Implementation of User Experience Design Approach in Web Based E-Commerce for the Agricultural Sector

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ABSTRACT

The technological advancements of the past have transformed various sectors, including information, education, and commerce. Many utilized the internet to enhance business and trade efficiency. Pantai Gading Village was a significant contributor to agricultural production. Its residents traditionally sold agricultural products locally, resulting in a narrow market scope. Consequently, a web-based E-commerce platform was developed using the User Experience Design Process to aid farmers and expand the market for agricultural products in the village. E-commerce facilitated cost reduction for companies, consumers, and management while enhancing service quality and speed. Through this platform, farmers could promote and sell their products online, overcoming the limitations of the local market and enhancing the village's global visibility. User Experience Design (UXD) improved user satisfaction with products through enhanced usability, accessibility, and satisfaction in interactions. This approach yielded designs that were neat, simple, intuitive, flexible, and appealing, providing users with a unique experience and differentiating products or services from competitors. The author of this study employed the Research and Development (R&D) methodology and the Waterfall development method. The system developed incorporated user experience design processes derived from questionnaire results. Users expressed the need for features such as live chat for each product, shipping options, displaying reviews, and offering Cash on Delivery payment method. This system facilitated and streamlined the marketing of agricultural products, thus boosting sales in Pantai Gading Village.

Keywords: E-Commerce; Agricultural Produce; User Experience Design; Waterfall; Website

INTRODUCTION

The continuous advancement of technology has led to an increasingly enhanced relationship with the surrounding world. This has not only impacted communication methods and work activities but has also influenced various aspects of daily life, including information access, learning processes, and business transactions. As a result, significant changes were observed in key sectors such as information, education, and commerce. This phenomenon reflected a global trend towards broader and more integrated utilization of technology in meeting the evolving demands of humanity (Batubara & Nasution, 2023). The internet has become an efficient medium for conducting business and trade, without geographical limitations in reaching customers (Fauziah et al., 2021). This has prompted many entrepreneurs to establish online stores as a means to reach a broader market (Yanuar & Senubekti, 2022). Additionally, the demand for information access has driven the development of applications that cater to the needs of the public. The impact of these technological developments has been widely felt by society, including rural areas (Nurussofiah et al., 2022).

Rural areas, such as Pantai Gading Village in Secanggang District, Langkat Regency, North Sumatra, play a crucial role in the agricultural sector. With 13 hamlets and a population of approximately 3,675 inhabitants, the majority are farmers producing various agricultural yields. However, the sale of agricultural products is still limited locally. Farmers often sell their products through local middlemen or small local shops at unfavorable prices due to the limited market. To address this issue, the author designed a web-based E-commerce platform to enable farmers to promote and sell their agricultural products online. This initiative also aimed to introduce Pantai Gading Village to the outside world and promote it as a Smart Village through digital technology, thereby increasing the recognition of its agricultural products among the public and expanding the market.

Smart village was a series of rural development concepts that provided solutions to village problems through the utilization of technology (Saputra & Isnain, 2021). The concept of smart village also served as a solution to address various issues faced by village governments and stimulated economic empowerment (Premana et al., 2022). Within the development of smart village, there were five dimensions, namely smart people, smart government, smart

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economy, smart promotion, and smart environment. This emphasized the advancement of technology in trade within a village (Lubis & Yusniah, 2022).

E-commerce, as part of Smart promotion, is crucial for expanding marketing efforts in village development (Krisdiawan & Yulyanto, 2020). With e-commerce, companies, consumers, and management can reduce service costs while improving product quality and service speed. E-commerce business systems also assist farmers in promotion, communication, and distribution of agricultural products (Sudarmaji et al., 2023). With broader marketing channels, production demand increases, stimulating farmer production, and offering more competitive prices to consumers (Ranto, 2022).

User Experience Design (UXD) is the process of developing products to enhance user satisfaction by improving usability, accessibility, and satisfaction in product or application interactions. The success of application development depends heavily on user experience, making UXD a top priority. This approach produces designs that are neat, simple, intuitive, flexible, and appealing, providing users with a unique experience and differentiating products or services from competitors (Setiawansyah et al., 2021).

