

Implementation of the Waterfall Method in the Lalungguh Ecoprint Website

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ABSTRACT

The rapid development of the digital era has encouraged MSME (Micro, Small, and Medium Enterprises) owners to adopt technology to enhance business efficiency and effectiveness. Lalungguh Ecoprint, an MSME engaged in sustainable fashion through the use of natural-based ecoprint techniques, still encountered obstacles in product promotion and manual financial record-keeping. This study aimed to develop a website that integrates product catalog management with financial recording into a unified, more efficient system. The development process employed the Waterfall method to ensure a structured and systematic workflow. Laravel was chosen as the primary framework due to its support for the Model-View-Controller (MVC) architecture, which simplifies code organization and modular feature development. MySQL was utilized as the database management system for its reliability in managing complex data storage. The resulting website enables real-time, centralized management of product and financial data and is accessible across multiple devices. This system is expected to enhance operational efficiency, streamline business activities, and broaden Lalungguh Ecoprint's marketing reach through a digital platform.

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1. Introduction

The rapid advancement of information technology has encouraged MSME (Micro, Small, and Medium Enterprises) actors to adopt digital technology to support the smooth operation of their businesses [1][2]. The use of digital technology can be realized through the development of a website that serves as an efficient medium for information and promotion, where the website functions to deliver detailed product information and promotional content effectively [3]. A website not only serves as a company profile, but can also be used as a product catalog and a simple financial recording system for MSMEs.

Lalungguh Ecoprint is one of the MSMEs operating in the fashion sector by utilizing the ecoprint technique, which is a fabric dyeing method that uses natural materials such as leaves and flowers [4][5]. Concern over the increasingly threatened state of the environment has driven the emergence of the ecoprint technique as an environmentally friendly alternative that is being adopted by some people in fabric

production [6]. Ecoprint products are characterized by soft colors and unique natural patterns, giving them a distinct appeal in the eco-friendly fashion market [7]. In order to expand market reach and improve operational efficiency, Lalungguh Ecoprint requires a web-based system that can display a product catalog and record financial data periodically [8].

In developing this website, the Laravel framework is used as the main framework because it provides a Model-View-Controller (MVC) architecture that facilitates structured and efficient code management. Laravel also comes with various built-in features such as routing, authentication, and database management that greatly support the development of web-based applications [9]. As the data management system, MySQL is chosen for its reliability and flexibility in managing relational databases [10][11]. The combination of Laravel and MySQL enables the optimal development of the Lalungguh Ecoprint product catalog and financial recording website, both in terms of functionality and data processing efficiency.

To ensure that the software development process proceeds in a structured and systematic manner, the Waterfall method is chosen as the approach in designing and building this website [12][13]. The Waterfall method is a software development model with clearly defined and structured stages [14]. The stages of the Waterfall Method begin with requirements analysis, system design, implementation, testing, and maintenance [15]. This approach is applied to create a well-organized and systematic workflow so that the developed software can meet user needs while maintaining its quality [16]. The main objective of this website development is to provide an efficient web-based solution for the MSME Lalungguh Ecoprint to manage its product catalog and financial records, as well as to expand its market reach optimally.

2. Research Method

Waterfall is a linear software development method in which each phase must be completed before moving on to the next [17]. This method is ideal for projects with clearly defined specifications from the beginning and that require an organized completion process [18].

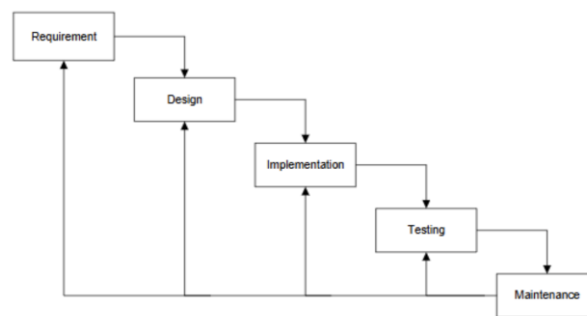


Figure 1. Waterfall method

- a. Requirement Analysis
Requirements Analysis is the process of gathering information to determine system needs, both from the user's perspective (user requirements) and from the technical side of the system itself [19].
- b. System Design
After the requirements analysis is completed, the next step is system design. At this stage, the main focus is to structure the system and design the user interface of the website [20]. This stage also includes system design using a Use Case Diagram to illustrate functionalities, as well as a Class Diagram to represent data structures and relationships between objects [21].
- c. Implementation
The implementation stage is the step where the system is built based on the previously planned design [22].
- d. Testing
After the implementation stage is completed, the next step is system testing. This testing is conducted to ensure that the developed website functions according to the requirements analyzed in the initial stage [23].
- e. Maintenance
Once the system has been tested and deployed, the final step is maintenance. At this stage, the system is evaluated and adjusted if necessary to ensure its performance remains optimal and

continues to meet user needs over time. Maintenance also includes updates and feature improvements based on user feedback [24].

