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Design of a Web-Based E-Commerce Sales System for the Economic Empowerment of Tambak Fish Farmers

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Abstract*— This research addresses the economic challenges of fish farmers in Argomulyo Village, Cangkringan District, by developing a web-based e-commerce sales system. The primary issue identified is the limited market access experienced by these farmers. To address this, the study employs a qualitative research methodology using the Waterfall software development model and gathers data through observation, interviews, literature reviews, and questionnaires. The e-commerce platform aims to enhance economic opportunities for local fish farmers by providing a digital marketplace to overcome limited market access. Quantitative data was collected from 15 respondents using a questionnaire with 10 statements to evaluate the system. The analysis results show that the validity test (R Calculated > R Table) confirms all statements are valid, and reliability is tested with a Cronbach's Alpha of 0.958, exceeding the reference value of 0.6, indicating high reliability. The e-commerce system has proven effective in broadening market reach, boosting sales, and increasing farmers' income. The study results highlight the e-commerce system's positive impact on fish farmers' economic empowerment, demonstrating its potential to foster sustainable growth and market expansion in the digital era. This research provides valuable insights into the use of technology to enhance and advance the lives of farmers in rural communities.

Keywords: Argomulyo Village; E-Commerce; Farms; Fish Farmers; Gtrade Argomulyo.

1 INTRODUCTION

In contemporary times, communication has evolved into a vital pillar of human life, with the internet serving as an essential tool in information systems, indispensable for daily needs. Effective communication is crucial for individuals to overcome limitations in their daily routines and activities [1]. The rapid advancement in communication technology, particularly Information and Communication Technology (ICT) has ushered in an era where distance and time are no longer communication barriers. This evolution has had significant impacts on various sectors, including agriculture.

The use of ICT in fish farming and the fish trade has transformed productivity and economic growth, especially in developing countries. Mobile phones have become key information channels for farmers and entrepreneurs. Through ICT, they can mitigate the risks of failure and efficiently benefit from opportunities. Numerous empirical studies have affirmed that ICT strengthens fish farming communities, enhances productivity, and provides real-time access to market information, technology, prices, weather, and conditions. Therefore, it is crucial to examine the impact and role played by ICT in combating social isolation and enhancing well-being, particularly among fish farmers and entrepreneurs in the agricultural sector. The positive dynamics in market growth can be explained by the fact that agriculture ICTs are vital instruments for increasing production and fostering interactions among governments, company owners, buyers, policymakers, and farmers [2].

However, challenges persist in the fish processing industry, necessitating thoughtful solutions to mitigate potential issues. A prominent concern revolves around the risk of fish spoilage, stemming from high water content, which poses a substantial threat to the livelihoods of fish farmers. This risk spans various stages, from catching and loading to unloading, processing, and sales. Fish spoilage primarily results from infections incurred during prolonged fishing gear settings, payback periods, and inadequate use of ice in storage and transport [3].

To effectively address this issue, it is imperative to devise solutions to overcome obstacles in the fish processing workflow. One promising approach involves adopting modern technology within the fish processing industry. By incorporating technology, such as advanced preservation methods, expedited distribution processes, and integrated production management, fish farmers can significantly boost efficiency and elevate the overall quality of their products. This strategic integration of technology is a viable alternative to enhance the resilience and productivity of the fish processing sector.

E-commerce is the process of selling goods and services over the Internet. Customers visit a website or online marketplace and purchase products using electronic payments. After receiving the money, the merchant ships the goods or provides the service [4]. E-commerce is one of the most developed concepts in the Internet. The use of this system can benefit many parties, both consumers, producers, and sellers. Online shopping provides many conveniences and advantages compared to conventional shopping. In addition to the faster transaction process, the internet has provided almost all items usually sold in full. Prospective buyers can save time and money because they do not need to come to the store or transaction site so they can make decisions quickly from where they sit. Online transactions can connect sellers and potential buyers directly without being limited by space and time [5].

The development of E-commerce is so fast. This is reflected in the number of startups that run e-commerce businesses in Indonesia. Of course, this development is based on significant technological developments and coupled with the convenience generated by the presence of e-commerce [6]. In the trading sector, especially in the fish trade, the implementation of e-commerce brings remarkable impacts. E-commerce enables businesses to reach consumers worldwide without being restricted by geographic limitations. However, the competition in the e-commerce arena is intensifying. Therefore, companies must be responsive to technological developments and innovations that can help improve business performance. Additionally, e-commerce benefits consumers by simplifying the shopping and transaction processes and providing information about offered products.

Nevertheless, various challenges need to be addressed. One research gap is the lack of focus on the effectiveness and security of online payment systems in e-commerce. Such research would assist e-commerce companies in selecting the most effective and secure payment systems for consumers. Furthermore, research should explore the role of technology and innovation in enhancing e-commerce business performance, aiding companies in formulating strategies for success.

Empowering micro and small businesses in fish processing in Argomulyo Village is imperative due to the significant benefits it brings. Fish processing plays a crucial role in enhancing the durability of fish products and facilitates their efficient distribution across various regions [7]. Furthermore, special emphasis should be placed on addressing legal and regulatory considerations, particularly online transactions. This is especially crucial for small businesses that leverage e-commerce platforms. By addressing these key areas, we can create a more conducive environment for the growth and sustainability of micro and small trades engaged in fish processing in Argomulyo Village.

Quantitative data supports the urgency of this study. According to the survey, 60% of fish farmers in Argomulyo village suffer significant losses due to corruption, highlighting the urgent need to improve processing and distribution methods. In addition, 70% of respondents said that lack of market access is a major barrier, highlighting the potential of e-commerce to bridge this gap. To address these issues, a web-based e-commerce sales system provides a digital marketplace that can improve economic opportunities for local fish farmers by overcoming limited market access and reducing perishable losses.