Previous research has been conducted on the marketing of agricultural products in Pulau Panjang Hilir Inuman Village, titled "E-Commerce Information System for Marketing Agricultural Products in Pulau Panjang Hilir Inuman Village" (Madesko, 2019). This study developed a web-based sales application using PHP and MySQL. The application serves as a B2B platform accessible online to the public, facilitating online sales transactions. Based on the issues discussed and previous research, the author was interested in addressing this research as a contribution to improving sales and expanding marketing in Pantai Gading Village. It is hoped that this system will assist in facilitating agricultural product marketing and increasing sales in the village.

LITERATURE REVIEW

In the research conducted in 2019 by Madesko, a System of Information E-Commerce for Marketing Agricultural Products in Pulau Panjang Hilir Inuman was designed using PHP programming language and MySQL database. The outcome of this study yielded a web-based Business to Business (B2B) sales application accessible online, which successfully increased sales in Pulau Panjang Hilir Inuman.

In the same year, Sofiani & Nurhidayat also conducted research by designing an Information System for Agricultural Product E-Marketplace Based on a Website using the Codeigniter framework. The application design involved analysis of the system, application design planning, and implementation using the Codeigniter framework. The application's feasibility was tested through questionnaires distributed to the community of Banjeng sub-district (Sofiani & Nurhidayat, 2019).

In 2022, Kelana & Tiffany conducted research on the Design of UI/UX Application KITATANIPRENEUR for Agricultural Business Management. The UI/UX of the KITATANIPRENEUR Application was successfully designed as a prototype, which would then be further developed. The aim is for this application to provide solutions to the constraints of accessing agricultural technology information, business management, and broader networking (Kelana & Tiffany, 2022).

Based on these studies, there were innovations in designing and developing an e-commerce information system for Agricultural Products in Pantai Gading Village, based on Web platforms using User Experience Design to enhance user satisfaction with the product through improving usability, accessibility, and satisfaction in product or application interaction.

Through questionnaires, it was found that users needed features such as live chat, shipping options, review displays, and cash on delivery payment methods. This research utilized an R&D approach and the waterfall development method to systematically design the product and test its effectiveness.

METHOD

In this study, the author employed the Research and Development (R&D) methodology and the Waterfall system development methodology.

Research Methodology

Research and Development (R&D) development is a research method utilized to generate specific products and assess their effectiveness (Syahranitazli & Samsudin, 2023). The development research procedure fundamentally comprises two main objectives: developing products and testing their effectiveness in achieving objectives. The first objective is referred to as the development function, while the second objective is termed validation. The steps undertaken for the Research and Development (R&D) research design include Potential and Problems, Data Collection, Product Design,

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Design Validation, Design Revision, Product Testing, Product Revision, Usage Testing, Product Revision, and Mass Production (Fransisca & Putri, 2019). In this research phase, only up to step 6 was conducted, which is Product Testing.

Potential and Problem
The research commenced by gathering information about the issues and needs in Pantai Gading village. One of the primary concerns was the conventional method of agricultural product sales, where products were sold to middlemen at prices determined by them.

Data Collection
In this stage, data were collected from various sources such as observation in the village of Pantai Gading, interviews with the Chairman of Gapoktan Gading Berkah, literature review from relevant books and journals, as well as the preparation of questionnaires. Observation involved direct observation of the agricultural product sales process in the village. Interviews were conducted with Mr. Pajaruddin to obtain more detailed information about the sales process. Literature review was conducted by reading relevant books, journals, and reports related to the research topic. Questionnaires were used to gather input from farmers and consumers regarding the functions and features desired in the system to be developed. The questionnaire served as a data collection technique by posing questions to be answered by respondents. The data obtained from the questionnaire were part of the User Experience Design (UXD) process aimed at determining the functions and features desired by farmers and consumers in the system to be developed.

Product Design
The next step was designing the product. In this stage, the author utilized the Waterfall development method to design a product that would result in a system.

Design Validation
Design validation involved assessing whether the product design would be more effective compared to the old system's operation. Validation was primarily based on rational thought and opinions rather than field facts, meaning the product was still in the form of provisional designs.