3. Result and Discussion

As a result of this research, a web-based technology system was successfully developed for Lalungguh Ecoprint to improve operational efficiency and expand market reach. This system manages the product catalog and records financial data in a more efficient manner.

3.1. Requirement Analysis

3.1.1. User Requirements

This section refers to the requirements originating from individuals who will utilize the system, including administrators (the owner of Lalungguh Ecoprint) and regular users (website visitors). The following are the requirements for each type of user:

Table 1. User requirements

Code	User Type	Requirements
K1-001	Admin	Login
K1-002		Add Product
K1-003		Edit Product
K1-004		Delete Produk
K1-005		Add Finance
K1-006		Edit Finance
K1-007		Delete Finance
K1-008		Print Monthly Report
K1-009		View the Finance Page
K1-010	Admin and Visitors	View the Homepage
K1-011		View the About Page
K1-012		View the Contact Page
K1-013		View the Gallery Page
K1-014		View the Catalog Page



Figure 2. Use case diagram

3.1.2. System Requirements

System requirements formulation plays an important role in ensuring the alignment between the designed solution and user needs, so that the developed system can perform its functions optimally and in accordance with its objectives [25]. These system requirements include the technical specifications necessary for the system to function properly, including the software and hardware needed to support effective system operations.

Table 2. System requirements

Kode	User Type	Requirements
K2-001	Server	Dual Core Processor
K2-002		4 GB RAM
K2-003		100 GB SSD Storage
K2-004		Intel i3 Operating System
K2-005	Visitors	Computer/Smartphone

3.2. System Design

The system design phase is crucial in software development as it serves as the foundation for the implementation of the system to be developed. During this phase, the system's structure and workflow are designed, as well as the system's user interface, to ensure it meets the users' needs[26].