Considering the development of communication technologies and their implementation in agriculture, trade and fish processing, many opportunities for improving productivity, well-being and overall economic growth emerge. However, such implementation also has its challenges and limitations. Through continuous research and innovation efforts, solutions can be identified and developed to overcome emerging problems and more importantly, enhance the potential of technology to support human life. Therefore, it cannot be ignored that information and communication technologies and e-commerce play a vital role in society, farmers, entrepreneurs, and industries in the current digital era.

2 METHOD

This study employs a descriptive quantitative and qualitative research design, aiming to describe social or natural phenomena [8]. This study employed a systematic review methodology, beginning with the development of a protocol and an extensive literature search to identify relevant materials [9]. Data collection was carried out using a structured questionnaire. The questionnaire is an efficient data collection technique if the researcher knows the variables to be measured and understands what to expect from respondents [10]. The questionnaire was designed using Google Forms and distributed to the target population. Responses were collected using a Likert scale, as shown in Table 1.

Table 1 Likert Scale

Value	Description
1	Strongly Disagree (SD)
2	Disagree (D)
3	Neutral (N)
4	Agree (A)
5	Strongly Agree (SA)

2.1 Data analysis

The data analysis involved both validity and reliability testing to ensure the accuracy and consistency of the questionnaire responses.

2.1.1. Validity Test: The validity of the questionnaire was tested using correlation techniques, comparing the calculated correlation values (r_{hitung}) with the table values (r_{tabel}). A statement is considered valid if $r_{\text{hitung}} > r_{\text{tabel}}$. If $r_{hitung} < r_{\text{tabel}}$, the statement is deemed invalid.

2.1.2. Reliability Test: The reliability test was conducted to determine whether the distributed questionnaire is reliable and trustworthy. A Cronbach's Alpha value greater than 0.60 indicates that the questionnaire is reliable, otherwise, if the value is less than 0.60, it is considered non-reliable.

2.1. System Flow

The flow system in an e-commerce website is the main foundation that determines the user experience and overall operational efficiency. This flowchart explains the flow of this Farm Fish E-Commerce sales system. First, the customer or CUSTOMER sees the item to be purchased or desired, then selects the item that has been seen previously, after selecting the item the item goes into the shopping cart or shelter for purchasing goods, then whether there is an addition or reduction for the purchase of the item.

If there are no additional items, the customer inputs the delivery area or their location. Otherwise, the customer returns to the shopping cart to add the items to be added. The system will process the input from the customer. Then the payment is by the total price of the items. After that, confirm the proof that you have made an online payment or e-payment in the system. After finishing and confirming payment, the goods will be packed and sent to the address entered by the customer on the system, as shown in Figure 1.

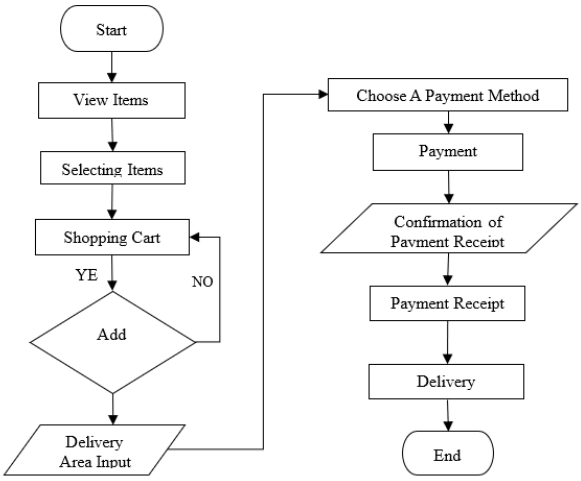

Figure 1. System flowchart website Gtrade Cangkringan

2.2 Dataset

The dataset is a collection of data that serves as the foundation for training, evaluating, and measuring the performance of machine learning models, which has played a fundamental role in advancing the field. Additionally, how we collect, construct, and share these datasets influences the types of problems pursued by the field and the methods explored in algorithm development [11]. In this research, the dataset is sourced from secondary data obtained from Argomulyo Village, Cangkringan District. This data comes from the village office which has complete records and meets the criteria as a sample for system testing. The focus is on fish, which are five types of fish, namely tilapia, red carp, catfish, catfish, and carp.

The number of samples taken for each fish species was 500, totaling 2500 fish that will form the basis of analysis in this study. The selection of these five fish species was based on several factors, including the diversity of fish species commonly found in the area or their relevance to the research objectives. Various factors were considered in selecting these five fish species to ensure their relevance and accurate representation of the conditions in the field.

2.3 Tools Used

Some research tools are needed. First, it uses the following specifications: 10th generation Intel Core i3 processor, 8 GB of RAM, and 512 GB SSD. All of this aims to ensure stable and responsive system performance.

Then, in terms of software, various tools are used to design and develop the website sales system. First, it uses Windows 11, as the main environment in running the application and development process. Furthermore, various programming languages such as PHP, HTML, CSS, and React Native were adopted to design and build important functions in the sales system.

Database Management System (DBMS) is a precise software designed to efficiently and conveniently manage databases. Its primary function is to store, retrieve, and manipulate data in a manner that is both efficient and user-friendly [12]. The DBMS used is MySQL, a reliable system for storing and managing customer, product, and order data. Another is web development software such as Visual Studio Code is the first choice to write and manage website codes with high efficiency.

2.4 Context Diagram

Context Diagram is a graphical representation of a system that illustrates the relationships between external entities, system inputs, and outputs. In a context diagram, the system is depicted as a single circle encompassing all its elements, providing a comprehensive overview of the system's functionality and interaction with relevant external entities [13].

The context diagram below depicts the online sales system and its interactions with related external entities. The center of attention of the diagram is represented by a large circle labeled "Systemize Online Sales," reflecting the focus on the system under discussion.

To the left of the system, there is an entity "ADMIN" that actively interacts with the system. ADMIN contributes by providing inputs such as "Username, Password, Transaction Status" and receives outputs such as "Sales Report, Transaction Data, Stock Info, CUSTOMER Report" that ADMIN's responsibilities involve system management, including transaction verification and report monitoring.

