

Design and Impelentation of a Farmer-Centered Web-Based Palm Oil Plantation Management Information System

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Abstract

Oil palm plantations are among Indonesia's major economic sectors, yet many smallholder farmers still rely on manual record-keeping methods, leading to data inaccuracies, inefficiencies, and the absence of financial reports. This study aims to design and develop a farmer-centered web-based information system to support palm oil plantation management. The research adopts the Design Science Research (DSR) methodology, consisting of problem identification, objective formulation, design, development, demonstration, and evaluation. The system was developed using Laravel 10 framework and MySQL database, featuring modules for farmer data, plantation data, fertilization, harvesting, and activity recording. Testing was conducted using Black Box yielding 100% functional success. The results show that this system can assist farmers in managing plantation activities and provides structured, accurate, and easily accessible information to support better decision-making.

Keywords : Palm Oil, Information System, Laravel, Design Science Research

1. INTRODUCTION

Oil palm is one of the strategic plantation commodities in Indonesia that makes a significant contribution to the national economy. In addition to being a source of foreign exchange, the palm oil industry also absorbs a large workforce and supports community welfare. Data shows that this sector can contribute up to trillions of rupiah per year through its main products such as Crude Palm Oil (CPO), cooking oil, margarine, and biodiesel (Agustiyanti, 2024).

Despite its great potential, oil palm plantation management still faces various challenges. Most farmers continue to use manual methods in recording essential activities such as fertilization, maintenance, and harvesting. This creates problems such as delayed maintenance, improper fertilizer system, and difficulties in evaluating both financial conditions and plantation productivity. As a result, crop yields decrease and operational costs become uncontrolled.

Previous studies have also highlighted the importance of implementing information systems in oil palm plantation management. Risawandi et al., (2023) developed a web-based oil palm plantation management information system at PT. Teboplasma Intilestari. The results of their study indicated that the use of such an application can facilitate the company in recording, storing, and monitoring plantation data more efficiently compared to manual methods.

These problems indicate the need for the implementation of information technology in plantation management. A web-based information system allows farmers to record, store, and manage plantation data in a more structured manner. With such a system, farmers can monitor plantation maintenance activities, record fertilizer purchases and usage, track harvest results, and automatically generate financial reports.

Based on this background, this study aims to design and impelentation of a farmer-centered web-based palm oil plantation management information system. This system is expected to assist farmers in improving management efficiency, simplifying record-keeping activities, and supporting better decision-making in the planning and evaluation of oil palm plantation businesses.

2. REVIEW OF LITERATURE

This study is structured based on references and literature from previous relevant research as a foundation of data for the research framework, encompassing theories, methods, and prior research findings.

- a. (Sutianingtyas et al., 2023) developed a web-based agricultural data processing system in Karang Duren Village to address the limitations of manual recording. The application was built using PHP and MySQL with the Waterfall method. The results showed that the system assisted farmers in managing schedules for planting, fertilization, pest control, and harvesting.
- b. (Risawandi et al., 2023) conducted a study on the development of a web-based oil palm plantation management information system at PT. Teboplasma Intilestari Nisam Antara. The research was motivated by the company's reliance on manual data recording. The findings indicated that the system simplified the processes of searching, storing, and managing plantation administrative data.
- c. (Rafiq et al., 2023) designed a web-based application for processing palm oil data at PT. Perkebunan Nusantara VII Sungai Niru. The main issue addressed was the manual recording of production data using paper forms, which often resulted in data loss. By applying the Rapid Application Development (RAD) method, the study succeeded in producing an application that generated faster palm oil processing reports in PDF format.
- d. (Widaningsih et al., 2022) also developed a web-based agricultural data management application using the CodeIgniter framework. Data for the system were collected through interviews and observations with farmers in Cianjur Regency. The study proved that the system supported farmers in managing agricultural data ranging from pre-planting, planting, to harvesting activities.
- e. (Hutagalung, 2021) designed a desktop-based information system for managing oil palm plantation data. The study aimed to resolve issues of unorganized manual data processing. The results showed that the system improved the efficiency of recording sales transactions and monitoring production, thereby reducing errors that frequently occurred in manual record-keeping.

3. METHOD

At this stage, data collection was carried out as the foundation of the research. The data were obtained through observation and interviews with several oil palm farmers located in Bengkalis.

