reports
   6. Log out

b) User / Buyer (General Public)
   1. Register
   2. Log in to the system
   3. View the product catalog and prices
   4. Add desired products to the shopping cart
   5. Purchase selected products
   6. Log out.

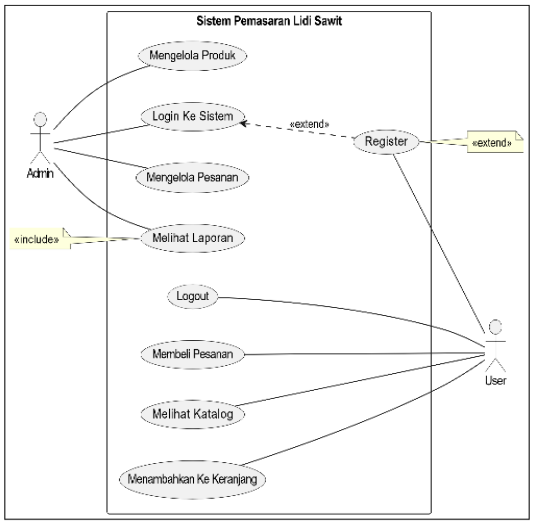

Figure 1. Use Case Diagram

II. Activity Diagram

The Activity Diagram models the operational workflow of the web-based marketing information system, particularly in product data management, promotional activities, and user interaction in accessing and ordering products. The modeled workflow begins from user authentication, proceeds to product browsing and order submission, and ends with transaction recording by the administrator.

Rather than merely representing procedural steps, the activity model formalizes previously informal and unstructured marketing practices observed in Kayu Raja Village. By translating manual communication-based transactions into sequential and logically controlled digital processes, the system reduces operational ambiguity and improves traceability. Structured workflow modeling has been shown to improve system clarity, minimize implementation errors, and enhance process control in small-scale information systems [33]. In the context of rural MSMEs, clear digital process mapping contributes to operational efficiency and supports gradual digital adoption [23]. Therefore, the Activity Diagram in this study does not only describe system flow but also represents the transformation of traditional marketing mechanisms into a controlled and accountable digital workflow. The processes occurring within this system include the following:

A. Admin / Seller Activity Diagram Process
   a. The admin accesses the web-based marketing information system page.
   b. The admin logs in by entering a username and password.

c. The system validates the login credentials.
   a) If the data are valid, the system displays the admin dashboard.
   b) If the data are invalid, the system displays an error message and returns to the login page.
d. The admin manages oil palm midrib products, including:
   a) Add product data
   b) Edit product data
   c) Delete product data
e. The system stores every data modification in the database.
f. The admin manages marketing information and system content.
g. The admin completes the activities and logs out.
h. The system terminates the admin session.

B. User / Buyer Activity Diagram Process
   a. The buyer accesses the marketing information system website.
   b. The system displays the main page.
   c. The buyer views the list of oil palm midrib products.
   d. The buyer selects a product to view detailed information.
   e. The system displays the product details and marketing information.
   f. The buyer obtains the required information.
   g. The buyer exits or closes the website page.
   h. The process ends.

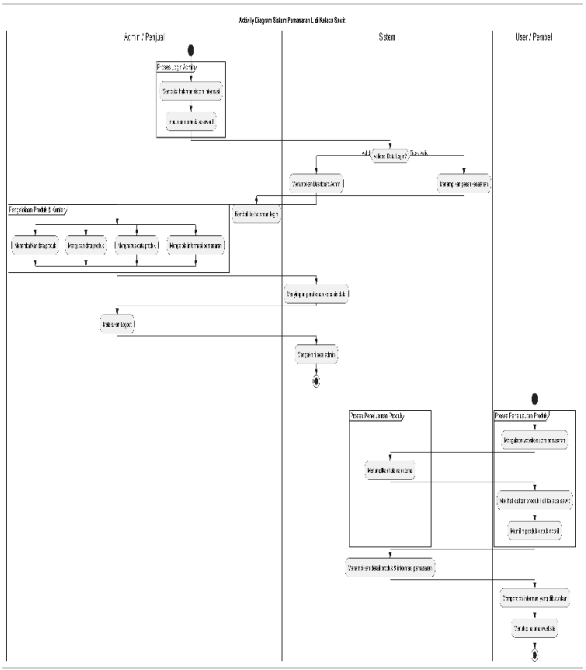

Figure 2. Activity Diagram

III. Sequence Diagram

The Sequence Diagram in this study models the transaction flow within the web-based marketing information system, particularly during product ordering and product data management processes. The interaction begins when a user submits a request through the interface, such as browsing products or placing an order. The system processes the request by validating the input data before forwarding it to the application logic layer.