While on the right side, the entity "CUSTOMER" is also involved in interacting with the system. The CUSTOMER provides input in the form of "Username, Password, Payment Method, Advertisement" and receives output in "Product Info, Transaction Status." The CUSTOMER is involved in the product purchasing process and interacts with the system to obtain product-related information and transaction status. On the bottom, there is a direct connection with "Payment Method," showing the system's integration with various payment methods during the transaction process.

At the top of the diagram, the data flow between the system and an unnamed external entity is visible. This data flow includes "No_Order, Fish, Customer Status, Admin" entering the system and "No_Order, Fish, Customer Status" exiting the system. It may signify the involvement of additional external entities, such as suppliers or logistics systems, that interact with the online sales system to manage orders, customer status, and product information as shown in Figure 2.

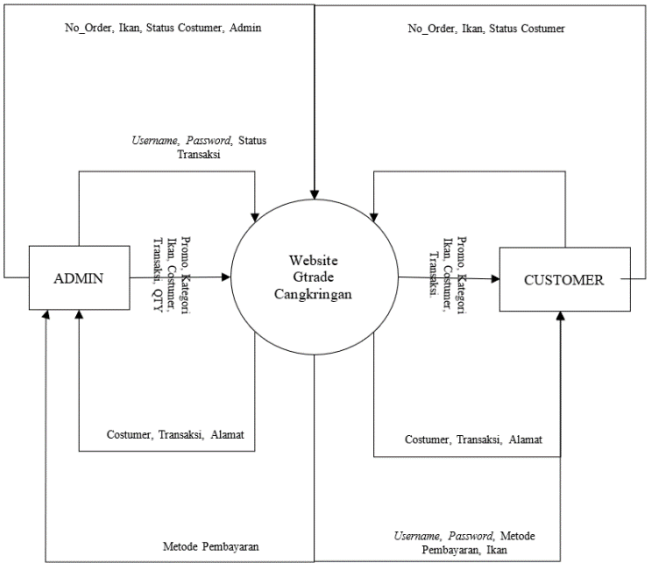

Figure 2. Context diagram

2.5 System Testing

In this study using the Black Box testing method. Where black box testing is one type of software testing that is carried out without paying attention to the internal structure or source code of the program being tested. Black Box Testing is a test that verifies the results of application execution based on the input provided to ensure that the functionality of the application is appropriate to the requirements [14]. In black box testing, a tester only focuses on the input given and the output produced by the program without knowing the implementation details or internal logic used. Some techniques used in black box testing include functional testing, non-functional testing, equivalence partitioning testing, boundary value analysis testing, and others.

The implementation phase of the E-Commerce platform focuses on developing and integrating the system based on the earlier analyzed system design. In this phase,

various supporting variables for e-commerce, such as business branding, social and economic development, and an efficient system e-commerce platform, are considered within the framework application [15]. The process starts with the creation of different units, each of which undergoes thorough testing to evaluate its functionality and performance. This rigorous testing ensures the effectiveness of the system in real-world scenarios. Throughout this phase, meticulous documentation is maintained to archive the research processes and outcomes, providing a valuable reference for future use.

Following the successful testing of individual units, they are integrated into the overall system. A comprehensive system test is then conducted to identify and address any failures or errors that may arise during the integration process. This thorough testing phase aims to guarantee the seamless operation and reliability of the E-Commerce platform in practical situations [16]. Overall, the implementation phase encompasses the development, integration, and meticulous testing of the system, with a focus on achieving optimal functionality and performance.

In essence, the research methodology outlined underscores a systematic and rigorous approach towards constructing an E-Commerce platform for "Pasar Tradisional Ikan Tambak." By adhering to a well-defined research timeline, employing a comprehensive research design, and meticulously executing the research procedure, the study endeavors to provide valuable insights into the domain of traditional market digitization, thereby empowering fish farmers through online market access.

3 RESULT AND DISCUSSION

The following is an interface description of the design of a web-based E-Commerce Sales System developed to support the economic empowerment of farm fish farmers.

3.1 Homepage

The interface design of the main page (home) for the farm fish sales website is directed at increasing the practicality and ease of users in conducting transactions. By structuring the menus, visitors can easily access important options, such as login, register, show promos, available fish, categories, and most popular fish. An attractive and responsive interface is the main focus, inviting users to explore the different types of fish on offer. This design ensures that users can easily navigate the site and find the information they need without a hitch. The home page display can be seen in Figure 3 below.