3.1 Research Procedure

The research procedure was carried out through several stages as follows:

- a. **Problem Identification**
The initial stage was conducted through direct observation in oil palm plantations and interviews with farmers. The observations revealed that plantation activity records were still managed manually, which often led to delays in maintenance, errors in fertilization records, and difficulties in generating financial and harvesting reports.
- b. **Data Collection**
Research data were obtained using two methods:
 - i. **Interviews:** conducted with farmers to gather information related to plantation activities (fertilization, maintenance, harvesting, and purchasing).
 - ii. **Literature Review:** using references from books, journals, and previous relevant research to strengthen the theoretical and methodological foundation.

c. System Analysis

After data collection, an analysis of the existing process was carried out. This analysis was used to map the requirements for the new system. The results included the identification of entities, processed data, and the feature requirements that the system should provide.

d. System Design

The system was designed using modeling tools, including a Data Flow Diagram, Use Case Diagram, and Entity Relationship Diagram. In addition, database design and interface design were created to describe the main menu layout and user interaction flow.

e. Application Implementation

The system was developed using the PHP programming language with the Laravel 10 framework and MySQL as the database. The interface design was implemented into login pages, dashboard, and menus for plantation data, fertilization, maintenance, harvesting, purchasing, and automatic reporting.

f. System Testing

Testing was conducted using the Black Box Testing method to ensure that each application function runs according to requirements. The test included login processes, data management, report generation, and display responsiveness across different devices.

g. Report Preparation

The final stage was documenting the research results in the form of a written report, which was then revised into a scientific article in accordance with the journal format.

3.2 System Design

The design carried out in developing the Web-Based Palm Oil Plantation Management Information System includes:

1. Context Diagram

The overall workflow of the system is depicted in the Context Diagram, as shown in Figure 1.

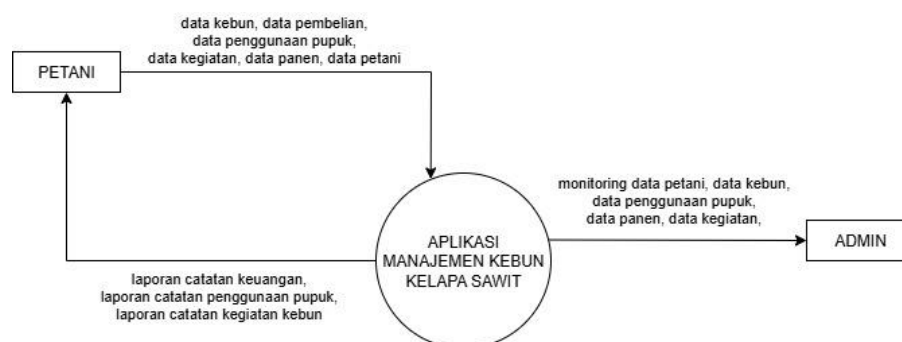


Figure 1. Context Diagram

2. Use Case Diagram

The functional requirements of the system are represented in the Use Case Diagram, as illustrated in Figure 2.

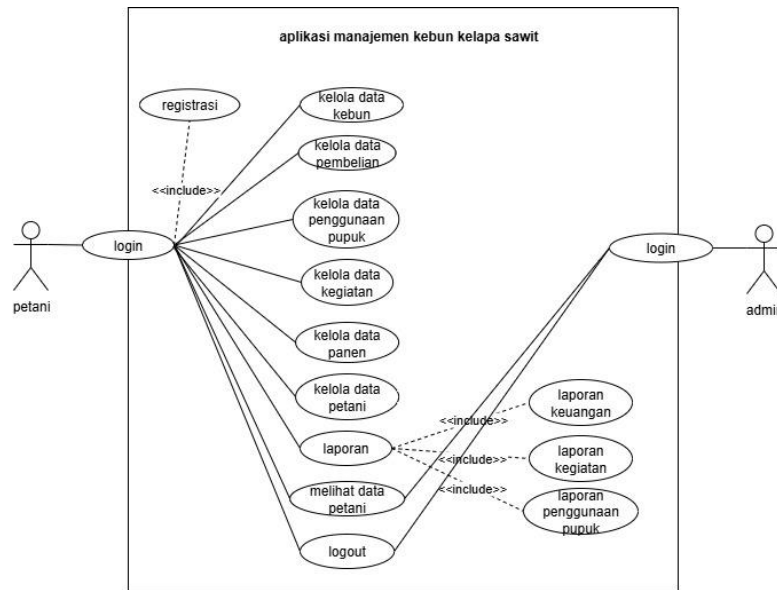


Figure 2. Use Case Diagram

3. Entity Relationship Diagram

The database structure and relationships among entities are modeled in the Entity Relationship Diagram, as shown in Figure 3.