3.2.1. System Architecture Design

1. Class Diagram

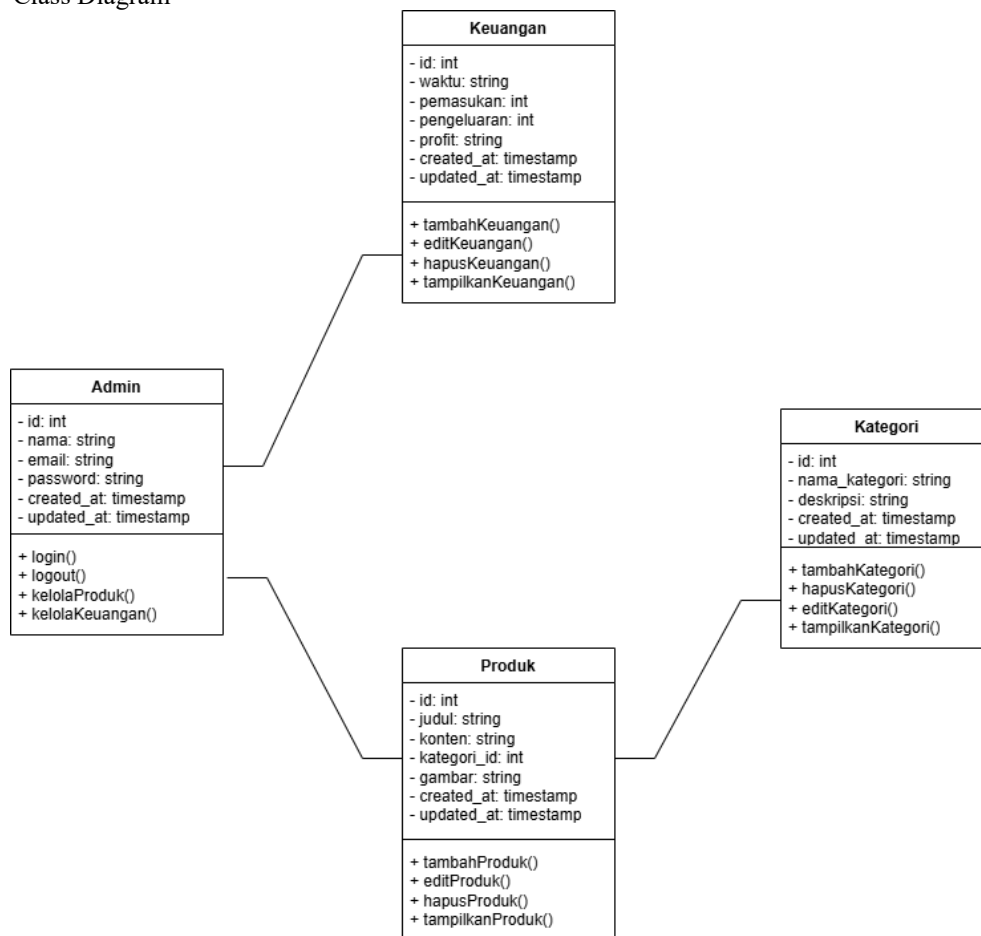


Figure 3. Class diagram

2. Entity Relationship Diagram

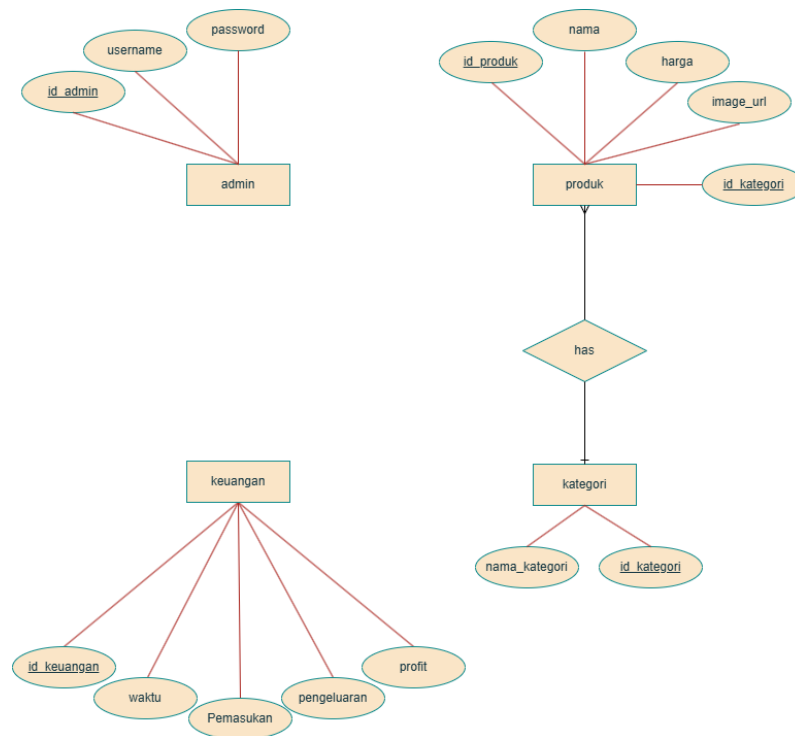


Figure 4. Entity relationship diagram

3.2.2. User Interface Design

At this stage, a wireframe is designed as the initial framework for the website's layout, illustrating the structure and placement of the main interface components. Following this, the user interface (UI) is created as the final visual design to be implemented into the system. The process of designing the wireframe and UI is carried out using Figma, an interface design tool that enables interactive and responsive design visualization across various devices, as well as collaboration among team members.

1. Wireframe

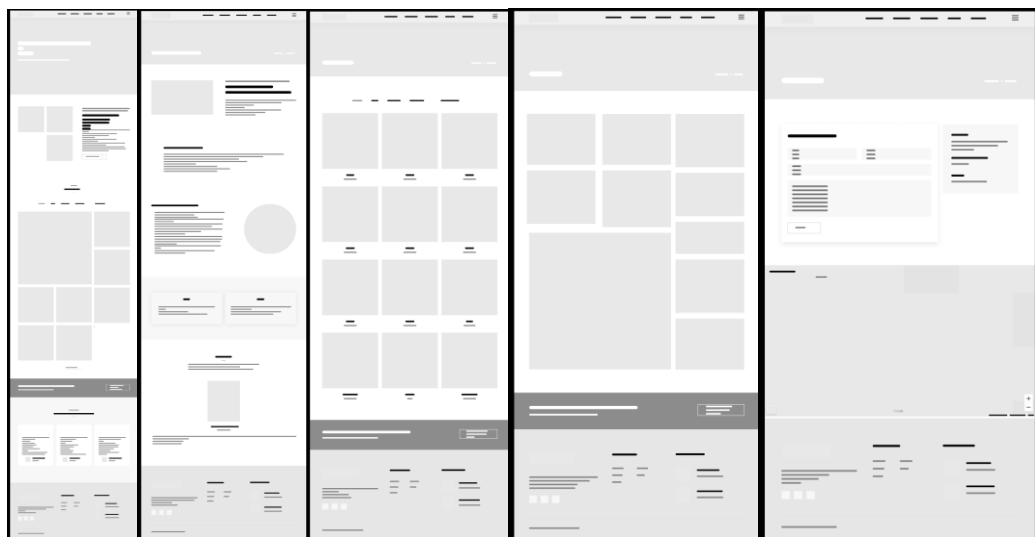


Figure 5. Website wireframe

Wireframe is the initial stage in the process of designing a website interface, serving as a visual framework that outlines the structure and key elements of each page. In the development of the Lalungguh Ecoprint website, wireframes were created to provide a preliminary view of the layout, navigation, and overall user interaction flow.