After validation, the system communicates with the database to retrieve product information or to store transaction records. The database integration ensures that product data and transaction histories are stored consistently and can be accessed in real time. Once the database operation is completed, the system generates a response that is returned to the user interface, confirming the success or failure of the transaction.

In the product management process, the administrator submits product updates, which are processed and synchronized directly with the database. This structured interaction between the user interface, application layer, and database improves data integrity and reduces the risk of logical inconsistencies. Recent studies emphasize that interaction-based modeling enhances system reliability by clearly defining message flow and transactional dependencies in web-based systems [34]. Furthermore, structured transaction sequencing supports traceability and minimizes implementation errors in small-scale information

systems [23]. By formalizing transaction flow and database integration, the Sequence Diagram in this research contributes to improving operational transparency and ensuring accountable digital marketing processes within the rural enterprise context.

The sequence diagram for product ordering includes the following:

A. Objects Involved:
   1. User
   2. Web Server
   3. Database
   4. Admin

B. Process Flow:
   1. The user opens the product catalog page and sends a request to the server.
   2. The server receives the request and retrieves product data from the database.
   3. The database returns the product data to the server.
   4. The server displays the product data to the user.
   5. The user selects a product and completes the order form.
   6. The server receives the order data from the user and stores it in the database.
   7. The admin logs into the system and accesses the order data.
   8. The system displays new order data to the admin.
   9. The admin updates the order status to "processed."
   10. The server saves the updated order status to the database.
   11. The system sends a notification to the user that the order has been received and is being processed.
   12. The sequence diagram process ends.

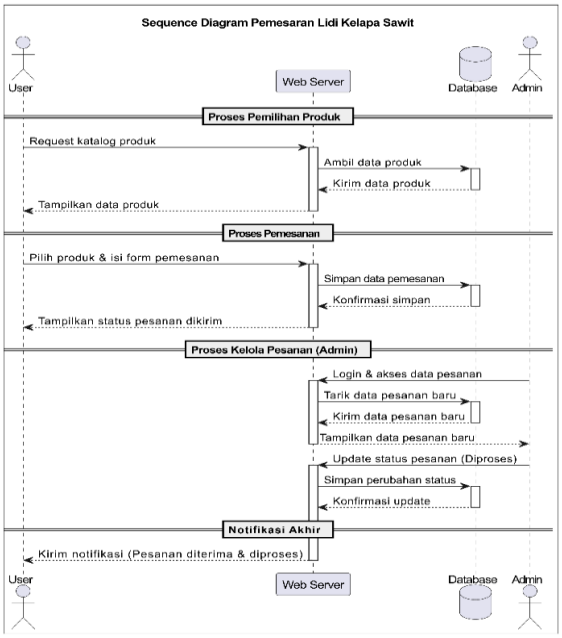

Figure 3. Sequence Diagram

This process indicates that the system operates in real time, allowing administrators and users to be interconnected through the web server.

With the application of UML based process design:

1. Researchers can ensure that every functional requirement is represented in the system design.
2. System documentation becomes clearer and easier to understand for the development team and other stakeholders.
3. The implementation phase becomes more efficient because a structured workflow reference is already available.
4. System testing is facilitated, as each scenario has been modeled in UML.

4.2 System Design and Implementation

The web-based marketing information system was implemented to operationalize the structured models developed in the design phase. The system integrates a web application layer with a relational database to support product management, transaction processing, and digital marketing activities.

Rather than merely providing an online interface, the implemented system formalizes previously informal marketing practices into a controlled digital environment. The product catalog feature enables structured presentation of product information, reducing dependency on oral communication and intermediaries. The ordering module supports systematic transaction recording, ensuring that each purchase request is validated, processed, and stored within the database.