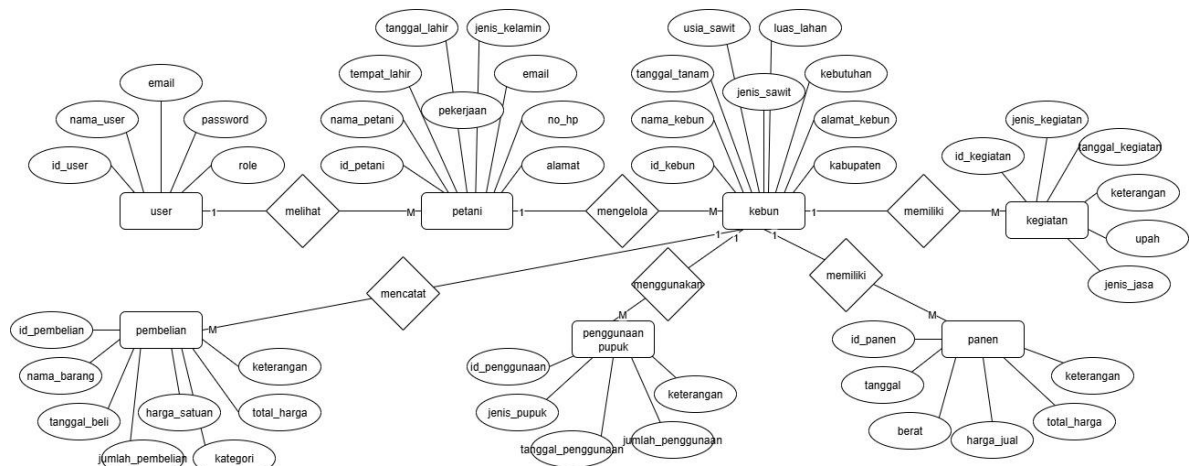


Figure 3. Entity Relationship Diagram

4. RESULT & DISCUSSION

The developed web-based information system provides an intuitive interface for farmers to record and monitor plantation activities. The dashboard summarizes data such as plantation area, harvest results, and fertilization frequency. The Black Box testing confirmed all functionalities met user expectations. The system interface is presented in Bahasa Indonesia and optimized for Google Chrome desktop access.

4.1 Farmer Page Display

1. Farmer Dashboard Page

This page displays the total plantations, harvests, fertilizer usage, and harvest charts in tons belonging to the farmer currently logged into the system, as shown in Figure 4.

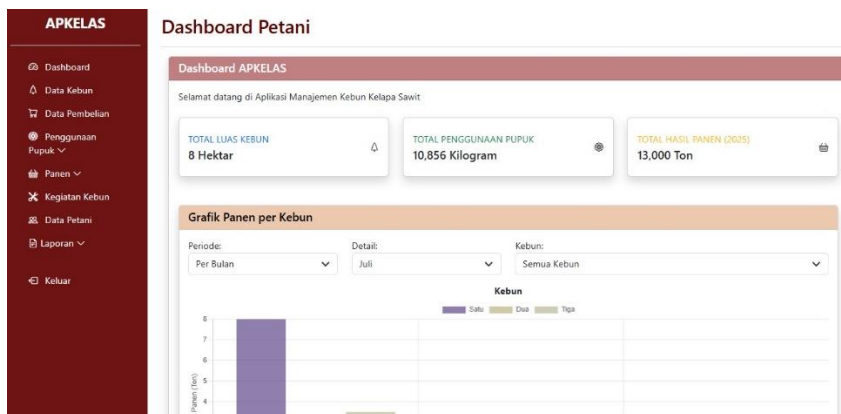


Figure 4. Farmer Dashboard Page

2. Plantation Data Page

This page presents plantation data such as plantation name, planting year, palm age, palm type, land area, and plantation address, as shown in Figure 5.

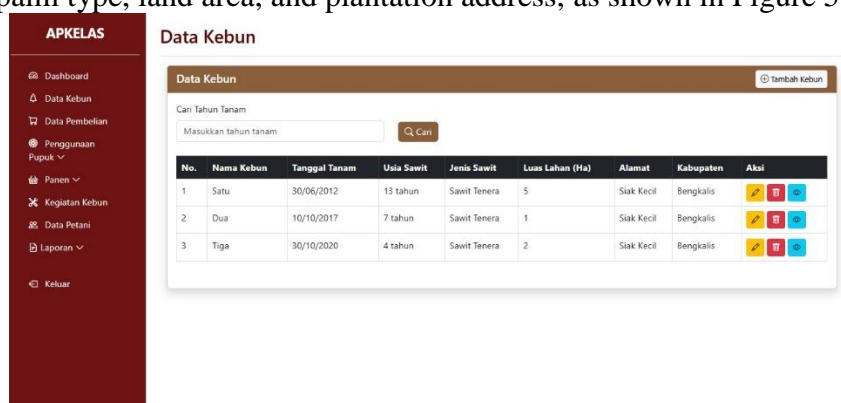


Figure 5. Plantation Data Page

3. Fertilizer Usage Data Page

This page presents fertilizer usage data, including fertilizer type, date, amount (kg), plantation name, and plantation address, as shown in Figure 6.