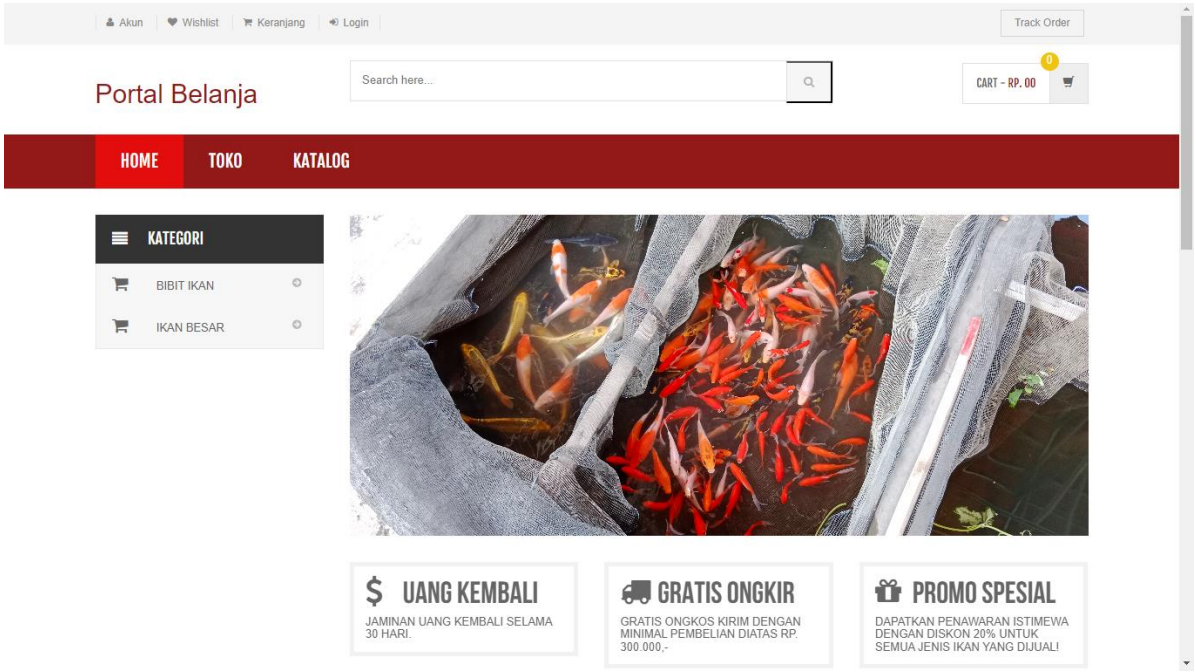

Figure 3. Homepage

In Fig. 3, it can be seen that the display is crucial in attracting users to explore and make transactions on the farm fish shopping portal. Some of the features that are the focus of research include wishlist, cart, fish categories, founder, featured products, and promos. The wishlist feature is explained as a tool to save fish that interests users, with research on its effectiveness, ease of use, and impact on purchasing decisions. The cart feature was important to ensure affordability, clarity, and practicality in the transaction process. Fish categories were identified as an important element in presenting a complete selection to

users, with research covering ease of navigation and information presentation.

The website was raised as a research element to understand how this information can build trust and enhance brand image. Featured product features were also analyzed to understand the influence of these product presentations on user interest and purchase decisions. Promos, including discounts, special offers, and item delivery, are studied to understand their influences on attracting users to make purchases and user satisfaction levels. Overall, this thesis investigates these elements to improve the user experience, increase trust, and drive purchase decisions on farmed fish shopping portals.

3.2 Register Page

The registration page is an interface for registering. The user registration page display on the system starts the registration process by filling in certain fields which can be seen in Figure 4 below.

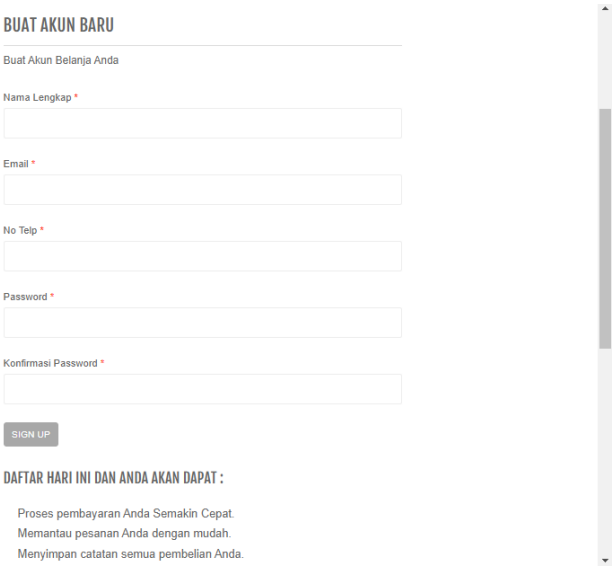

Figure 4. Register page

In Fig. 4, it can be seen that users are required to fill in a valid email address as one of the account verification methods and means of communication. This email address is the main key in confirming the user's identity. Next, the next step is to enter an active phone number. This phone number not only serves as an additional verification method but also facilitates the account recovery process in the future.

The final step in the registration process is for the user to create a strong and secure password. This password must be unique and consist of a combination of letters, numbers, and special characters. This aims to increase user account security by reducing the risk of potential attacks and unauthorized access. By using this combination, it is expected that account security can be optimally maintained.

This register page is important because it serves as a gateway for users who want to use special services or access that can only be accessed with a registered account. With a thorough registration process and strict verification measures, the system can ensure that each registered account is legitimate and operated by its true owner. Moreover, involving dual verification methods such as email and phone numbers, will provide an additional layer of security for users, increasing trust in the platform or service.

3.3 Login Page

Login is a process of entering a computer network by entering an account identity of a user name or user account along with a password to obtain access rights. The login form provides access to your website or web application, and consequently, to your data [17]. The login page is a web page that validates a user's identity before they can access a specific personal account or service. The login page is used by users who have registered with the system to enter the system and perform activities according to the level of each user. To log in, users visit the login page and enter the correct user email and password, obtained from the registration process. Furthermore, after users have entered the username and password correctly, they fill in the security code provided by the system. The system's login page will display a form or text box where users enter their login information, such as email, password, and security code. The login page may also include a "Login" or "Sign In" button to send the login information entered by the user to the server for verification. The login page can be seen in Figure 5 below.

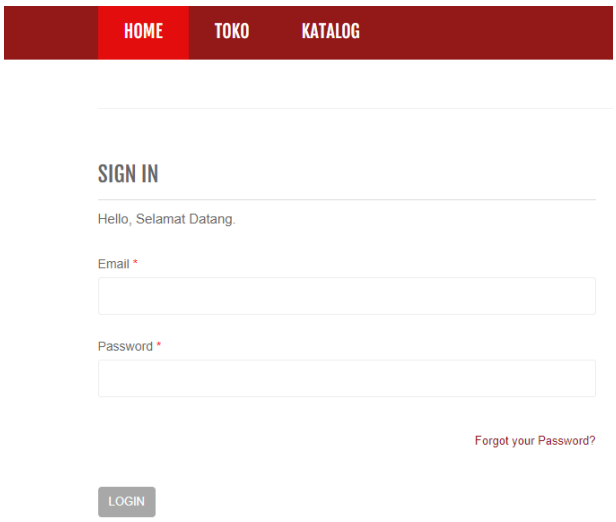

Figure 5. Login page

In Fig. 5, it can be seen that the login process utilizes an authentication-based security system, which verifies whether the entered credentials match the data in the database. If the entered credentials are correct, the system will grant access permission and the user can use the account or page that has been addressed. If the credentials entered are incorrect, the user needs to try again or recover the account through the procedure set by the service provider. This login process is one of the key steps to maintain the security of user data and provide a personalized experience according to the authenticated user identity.