The integration between the application layer and the database ensures data consistency and real-time synchronization between product updates and user access. This integration minimizes manual recording errors and enhances traceability of transactions, which was identified as a major limitation in traditional practices. From an operational perspective, the implementation demonstrates how structured web-based systems can transform rural marketing mechanisms into accountable digital processes. Similar findings have been reported in recent studies on digital transformation in rural MSMEs, where system integration improves efficiency and market accessibility[35] [36].

Therefore, the implementation results do not merely represent technical deployment but illustrate the practical realization of digital process restructuring within the Kayu Raja Village enterprise context.

A. User (Buyer) Implementation

The user component is designed to facilitate prospective buyers in accessing product information and placing orders online.

The following presents the implementation of features on the user side:

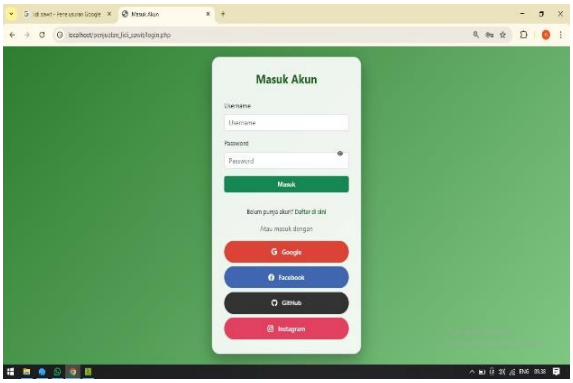

Figure 4. Login Page

Figure 4 illustrates the login page (“Account Sign In”) of the oil palm midrib sales web application. This page provides fields for username and password, a Sign In button, and an option to register a new account. It also offers login via third-party accounts such as Google, Facebook, GitHub, and Instagram. This page functions as the authentication gateway for users (buyers and sellers) before accessing the system.

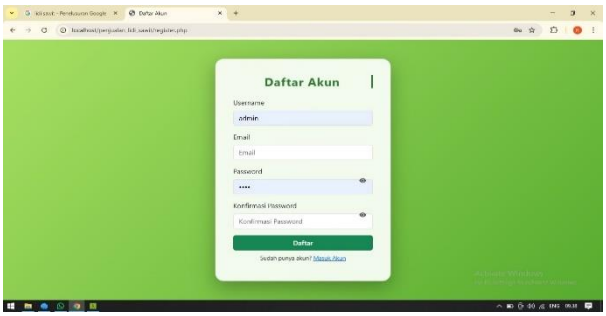

Figure 5. Account Registration Page (Register)

Figure 5 illustrates the account registration page (“Create Account”) of the oil palm midrib sales web application. This page functions to register new users by providing input fields for username, email, password, and password confirmation. A “Register” button is available to save user data, along with a Sign In link for users who already have an account.

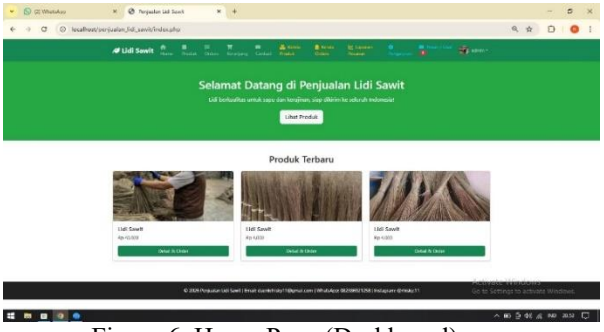

Figure 6. Home Page (Dashboard)

Figure 6 illustrates the home page (dashboard) of the oil palm midrib sales system, which is equipped with a comprehensive navigation menu, including product management, orders, reports, settings, and messaging features. This page functions as the central hub for control and information by displaying a system welcome message and a list of the latest products to support management and transaction activities.