These wireframes help the development team and business owner understand the placement and function of each component, such as the navigation menu, gallery, product catalog, contact form, and admin dashboard. This approach ensures that the final website design is more focused, aligned with user needs, and capable of delivering an optimal user experience. Wireframes also play a crucial role in identifying potential issues early on, before moving into the coding or more advanced development stages.

2. User Interface

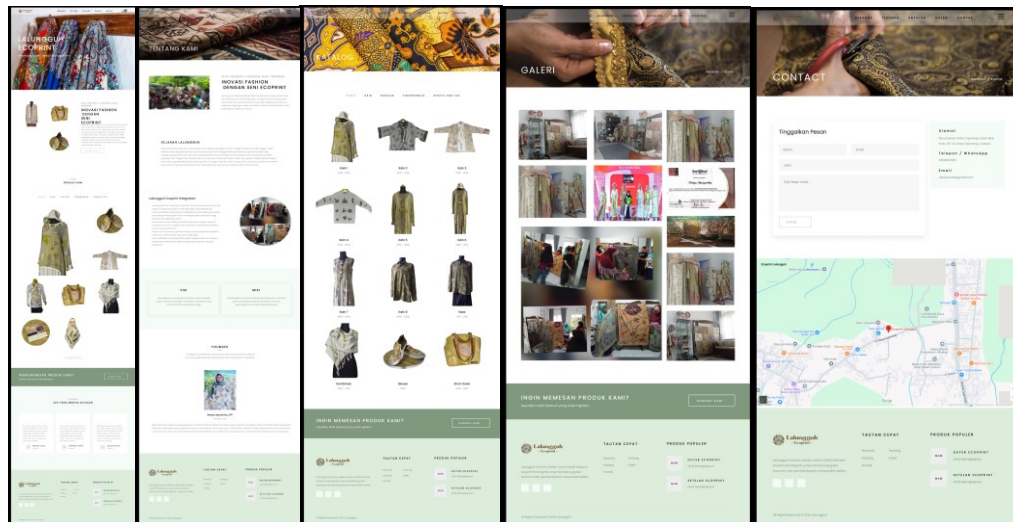


Figure 6. User interface

3.3. Implementation

The implementation process involves converting the planned system design into an application that can be directly used by users[27]. In the development of the Lalungguh Ecoprint website project, the implementation is carried out based on the system design that was previously prepared, including the database structure, user interface design, and the proposed functional logic.

The user interface (frontend) comprises several key pages that can be accessed by visitors, including Home, About, Gallery, Product Catalog, and Contact. The Home page offers a brief overview and serves as the main navigation hub to other sections. The About page describes the meaning behind the name and presents the business profile of Lalungguh Ecoprint. The Gallery page features visual documentation of ecoprint creations in various product forms. The Product Catalog organizes and displays items by category, such as vintage clothing, fabrics, bags, shoes, and accessories. Lastly, the Contact page contains business contact details and a form that allows users to get in touch via social media or email.

The admin section is exclusively accessible to the website owner or administrator and offers several key functionalities. Through the admin dashboard, users can manage the product catalog by adding new products, uploading images, providing descriptions, and organizing or modifying product categories. In addition, the financial management feature enables the recording of monthly income and expenses, with the system automatically calculating profits using the formula: $\text{profit} = \text{income} - \text{expenses}$. To facilitate documentation and financial review, the system also includes a feature to generate and print monthly financial reports in PDF format. These features are designed to enhance the efficiency and ease of managing both products and finances for the business owner.

1. Homepage

This is the landing page that creates the first impression for visitors. It features a slider showcasing ecoprint product images, a brief description of Lalungguh Ecoprint, and main navigation to other sections such as the catalog, gallery, and contact page. It also includes the business tagline and mission to attract visitor interest.