3.4 Shop Page

The shop page is a webpage on a website or platform designed for the sale of products or services to customers via the Internet. Shop pages are the options utilized by merchants for promoting products or services to customers [18]. The shop page on the farm fish sales website is an online platform that provides various types of farm fish for users who are interested in buying fresh fish or fish seeds practically. The shopping portal on this website consists of several categories that make it easier for users to find the fish they want. The shop page display can be seen in Figure 6 below.

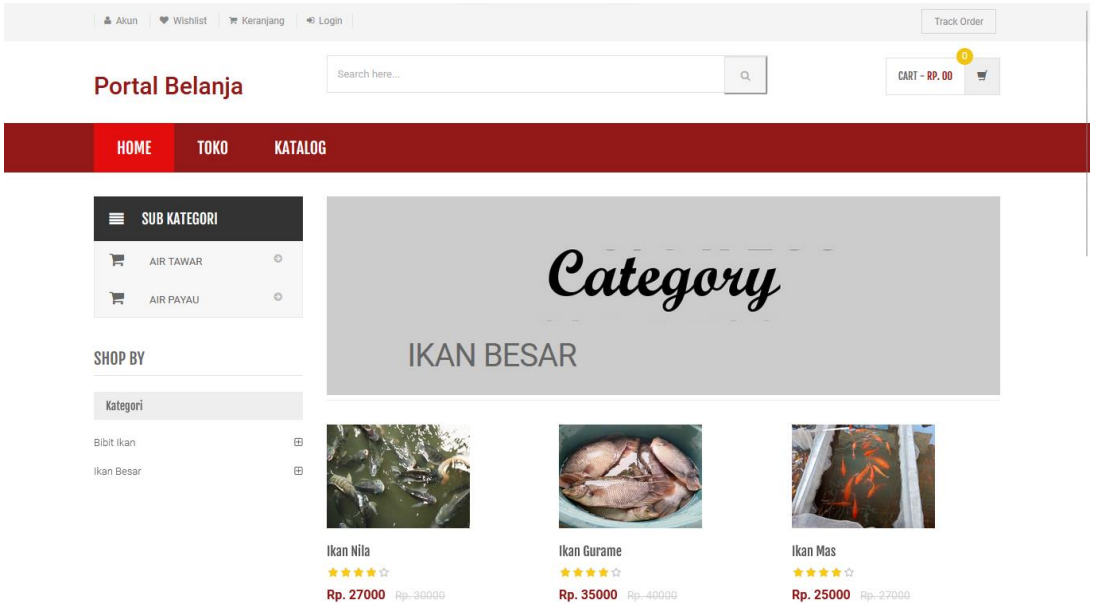

Figure 6. Shop page

The shopping portal on this website makes it easy for users to find the fish they want through structured categorization. There are several main categories, namely big fish and fish fry. The categories are further divided into

subcategories of brackish and freshwater fish, which increase the ease with which users can find fish according to their needs.

The information presented on the shopping portal is also very comprehensive. Each fish has its own identity, including the fish name, and the price before and after the discount. This disclosure makes it easy for users to know the true value of each product and compare it with other options. This helps users to make the right decision that suits their budget.

Another advantage of this shopping portal is the presentation of information about fish farmers in Argomulyo Village. This information includes the farmer's background, sales operation time, and contact details. This provides added value to users who care about the origin and quality of the fish they buy. With this information, users can get closer and connect with the farmer, providing a sense of trust and transparency in the buying process. The portal offers a good online shopping experience with clear category groupings, comprehensive product information, and direct engagement with fish farmers. This not only enhances user convenience but also builds customer trust and satisfaction.

3.5 Farmed Fish Order Cart Page

A shopping cart is a software application that enables customers to gather the items they intend to purchase before proceeding to the payment and checkout process. The shopping cart page is a webpage that displays the items selected for purchase before proceeding to further steps[19]. The process begins with users accessing the Farmed Fish Ordering Page, where they choose the specific type of farm fish they wish to purchase. Following this selection, users proceed to the Shopping Cart Page, which exhibits the products added to the cart from either the main page or the preceding product detail page. The primary purpose of the cart page is to compile the products intended for purchase [20].

Within the Shopping Cart Page, users may remove products from their cart by reviewing the product list and clicking the delete button. Once users have finished their fish selection, they move on to the Shopping Cart Page, where a comprehensive summary order is displayed. This summary encompasses details such as the selected fish type, order quantity, and the option to make adjustments or additions before initiating the payment process.

Designed as an intuitive interface, the Shopping Cart Page aims for a seamless and efficient experience in managing their farm fish orders. The farmed fish ordering page display can be seen in Figure 7 below.