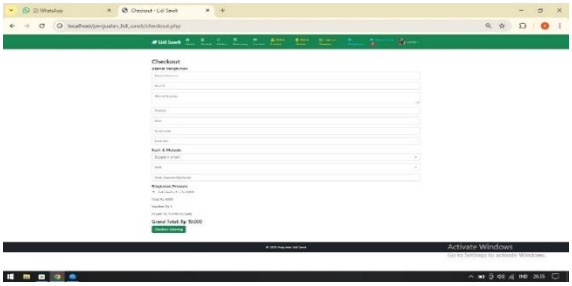

Figure 7. Product Catalog Page

Figure 7 presents the product catalog page of the oil palm midrib sales system. Figure 4 illustrates the implementation of the product catalog module, which operationalizes structured product data management and supports digital accessibility for customers.

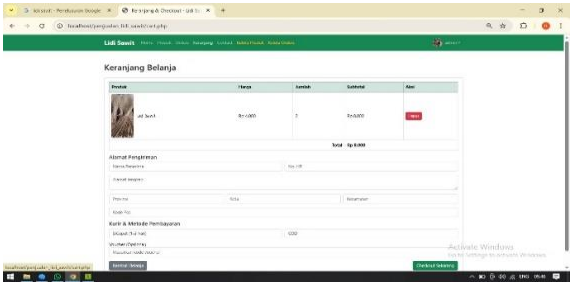

Figure 8. Shopping Cart Page

Figure 8 illustrates the shopping cart page of the oil palm midrib sales web application. This page functions to display and manage items selected for purchase, including product information, price, quantity, subtotal, and total payment. It also provides a shipping address form, courier and payment method options, and a checkout button. The page represents the transition from product selection to the transaction process.

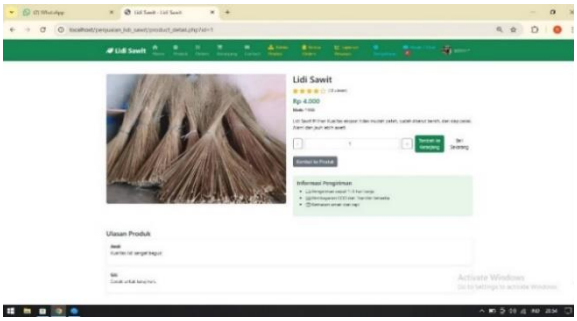

Figure 9. Checkout Page

Figure 9 illustrates the checkout page of the oil palm midrib sales system. This page is used to complete the transaction process by providing a shipping address form, courier and payment method options, and an order summary displaying the total cost and grand total.

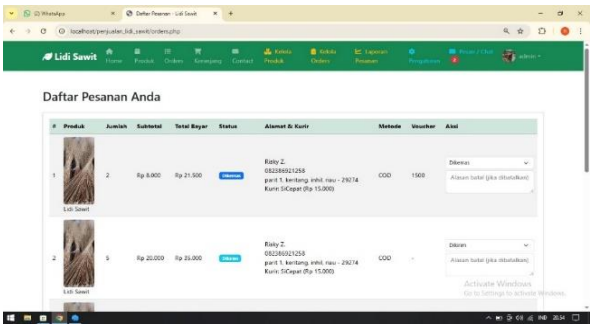

Figure 10. Order List Page

Figure 10 presents the order list page of the oil palm midrib sales system. This page displays transaction information in tabular form, including product, quantity, subtotal, total payment, order status, shipping address, payment method, and action options. The interface enables systematic monitoring and management of order progress.

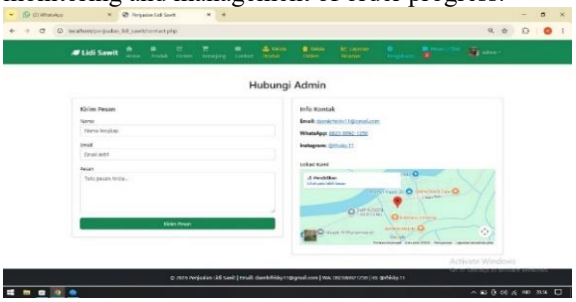

Figure 11. Contact Page (Contact Admin)

Figure 11 presents the contact page (“Contact Admin”) of the oil palm midrib sales system. This page provides a message submission form for users as well as admin contact information, including email, WhatsApp, and Instagram, accompanied by a location map. This feature facilitates direct communication and customer service within the system.