Design Revision
After validation through discussions with relevant units, weaknesses could be identified. Once these weaknesses were recognized, the researcher attempted to address them by reducing or adding to the design deficiencies, after which the product underwent testing.

Product Testing
The designed product could not be immediately tested; it needed to be created first, resulting in a product that was then tested. Testing could be conducted through experiments, comparing the effectiveness and efficiency of the old system with the new one.

System Development Methodology
The system development method employed in this research was the Waterfall method. According to Pressman, the waterfall model is a classic, systematic model used for building software. The actual name of this model is the "Linear Sequential Model". It is also often referred to as the "classic life cycle" or the waterfall method. This model follows a systematic and sequential approach. It is called waterfall because each stage must wait for the completion of the previous stage and proceeds sequentially (Risald & Lafu, 2021).
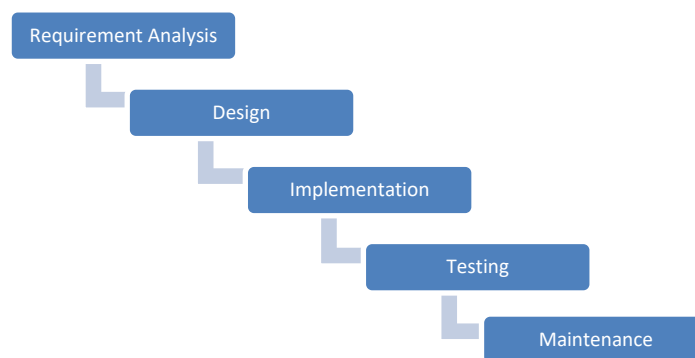
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Fig. 1 Metode Waterfall (Abdul Wahid, 2020)

Requirement Analysis
In this stage, the system developers needed to communicate with users to understand the desired software requirements and existing constraints. This information could be obtained through interviews, discussions, or direct surveys.

Design
In this stage, the developers created the system design to determine the hardware requirements and formulate the overall system architecture.

Implementation
The design that had been planned was developed and implemented into a functioning system.

Testing
In this stage, the system was tested to ensure it met overall requirements. Testing included unit testing (to test individual modules separately), integration testing (to evaluate the system's response when all modules were integrated), and acceptance testing (involving customers or stakeholders to assess whether their needs were met).

Maintenance
This was the final stage in the waterfall method where the fully developed software was implemented and maintained. Maintenance included fixing errors that might not have been detected in earlier stages (Aceng Abdul Wahid, 2020).

RESULT

Requirement Analysis
    The researcher conducted observations on Gapoktan Gading Berkah in Pantai Gading Village. Gapoktan Gading Berkah is a combination of several farming groups in the village. Interviews with the chairman of Gapoktan Gading Berkah revealed that farmers still sell their agricultural products conventionally through local middlemen only, thus limiting their sales market to the local area.

Analysis of the Current System
Farmers sell their produce through local middlemen by contacting them directly. The middlemen visit the farms, inspect the produce, and if satisfied, purchase it from the farmers. This traditional method limits the farmers' market reach as they rely solely on local middlemen for sales. Additionally, the process lacks transparency and efficiency, leading to potential delays and disputes in transactions.

Proposed System Analysis
To address the limitations of the current system and enhance efficiency and transparency in the sales process, a proposed system is suggested. This system would involve the establishment of an online platform where farmers, middlemen, and buyers can interact seamlessly. Farmers would register on the platform, list their produce with detailed descriptions and prices, and await orders from buyers. Middlemen can also register and browse available produce, facilitating transactions between farmers and buyers. Buyers, on the other hand, can search for specific products, place

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orders, and make payments through the platform. The proposed system would streamline the sales process, expand market reach for farmers, and provide greater transparency and convenience for all parties involved.

User Experience Design
In the user experience design process, there were 5 phases: product definition, research, analysis, design, and validation. However, in this study, the author only reached the analysis phase, as this research utilized the user experience design process to understand user needs in the development of the system.