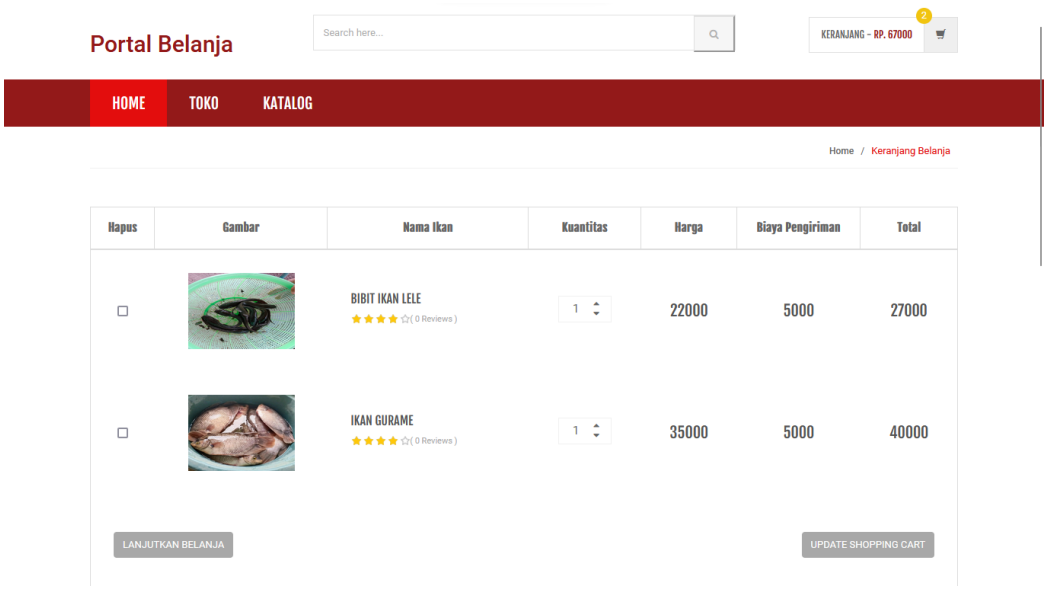

Figure 7. Farmed fish ordering page

In Fig. 7, it can be seen that the farmed fish ordering page is designed to provide an intuitive and user-friendly shopping experience for customers who want to order fresh fish. Begin on the product page to the Shopping Cart, users are presented with an ordered and informative display. The cart table on this page takes center stage by clearly showing the order details. The columns include all the essential information, making it easy for users to manage and verify their orders. The delete column feature takes center stage, giving users full control to delete unwanted items quickly and easily.

Each selected fish item is displayed with full details, from the name of the fish to an image that helps users identify the type of fish. Quantity and price information per item are displayed, making it easy for users to view their order in its entirety. Transparently listed shipping costs also provide a complete overview of the total cost of the order.

The total order price is displayed at the bottom of the table. Users can manage their cart contents easily, adjusting quantities or even deleting items, following proceeding to the checkout process.

The structured design and clear information offered by the Farmed Fish Ordering Page not only ease the users in viewing and managing their orders but also create a pleasant and efficient online shopping experience. The high flexibility in managing orders ensures that users can customize their orders according to their preferences and current needs. Thus, this page not only fulfils functional needs but also creates a sense of trust and convenience for customers purchasing fresh fish online.

3.6 Shipping and Payment Input Page

The shipping and payment entry page is important in the online purchase process where users can enter shipping address information and payment details to complete the transaction. The shipping page is divided into two tabs, highlighting shipping and collection methods. The Shipping Page displays items ordered, quantities, and fields related to shipping, such as the shipping address, during an ordering session. It is also where certain features, such as rush fees, are activated [21]. On this page, users will be required to fill in several fields with relevant information. Once the user has filled in all the required information, they can select their desired shipping method and available payment options before proceeding to the final step in their buying process. The shipping and payment entry page can be seen in Figure 8 below.

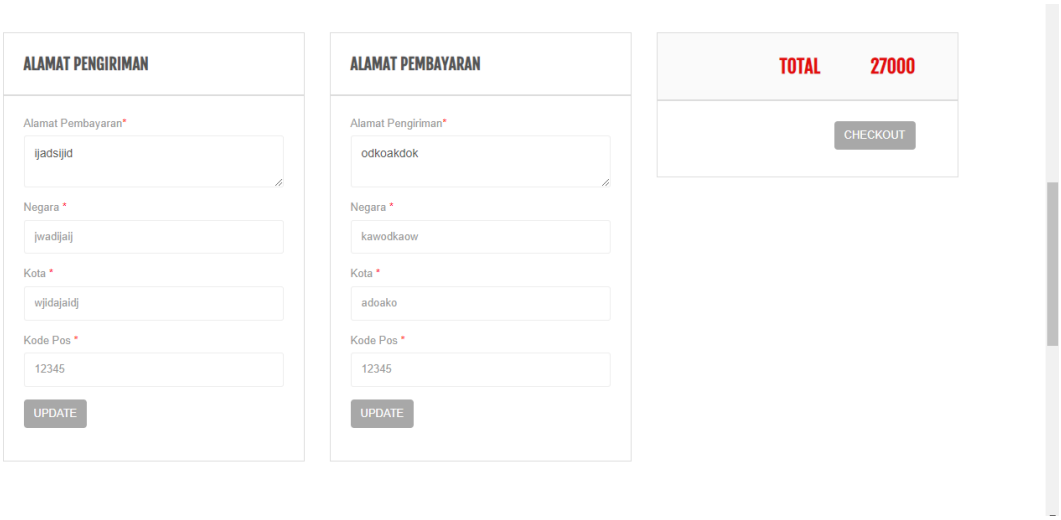

Figure 8. Shipping and payment entry page

In Fig. 8, it can be seen that users will be asked to fill in several fields with relevant information. First, the user is asked to fill in the full address, including the street name, house number, or apartment. Then, the user will be asked to select the country and city where the item will be delivered, and the corresponding zip code. This process ensures that the package can be delivered accurately and on time according to the address desired by the user. Once the delivery address is set, the user is asked to fill in the payment details. On this page, users will be asked to enter their credit card information or other payment method according to their preference.

The information requested usually includes the card number, expiration date, cardholder name, and security code. In addition, some platforms may also ask for the billing address if it differs from the shipping address. Efficient and secure use of the Shipping and Payment Entry page is necessary to ensure that orders are processed correctly and customers' data is protected.