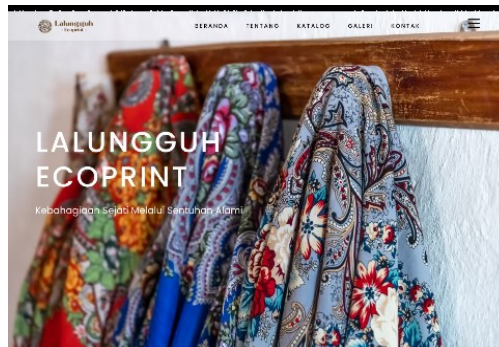


Figure 7. Homepage

2. About Page

This page presents a brief profile of Lalungguh Ecoprint, including the philosophy behind the name "Lalungguh", the business's background, and its commitment to environmentally friendly products. It aims to build customer trust by conveying the values and vision of the business.

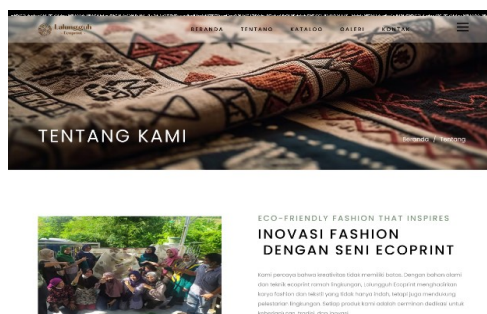


Figure 8. About page

3. Catalog Page

Displays a list of offered products categorized into several types like clothes, fabrics, bags, shoes, and accessories. Each product is shown with an image, name, price, and short description. Visitors can also filter products by category for easier browsing.

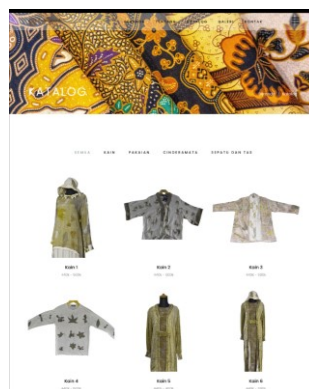


Figure 9. Catalog page

4. Gallery Page

This page showcases visual documentation of ecoprint products. Images are arranged in a grid layout, and each image can be clicked to view in a larger popup. It serves to strengthen the visual identity and aesthetic appeal of Lalungguh products.

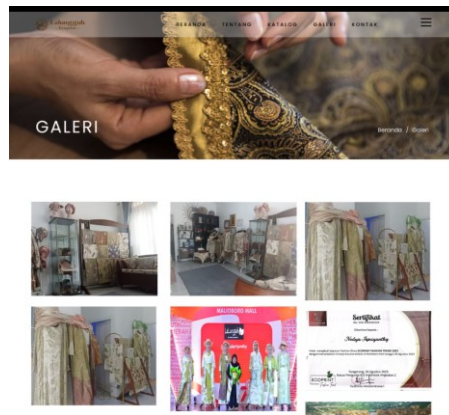


Figure 10. Gallery page

This page showcases visual documentation of ecoprint products, highlighting the uniqueness and artistic value of each creation. Images are arranged in a clean, organized grid layout to enhance visual clarity and user engagement. Each image is clickable and opens in a larger popup view, allowing visitors to appreciate the intricate patterns and natural beauty of the designs in greater detail. This gallery not only strengthens the visual identity of Lalungguh Ecoprint but also reinforces the brand's aesthetic appeal and commitment to sustainable fashion.

5. Contact Page

Provides contact information such as email address, phone number, and links to social media platforms. It also includes a contact form that visitors can fill out to send direct messages to the business owner.

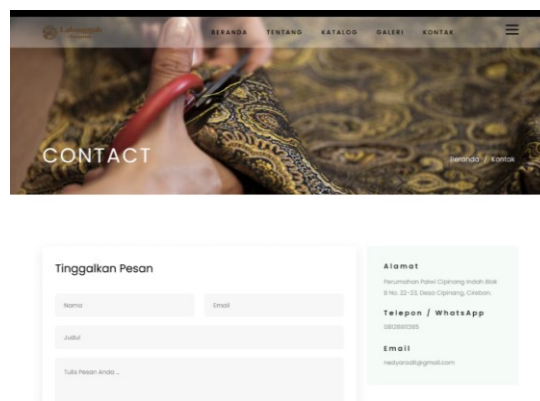


Figure 11. Contact page

This page provides essential contact information, including the business's email address, phone number, and links to its social media platforms, making it easy for visitors to connect through their preferred channels. In addition, it features a contact form that allows users to send direct messages to the business owner without leaving the website. This section is designed to facilitate communication, enhance customer engagement, and support potential inquiries or collaborations with Lalungguh Ecoprint.

6. Admin Dashboard Page

Admin dashboard, this is the main interface displayed after a successful admin login. It features financial data visualizations, including charts for income, expenses, and profit, presented in graph

format. This helps the business owner monitor financial performance quickly and efficiently each month.