Figure 6. Fertilizer Usage Data Page

4. Harvest Data Page

This page contains harvest data such as harvest date, selling price, weight (kg), plantation name, and address, as shown in Figure 7.

No.	Tanggal	Harga Jual	Berat (kg)	Total Harga	Nama Kebun	Alamat Kebun	Aksi
1	05/07/2025	Rp 2.700	5.000	Rp 13.500.000	Satu	Siak Kecil	[Edit] [Hapus] [Detail]
2	05/07/2025	Rp 2.700	1.000	Rp 2.700.000	Dua	Siak Kecil	[Edit] [Hapus] [Detail]
3	05/07/2025	Rp 2.700	2.000	Rp 5.400.000	Tiga	Siak Kecil	[Edit] [Hapus] [Detail]
4	18/07/2025	Rp 2.700	3.000	Rp 8.100.000	Satu	Siak Kecil	[Edit] [Hapus] [Detail]
5	18/07/2025	Rp 2.700	500	Rp 1.350.000	Dua	Siak Kecil	[Edit] [Hapus] [Detail]
6	18/07/2025	Rp 2.700	1.500	Rp 4.050.000	Tiga	Siak Kecil	[Edit] [Hapus] [Detail]

Figure 7. Harvest Data Page

5. Financial Record Report Page

The financial record report presents notes related to income and expenses in oil palm plantation management according to the selected period, as shown in Figure 8.

Laporan Keuangan
APKELAS - Aplikasi Manajemen Kebun Sawit
Nama Petani: Arif Kurniawan
Periode: 01/01/2025 s/d 31/12/2025

Nama Akun	Saldo (Rp)
PENDAPATAN OPERASI	
Pendapatan Usaha	35.100.000
Total Pendapatan Usaha	35.100.000
BIAYA OPERASI	
Biaya Kegiatan Kebun	4.000.000
Biaya Pembelian	640.000
Biaya Aset	140.000
Biaya Barang Habis Pakai	500.000
Total Beban Operasi	4.640.000
LABA KOTOR	35.100.000
LABA BERSIH	30.460.000

Kesimpulan:
Berdasarkan laporan laba rugi periode 01/01/2025 hingga 31/12/2025, Anda memperoleh laba bersih sebesar Rp 30.460.000.

Figure 8. Financial Record Report Page

4.2 Administrator Page Display

1. Farmer Detail Page

This page presents details of the most recent activities added by farmers, as shown in Figure 9.

Detail Petani
Detail Aktivitas Petani: Arif Kurniawan
Email: arif@gmail.com

- Kebun (3 lokasi) ▾
- Panen (6 catatan) ▾
- Penggunaan Pupuk ▾
- Kegiatan Kebun ▾

Figure 9. Farmer Detail Page

4.3 Discussion

The testing results indicate that all system functions operate properly according to user requirements. The system can be accessed via both laptops and smartphones, ensuring flexible usage. These findings are consistent with the study by (Risawandi et al., 2023), who developed a web-based plantation management information system for PT. Teboplasma Intilestari Nisam Antara, targeting company administrators to manage plantation data, employees, harvests, and inventories. However, the present study differs by focusing on individual oil palm farmers as the main users, enabling them to directly record plantation data such as fertilizer system, maintenance, harvest results, and financial records, with administrators acting solely as observers. This highlights the unique contribution of the proposed system in providing a farmer-centered digital solution that enhances transparency, flexibility, and structured record-keeping to overcome the limitations of manual practices.

5. CONCLUSION

Based on the research that has been carried out, it can be concluded that this study successfully developed of a Farmer-Centered Web-Based Palm Oil Plantation Management Information System using the Laravel framework and MySQL database, supporting two types of users, namely farmers and administrators. The system is capable of facilitating the recording of plantation activities, including plantation data, fertilizer usage, harvest results, maintenance, and purchases, as well as generating automatic reports in PDF and Excel formats. The testing results show that the system functions according to user requirements and can assist farmers in managing their plantations more effectively and in a more structured manner compared to manual record-keeping. Thus, the information system addresses the problems outlined in the introduction and contributes to improving the efficiency of oil palm plantation management.

6. ACKNOWLEDGEMENTS

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