3.7 Payment Method Page

The Payment Method page serves as a valuable resource for users, aiding them in selecting a payment method that aligns with their preferences and convenience. While the growth of non-cash transactions may experience a gradual slowdown due to factors such as rising inflation and geopolitical risks, comparative data indicates a rising popularity in new payment methods like instant payments, electronic money, mobile and digital wallets, account-to-account transfers, and QR codes [22].

This page offers flexibility in choosing payment methods for users: Cash on Delivery (COD), Bank Transfer, or Debit/Credit Card. Furthermore, it equips users with comprehensive information about each payment method and a step-by-step guide for executing transactions using these options. Additionally, users can access details, such as estimated payment processing times and refund policies associated with each method, reinforcing the commitment to providing a transparent and secure online shopping experience. The payment method page can be seen in Figure 9 below.

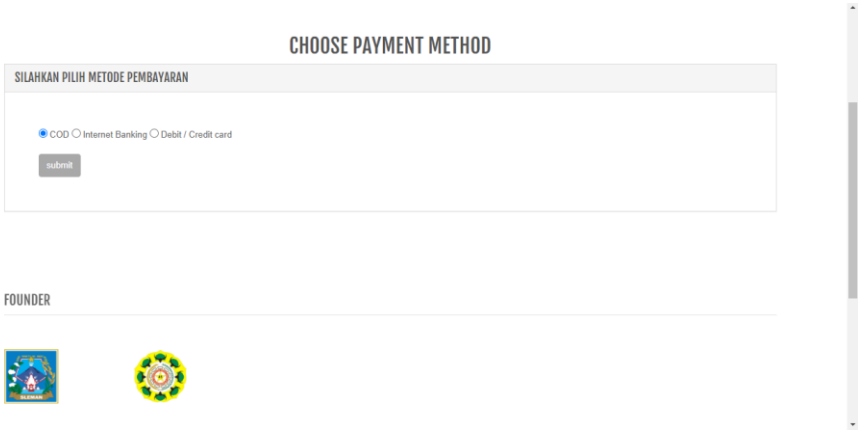

Figure 9. Payment method page

In Fig. 9, it can be seen that users are given the option to choose one of the three available payment methods, namely COD (Cash on Delivery), Bank Transfer, or Debit/Credit Card. The COD payment method allows users to pay for their order in cash when theirs arrives at the designated location. This is a suitable option for users to be more comfortable making payments directly after receiving the ordered products or services.

The Bank Transfer method facilitates users in making payments by transferring funds directly from their bank account to the seller's account. Payment via bank transfer involves the electronic transfer of funds from one bank account to another. Bank accounts often serve as typical examples in Domain-Driven Design (DCI), with classes representing various accounts. The Bank Transfer method facilitates users in making payments by transferring funds directly from their bank account to the seller's account. Payment via bank transfer involves the electronic transfer of funds from one bank account to another. Bank accounts often serve as common examples in DCI, with classes representing various types of accounts[23]. This method offers the convenience of making payments without the need to carry cash to users. However, users must transfer the funds to make the goods or services are delivered. Meanwhile, the Debit/Credit Card option lets users pay using a debit or credit card associated with their bank account.

This method usually offers security, convenience, and protection to the transaction. By providing three different payment method options, this page gives users the flexibility to choose a mode of payment that suits their preferences and needs, enhancing the overall shopping experience.

3.8 Order Tracking Page

The farm fish sales website features an Order Tracking Page. The page serves as an online shopping platform specifically created to streamline the tracking of fish orders for users. In the context of this website, order tracking involves the extraction of both the amplitude and phase of individual components constituting vibration or acoustic signals. These components are referred to as "orders" due to their association with frequencies related to the rotating speed of the machine, a terminology initially introduced when order tracking was first implemented [24].

The Order Tracking Page prominently displays a comprehensive order table, presenting crucial information such as the order number, fish name, fish image, quantity, price, shipping cost, total price, payment method, Order Date, and an Action button for user interaction. This systematic arrangement ensures that users can easily and efficiently monitor and manage fish orders through a user-friendly interface. The order tracking page can be seen in Figure 10 below.

In Fig. 10, the order table provides clear and detailed information about each order. Users can easily identify their orders using the order number. In addition, the fish name and picture help users identify the type of ordered fish. Moreover, information on quantity, price, shipping cost, and total price provides a complete overview of the cost and the number of ordered fish.

One of the key features of this Order Tracking Page is the Action button provided for each order. Through this button, users can check the status of their orders easily. By clicking the Action button, users can find out about the orders, and whether the orders have been processed or not. The order status tells users whether the order is in the packaging process, in transit, or has already reached its destination. This feature provides transparency to users so they can monitor the progress of their orders in real-time.

The Order Tracking page provides users with clear, targeted, and comprehensive information about the status of their orders. With this feature, users can better manage their expectations and know when they expect delivery of their orders. Thus, this pond fish sales website provides a more targeted, transparent, and satisfying shopping experience. Users feel engaged and informed throughout the buying process.