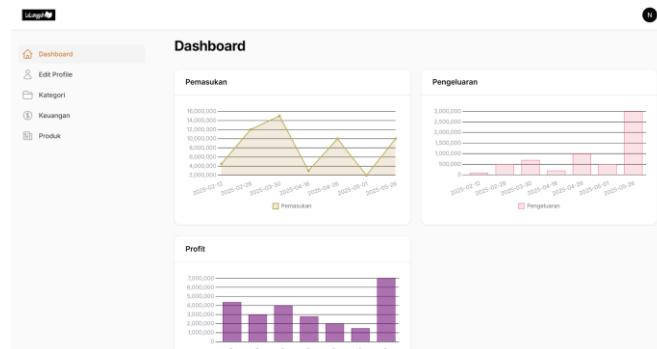


Figure 12. Admin dashboard page

7. Products Data Page

Used to manage the list of products. Admins can add new products, edit product details (images, name, price, description), and delete items that are no longer available. Each product is assigned to a specific category.

Gambar	Judul	Tanggal Dibuat	Kategori	
	Kaos Parang	May 23, 2025	Pakaian	Edit
	Outer 1	May 23, 2025	Pakaian	Edit
	Setelan 1	May 23, 2025	Pakaian	Edit
	Setelan 2	May 23, 2025	Pakaian	Edit
	Setelan 3	May 23, 2025	Pakaian	Edit
	Long Outer 1	May 23, 2025	Pakaian	Edit

Figure 13. Products data page

8. Category Data Page

Displays a list of product categories that can be created, edited, or deleted as needed. This feature supports product grouping within the catalog to make it more organized and easier to search by visitors.

Name	Description	
Pakaian	Pakaian	Edit
Souvenir	Souvenir	Edit
Shoes and Bag	Sepatu dan Tas	Edit
Aneka Kain	Kain Ecoprint	Edit

Showing 1 to 4 of 4 results

Figure 14. Category data page

9. Finance Page

Provides a form for recording monthly income and expenses. The system automatically calculates profit using the formula $\text{profit} = \text{income} - \text{expenses}$. Admins can also export monthly financial reports in PDF format for documentation or further analysis.

Waktu	Pemasukan	Pengeluaran	Profit
Apr 26, 2025	1000000	1000000	0000000
Feb 26, 2025	1200000	500000	1500000
Mar 30, 2025	1600000	700000	14300000
May 1, 2025	2000000	500000	1500000
Apr 16, 2025	3000000	200000	2800000
Feb 12, 2025	4500000	100000	4400000
May 26, 2025	10000000	3500000	7000000

Figure 15. Finance page

10. Monthly Financial Report Feature

To support documentation and financial analysis, the system includes a monthly financial report feature. This allows the administrator to generate and export financial summaries in PDF. The report includes key details such as total income, total expenses, and calculated profit, helping the business maintain proper financial records and evaluate performance trends over time.

Waktu	Pemasukan	Pengeluaran	Profit
2025-01-01 00:00:00	621958	831932	-209954
2025-01-02 00:00:00	1171155	517113	654042
2025-01-03 00:00:00	631932	168168	463764
2025-01-04 00:00:00	1914414	877889	1037325
2025-01-05 00:00:00	739178	748531	10647
2025-01-06 00:00:00	610298	351995	258273
2025-01-07 00:00:00	1232180	778843	453337
2025-01-08 00:00:00	1603462	672843	930619
2025-01-09 00:00:00	637237	336098	298129
2025-01-10 00:00:00	1499890	963591	536299
2025-01-11 00:00:00	1636074	996942	639132
2025-01-12 00:00:00	1412756	206030	1206726
2025-01-13 00:00:00	672383	704365	-29162
2025-01-14 00:00:00	1738911	922332	817559
2025-01-15 00:00:00	779037	580337	217600

Figure 16. Monthly financial report feature

3.4. Testing

The Black Box method is used in the testing process with a focus on evaluating the given input data, without directly examining the program code. The main advantage of this approach is that testers are not required to have technical knowledge of programming languages in order to conduct effective testing [28]. The purpose of compiling this table is to evaluate the extent to which the system operates according to user expectations and to identify any deficiencies or errors that need to be corrected to improve the system's performance. Below is the presentation of the test results for the Lalungguh Ecoprint website system in the form of a table.