Product Definition
To enhance sales, farmers needed to establish an online sales system so that agricultural products such as vegetables, fruits, and others could be marketed more widely. An e-commerce application tailored to the needs of farmers and buyers in Pantai Gading Village and its surroundings was necessary. The considerable distance between this village and the capital of the district resulted in limited public facilities and services, thus making online transactions less common. Therefore, the opinions of the community regarding the needs and features of the e-commerce application needed to be considered, both from the seller's and buyer's perspectives.

Research
The data for this research consisted of questionnaires tailored to the needs of Pantai Gading Village community. Two different types of questionnaires were used, one for farmers and another for buyers. A total of 31 respondents completed the questionnaire as buyers, and 30 respondents as farmers. The purpose of collecting this data was to determine the preferences for features and functions desired by the community regarding the e-commerce application to be developed. The questionnaires were distributed before the author began developing the application.

Table 1. Questionnaire for Farmers

No	Farmers' Demographics	Answer Choices
1	Full Name	Filled with brief responses
2	Age	1. 18 - 25 years old 2. 26 - 30 years old 3. 31 - 40 years old 4. 41 - 50 years old 5. 50 - 60 years old
3	Address	Filled with brief responses
4	Agricultural Produce	1. Vegetables 2. Fruits 3. Crops 4. Rice 5. Plantation Produce (Rubber, palm oil, pepper, cloves, etc.)
Questionnaire		
1	How do you market your harvest?	1. Selling directly at markets or traditional markets 2. Selling to middlemen 3. Selling through agents
2	How often do you use the internet?	1. All the time 2. Sometimes 3. Rarely 4. Never
3	Have you ever used e-commerce (Online Selling) services?	1. Always 2. Sometimes 3. Never
4	Are you interested in selling your products online?	1. Very Interested 2. Interested 3. Not Interested 4. Not Interested at All

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5	If you were to sell your products online, what payment system would you prefer to use?	1. Cash on Delivery (COD) 2. Bank Transfer 3. Digital Money (Ovo, Gopay, Dana, etc.)
6	If you sell your products online, how do you plan to deliver them to customers?	1. Using courier services 2. Self-delivery 3. Option 3

Table 2. Questionnaire for Buyer

No	Farmers' Demographics	Answer Choices
1	Full Name	Filled with brief responses
2	Age	1. Under 18 years old 2. 18 - 24 years old 3. 25 - 34 years old 4. 35 - 44 years old 5. 45 - 54 years old 6. 55 - 64 years old 7. 65 years old and above
3	Address	Filled with brief responses
4	Occupation	1. Student 2. Housewife 3. Employee 4. Entrepreneur 5. Other
Questionnaire		
1	Do you often shop online?	1. Very Often 2. Often 3. Sometimes 4. Never
2	How often do you make online purchases in a month?	1. Every Day 2. Several times a week 3. Once a week 4. Several times a month 5. Once a month
3	Do you require reviews and testimonials from previous buyers in an online store?	1. Very Necessary 2. Necessary 3. Not Necessary
4	Among the following payment methods, which one do you prefer?	1. Bank Transfer 2. Electronic Money (OVO, Gopay, Doku, etc.) 3. Cash On Delivery (COD)
5	In addition to product information (photos, prices, and product descriptions), what other information do you need about the product you are going to buy?	1. Seller's location 2. Seller's chat feature 3. Payment method options
6	Do you prefer getting assistance through live chat or email?	1. Live chat 2. Email 3. Don't mind
7	Have you ever purchased vegetables or fruits online?	1. Often 2. Once 3. Never
8	Which type of delivery method do you prefer?	1. Same Day service 2. Express (2 - 3 business days)

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		3. Regular (3 - 6 business days)

Analysis

In the process of conducting research to gather data, the next step was to analyze the data obtained from the conducted research. The data can be found in the appendix. From the results of the conducted questionnaires, the needs of the e-commerce system to be developed, tailored to the needs of buyers and farmers, were as follows:

The application displayed reviews or testimonials from previous product buyers.

The designed application provided Cash On Delivery (COD) payment service.

Provided a live chat feature for each offered product.

Options for delivery services were available.