B. Admin (Seller) Implementation

The admin component is used by business actors or system administrators to manage product data and process incoming orders. The following presents the implementation results on the admin side:

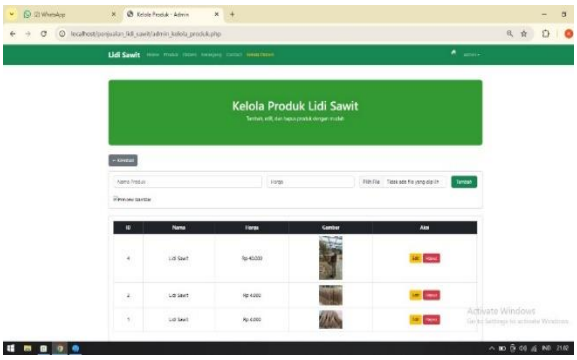

Figure 12. Dashboard Page (Admin)

Figure 12 presents the admin dashboard page for order management in the oil palm midrib sales system. This page displays detailed transaction information, including product data, order quantity, total payment, shipping address, payment method, and order status that can be updated. This feature functions as a systematic control mechanism for managing the ordering process from the seller's perspective.

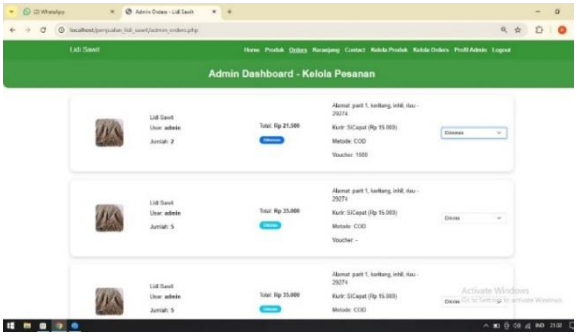

Figure 13. Product Management Page

Figure 13 presents the product management page for the seller (admin) in the oil palm midrib sales system. This page is used to add, edit, and delete product data, which are displayed in a table containing product name, price, image, and action buttons.

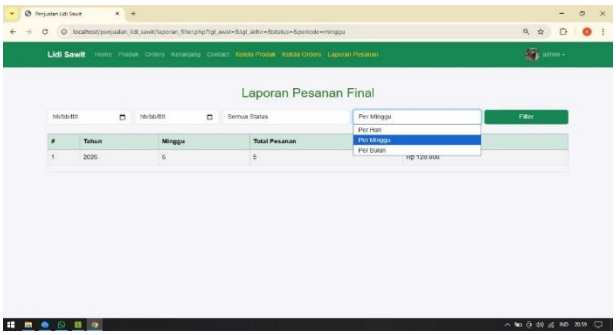

Figure 14. Order Report Page

Figure 14 presents the order report page of the oil palm midrib sales system on the admin side. This page provides data filtering features based on date range, order status, and reporting period (daily, weekly, monthly), and displays a summary of order quantities in tabular form. This feature supports systematic analysis of transaction performance.

C. Database Implementation

The database is used to store all information related to the system, including product data, admin data, buyer data, and order transaction data. The database system is designed to ensure data security, consistency, and integrity. The database is implemented in MySQL and created through the MySQL terminal in the Laragon environment.

5 CONCLUSION

This study developed and implemented a web-based marketing information system for oil palm midrib products to address the limitations of traditional marketing practices in Kayu Raja Village. The system was designed using the Software Development Life Cycle (SDLC) with the Waterfall model, ensuring a structured development process aligned with identified user requirements. Based on functional testing using the black-box method, all core features including product management, online ordering, and transaction recording operated according to system specifications. Furthermore, User Acceptance Testing (UAT) conducted with community members indicated that the system was perceived as easy to use and understandable, particularly in accessing product information and recording transactions.

The implementation results demonstrate that the system successfully formalizes previously manual marketing processes into a structured digital workflow supported by database integration. This transition improves transaction traceability and data organization under small-scale operational conditions. Although long-term impact measurement requires further observation, initial adoption results indicate positive

user acceptance within the rural community context. Therefore, this research contributes not only practically through system deployment but also academically by demonstrating the applicability of structured web-based marketing systems in supporting digital transformation initiatives for rural micro-enterprises.

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