Table 3. Black box test scenario

No.	Test Scenario	Test Code	Expected Result	Test Result	Conclusion
1	Login using a valid username and password combination.	DUPL-LLG-001	System redirects to the admin dashboard.	Matches	The login form appears and the username and password combination works correctly.
2	Login fails due to incorrect username.	DUPL-LLG-001	Error message "username or password is incorrect" is	Matches	The message "Username and Password are incorrect." appears, and the login feature cannot proceed.

		displayed.		
3	Login fails due to incorrect password.	DUPL-LLG-Validation 003	message appears stating the field cannot be empty.	Matches The message "Username and Password are incorrect." appears, and the login feature cannot proceed.
4	Login without entering username and password.	DUPL-LLG-Validation 004	message appears stating the field cannot be empty.	Matches A modal alert "please fill out this form" appears and the system rejects the login function.
5	Add product with complete and valid data.	DUPL-LLG-Product 005	Product is saved and appears in the catalog.	Matches The product is saved and an alert "created" appears.
6	Failed to add product due to empty title.	DUPL-LLG-Message 006	Message appears stating that Title is required.	Matches Data is not saved and an alert "please fill out this form" appears.
7	Failed to add product due to missing image.	DUPL-LLG-Message 007	Message appears stating that an image must be uploaded.	Matches Data is not saved and an alert "the image field is required" appears.
8	Failed to add product due to unselected category.	DUPL-LLG-Message 008	Message appears stating that category is required.	Matches Data is not saved and an alert "please select an item from the list" appears.
9	Failed to add product due to empty description.	DUPL-LLG-Message 009	Message appears stating that description is required.	Matches Data is not saved and an alert "the content field is required" appears.
10	Failed to add product due to invalid image file format	DUPL-LLG-Message 010	Message "invalid image format" is displayed.	Does Not Match The file is still uploaded without any error message.
11	Edit product with all data updated correctly.	DUPL-LLG-Product 011	Product data is updated.	Matches The product data is updated and an alert "saved" appears.
12	Failed to edit product due to deleted title.	DUPL-LLG-Message 012	Message appears stating that Title is required.	Matches The message "Please fill out this field." successfully appears, and an update with an empty title is not saved.
13	Failed to edit product due to missing image.	DUPL-LLG-System 013	The system does not save data and displays the message "Image is required."	Matches The message "The image field is required." appears when trying to save changes made. The changes are not saved.
14	Failed to edit product due to unselected category.	DUPL-LLG-Message 014	Message appears stating that category is required.	Matches The message "Please select an item in the list." successfully appears and the changes made are not saved.
15	Failed to edit product due to empty description.	DUPL-LLG-Message 015	Message appears stating that description is required.	Matches The message "The content field is required." successfully appears and changes cannot be saved.
16	Successfully delete product.	DUPL-LLG-Product 016	Product is removed from the	Matches The product is successfully deleted from the product list.

		list.		
17	Cancel product deletion.	DUPL-LLG-Product is not 017 deleted.	Matches	The product is not deleted and remains in the product list.
18	Add financial data with valid input.	DUPL-LLG-Financial data is 018 added.	Matches	Financial data is successfully added and displayed in the financial list.
19	Failed to add financial data due to missing date.	DUPL-LLG-Message appears 019 stating that date is required.	Matches	The message "Please fill out this field." appears and financial data cannot be created.
20	Failed to add financial data due to missing income.	DUPL-LLG-Message appears 020 stating that income is required.	Matches	The message "Please fill out this field." appears and financial data cannot be created.
21	Failed to add financial data due to missing expenses.	DUPL-LLG-Message appears 021 stating that expense is required.	Matches	The message "Please fill out this field." appears and financial data cannot be created.
22	Failed to add financial data due to invalid number format.	DUPL-LLG-Error message 022 "invalid number format" is displayed.	Matches	The "Income" and "Expenditure" fields cannot be filled (cannot type) with non-numeric formats, but the "Profit" field can be filled with a non-numeric format.
23	Successfully edit financial data with valid input.	DUPL-LLG-Financial data is 023 updated.	Matches	Financial data is updated.
24	Failed to edit due to missing date.	DUPL-LLG-Message appears 024 stating that date is required.	Matches	The message "please fill out this field" is displayed.
25	Failed to edit due to missing income.	DUPL-LLG-Message appears 025 stating that income is required.	Matches	The message "please fill out this field" is displayed.
26	Failed to edit due to missing expenses.	DUPL-LLG-Message appears 025 stating that expense is required.	Matches	The message "please fill out this field" is displayed.
27	Edit financial data by entering non-numeric value.	DUPL-LLG-Error message 027 "invalid number format" is displayed.	Matches	The message "invalid number format" is not displayed, and the profit column can be edited with a non-numeric format. However, the income and expenditure columns cannot be filled except with numeric values..
28	Delete financial data by clicking delete button on financial entry.	DUPL-LLG-Financial data is 028 deleted from the list.	Matches	Data is successfully deleted.
29	Cancel financial data deletion when confirmation appears.	DUPL-LLG-Data is not 029 deleted.	Matches	Data is not deleted.
30	Print monthly report by selecting a month and clicking 'export PDF'.	DUPL-LLG-Monthly report 030 PDF is successfully	Matches	The report is successfully printed, but there is no monthly menu.