Design

Here is the stage of the System Design or workflow process that occurred in the agricultural product sales e-commerce application depicted in the form of UML diagrams.

Use case Diagram

The use case diagram described the activities conducted by actors acting as users within a system to be constructed or depicted. Below is the use case diagram of the e-commerce system that was to be developed in this study.
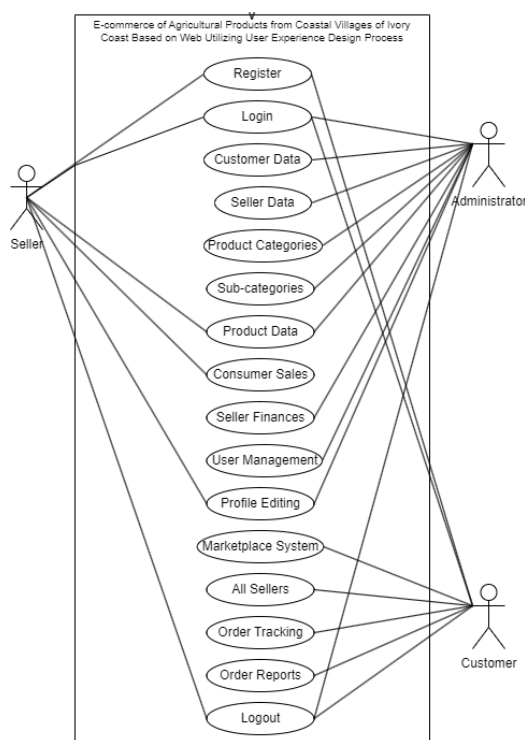

Fig. 2 Use case diagram

The use case diagram represented a description of a scenario of the e-commerce system under development, involving user levels, administrators, and buyers.

Implementation
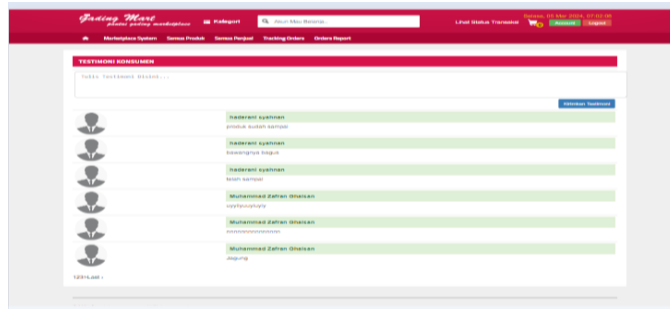
Main UI Display

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Fig. 3 Main UI Display

The fig.3 above depicted the homepage of the website upon initial access. This page displayed products based on their categories, where each product could be clicked to view its details and a button to purchase the product.
Product Detail UI Display

Fig. 4 Product Detail UI Display

Through the fig. 4, there was a detailed display of a product containing additional information about the product, including the available stock quantity, product description, purchase button, seller chat feature, and the option to provide reviews.

Chat with Seller Display

Fig. 5 Chat with Seller Display

The image above is the display of chatting with the seller, where if the buyer wants to contact the seller, they can click the chat with the seller button and later will be connected to WhatsApp as a medium to contact the seller.
Testimonials (Reviews) Display

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Fig. 6 Testimonials Display

In the image above is the display of testimonials from buyers who have purchased products on the website store.
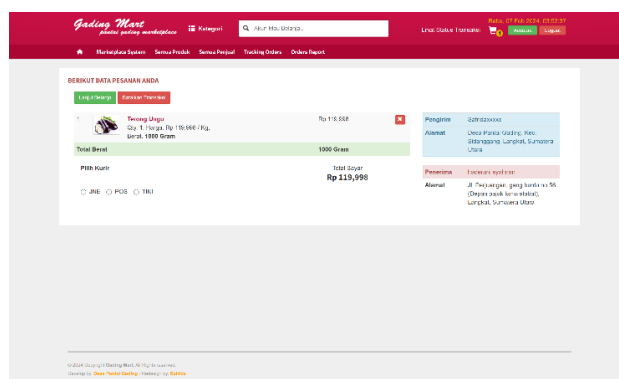
Shopping Cart Display