		downloaded.		
31	Print monthly report for a month with no data and click 'export PDF'.	DUPL-LLG-Empty PDF or message "no data available" is displayed.	Matches	Data is successfully downloaded.
32	Print monthly report without selecting a month and click 'export PDF'.	DUPL-LLG-Message "please select a month first" is displayed.	Matches	The report is successfully downloaded.
33	Display the financial page.	DUPL-LLG-All financial entries are displayed.	Matches	The 'Finance' page is displayed.
34	Filter financial data by month.	DUPL-LLG-Only data from the selected month is shown.	Does Not Match	There is no filter to display monthly data.
35	Access the homepage.	DUPL-LLG-Homepage appears normally.	Matches	The home page appears.
36	Test navigation links on the homepage.	DUPL-LLG-All links direct to the correct pages.	Matches	All links correctly lead to the corresponding pages.
37	Access the "About" page.	DUPL-LLG-Company profile and information page is displayed.	Matches	Successfully accessed the About Us page and displayed company information.
38	Access the Contact page.	DUPL-LLG-Contact information is displayed (address, phone, email).	Matches	Successfully navigated to the Contact page.
39	Click contact links (phone/email).	DUPL-LLG- User can send a message directly via email.	Matches	The message is not sent directly; instead, it navigates to email and requires manual sending.
40	Access the gallery page..	DUPL-LLG-Ecoprint/product images are displayed.	Matches	Successfully displayed the gallery page properly.
41	Click image in the gallery.	DUPL-LLG-Image is shown in a larger view (popup/lightbox).	Matches	Successfully appeared with a pop-up showing a larger image.
42	Access the product catalog page.	DUPL-LLG-Product list is displayed.	Matches	Successfully appeared.
43	Filter products by category.	DUPL-LLG-Products matching the category are displayed.	Matches	Successfully displayed the product list according to category.
44	Click product image to view details.	DUPL-LLG-Product details appear in a new page or popup.	Matches	Product details appear on a new page or popup.

Table 3 presents various results from the testing scenarios that have been conducted, reflecting that the system validity tests have been well fulfilled. Each scenario produces different outputs, illustrating how the system responds to various tested input conditions.

Based on the testing results, it can be concluded that the system is functioning properly. Out of a total of 44 test scenarios, 42 produced results that met expectations, while 2 resulted in failures. Therefore, the system achieved a success rate of 95.45%, indicating that it has fulfilled the majority of the expected functionalities. However, there were two test scenarios that did not meet the expected outcomes. The first issue pertains to the image upload feature in the product section, which still permits the submission of files in

non-image formats such as PDF. Ideally, this feature should enforce file type restrictions to accept only valid image formats. The second issue involves the financial data filtering functionality, which is currently unable to display records based on specific months. Instead, it presents the entire dataset without any monthly filtering capability. These shortcomings indicate the need for further refinement to ensure that the system fully adheres to the defined functional requirements.

3.5. Maintenance

The maintenance phase is a follow up process after the system has been successfully implemented and tested, aimed at ensuring the continuous performance and stability of the Lalungguh Ecoprint website. This phase includes system monitoring, managing catalog content and financial reports, enhancing security, and ensuring display compatibility across various devices. Additionally, it involves addressing issues identified during the testing phase, such as enforcing file type restrictions in the product image upload feature to accept only image formats, and implementing a monthly filter for financial data. With regular and responsive maintenance based on user needs and system evaluations, the website will remain optimal, relevant, and

4. Conclusion

The application of the Waterfall method in developing the Lalungguh Ecoprint website successfully produced a structured, requirement-compliant, and easy-to-manage system. This system facilitates the admin in efficiently managing the product catalog and financial records through centralized data storage. Out of 44 testing scenarios, 42 were successfully executed, resulting in a success rate of 95.45%. The maintenance phase is conducted to ensure the system remains stable and can adapt to future user needs through bug fixes, feature updates, and performance improvements. As part of the maintenance efforts, two failed test scenarios were also addressed: restricting the image upload feature to accept only valid image file formats, and adding a monthly filtering function to the financial data display. These improvements enhance the system's reliability and ensure alignment with the defined functional requirements.

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