Fig. 7 Shopping Cart Display

In the image above is the display of the buyer's shopping cart, and at the bottom, there are shipping options that can be selected to send the products to be purchased.
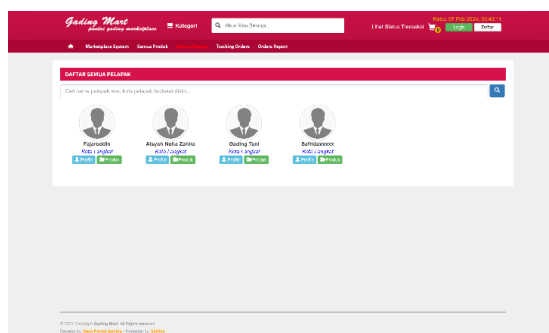
UI Display All Sellers

Fig. 8 All Sellers UI Display

The image above is the display of a list of all sellers who sell their products on the website. And on each seller, there are profile and product buttons that can be clicked to learn more about the seller.

UI Display Tracking Order

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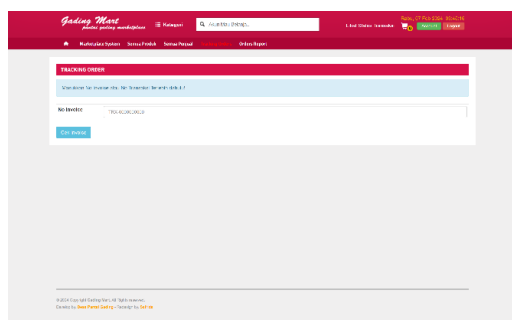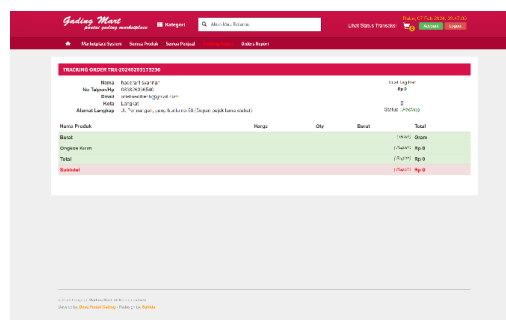
Fig. 9 Tracking Order UI Display   Fig. 10 Tracking Order Results UI Display

In the image above is the tracking order menu display, where we can enter the transaction number we want to check and then click check invoice. After clicking the check invoice button, the tracking order results will appear, and you can monitor the details of the orders that have been made.

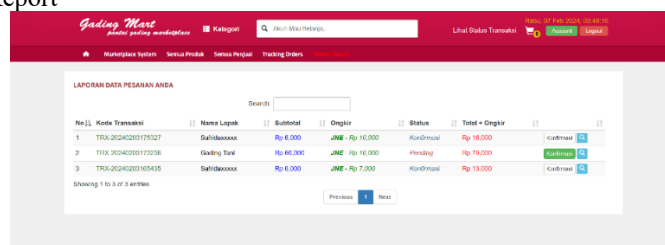UI Display Buyer Order Report

Fig. 11 Buyer Order Report UI Display

In the image above is the buyer order report menu display, where there is a confirmation button that can be clicked to change the pending status to in-process.
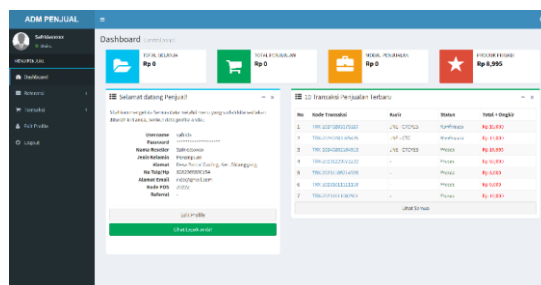
UI Display Dashboard

Fig. 12 Seller Dashboard UI Display

When the seller logged in, the seller dashboard appeared as shown in the image above. In the dashboard, there were menus that could be clicked by the seller.
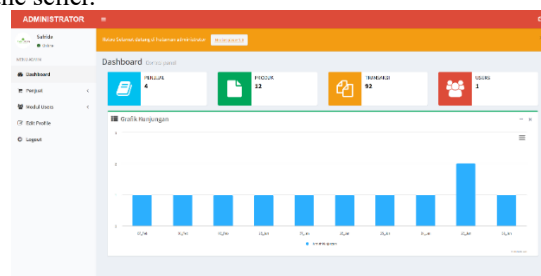

Fig. 13 Administrator Dashboard UI Display

When the administrator successfully logs in, the administrator dashboard page will appear, where there are menus that can be clicked and there is also a visit graph to see the number of visits to the website.

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Testing

The following section will involve testing the completed e-commerce application using the black-box testing method. This method focuses on the functional requirements of the system.

Tabel 3. Testing on the buyer side

Testing	Expected Outcome	Successful	Unsuccessful
Accessing the URL of the Tani Pantai Gading e-commerce site	Displaying the main page of the application and partially showing product data.	Yes	
"All Products" Menu	Displaying all product data including images of products sold on Pantai Gading Mart e-commerce.	Yes	
Clicking on the product image	Displaying detailed product information, as well as featuring a chat with the seller and testimonials (reviews).	Yes	
"Order Tracking" Menu	Displaying the status data of ordered products by entering the transaction code.	Yes	
"Order Report" Menu	Displaying data of products already ordered by the buyer	Yes	
Shopping Cart	Displaying the contents of the shopping cart ordered by the buyer, and presenting options for preferred shipping services.	Yes	

Tabel 4. Testing on the Seller Side

Testing	Expected Outcome	Successful	Unsuccessful
Seller Dashboard	Displaying brief information on purchase transactions already made by members (buyers).	Yes	
"Your Product Data" Menu	Displaying all seller's product data, adding, editing, and deleting data.	Yes	
"Sales to Consumers" Menu	Displaying all sales and orders data received by the seller and updating the sales status.	Yes	

Tabel 5. Testing on the Admin Side

Testing	Expected Outcome	Successful	Unsuccessful
Dashboard Page	Displaying graphical information on member (buyer) visits and showing brief information on seller, transaction, product, and user data.	Yes	
"Product Categories" Menu	Displaying data from all product categories sold on the system, adding, editing, and deleting product category data.	Yes	
"Seller Finance" Menu	Displaying all seller's financial data history and being able to display detailed sales data.	Yes	

DISCUSSIONS

The system developed through User Experience Design (UXD) aims to enhance the interface and usability to meet user needs. E-commerce can serve as an alternative for farmers in terms of promotion, communication, and information provision, as well as streamlining the distribution chain of agricultural products. With broader marketing channels, demand and prices of agricultural products can increase, benefiting farmers. The selection of UXD as the product development process aims to improve user satisfaction by enhancing usability, accessibility, and satisfaction in product interactions. This process yields designs that are neat, simple, intuitive, flexible, and appealing, providing a unique experience for users and setting your products or services apart from competitors. To ensure optimal performance of the distribution information system, it is important to use a laptop capable of preventing system failures during operation. The minimum specifications required are an Intel® Core™ i3-6006U CPU @ 2.00GHz 1.99GHz processor with 4.00 GB of RAM, and a 64-bit operating system, with a x64-based processor. Furthermore, continuous improvement of database security is necessary to reduce the potential for damage. For future development, it is recommended to explore methods other than UXD to achieve differentiation and development in line with the times. Additionally, additional features can be added, and further research is advised to enhance the system with both a web-based application version and a mobile-based application version.

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CONCLUSION

Based on a series of studies, it can be concluded that the web-based agricultural e-commerce in Pantai Gading village has been developed using the User Experience Design (UXD) process. From the survey results obtained by distributing questionnaires to users, it was found that there was a need for specific features. Desired features included an integrated live chat feature for each offered product, various shipping options, the ability to view product reviews, and a cash on delivery (COD) payment method. Based on these survey results, the e-commerce system was then designed and developed, involving the adjustment of features required by users, the integration of these features into the existing design, and testing to ensure functionality and user needs fulfillment. Thus, the developed e-commerce system is expected to better meet user expectations and needs.

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