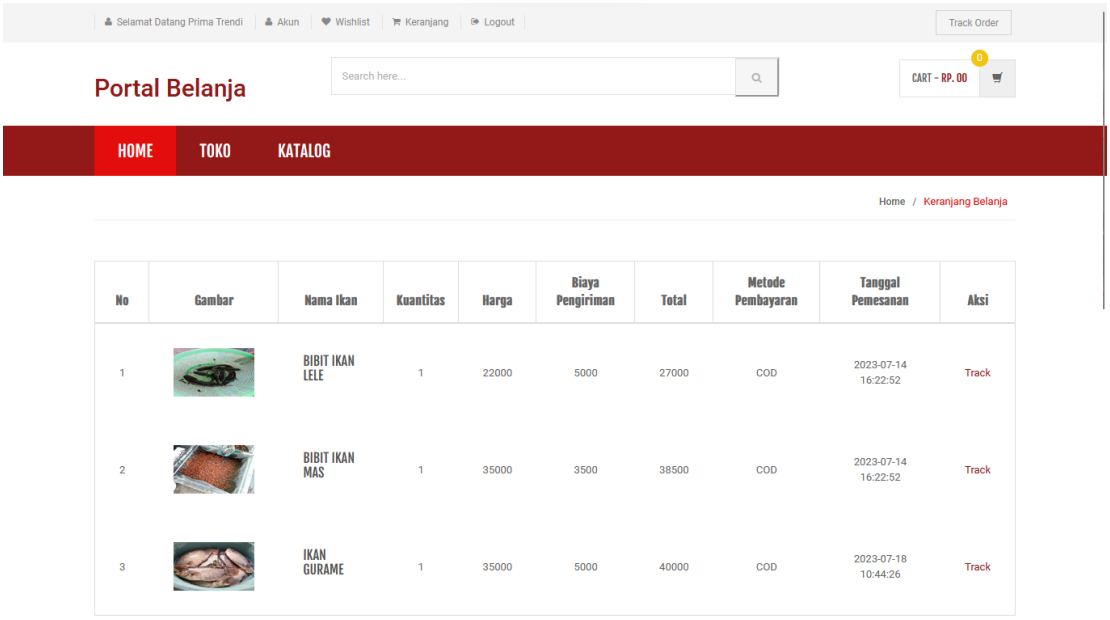

Figure 10. Order tracking page

3.9 Product Input Page

This page allows farm fish farmers and admins to manage and add fish products that will be offered to buyers. This Product input page is designed with a user-friendly interface, making it easy for farm fish farmers and admins to fill in product information such as fish type, weight, price, and stock availability. In addition, there is a feature that allows them to upload product images so that buyers can see the quality and condition of the fish offered. The product input page can be seen in Figure 11 below.

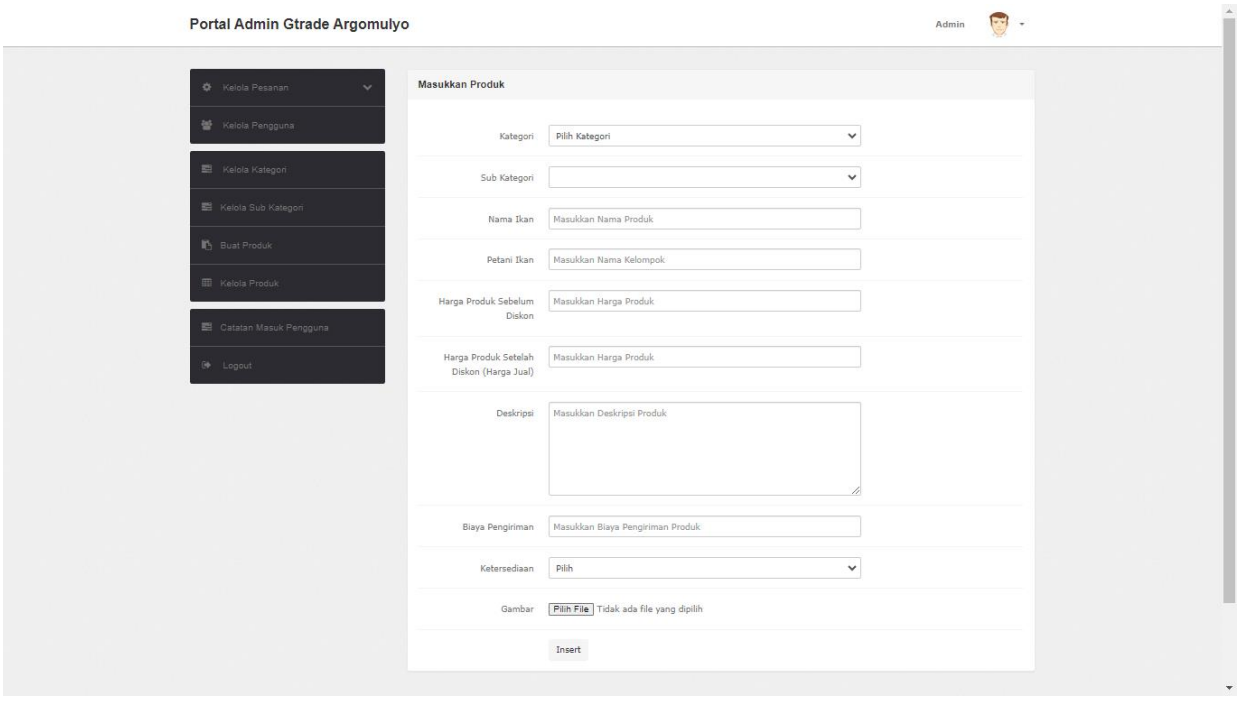

Figure 11. Product input page

In Fig. 11, it can be seen that the product input page on the Gtrade Argomulyo website serves as a platform for both farm fish farmers and administrators to manage and add fish products available for purchase. Administrators use this page to input products into the application, effectively creating a catalogue from which consumers can place orders [25]. This streamlined process ensures efficient management of product listings and facilitates seamless order processing for administrators and consumers alike.

The process starts by selecting the appropriate category and subcategory for the fish product. Next, farm fish farmers and admins can enter information about the fish names, the fish farmer who provides it, the price of the

product before the discount, and the selling price after the discount to be offered to customers. A description of the fish can also be entered to provide potential buyers with more information about the characteristics and uniqueness of the product.

Shipping costs will be set to inform customers about the shipping costs that will be charged. Fish farmers and admins can also set the availability of the product. To provide a visual picture, fish farmers and admins can enter images of the fish products so that customers can see what the products offered are like. With this Product Input Page, fish farmers and admins have full control over the content and product information displayed on the Gtrade Argomulyo website, ensuring a better and more satisfying shopping experience.

3.10 Manage Order Page

On the Order Management Page, the receiving, fulfilling, or tracking order at a level that aligns with a customer's expectations is processed. It is a pivotal and intricate aspect within the production processes of the iron and steel industry, given that orders serve as the connection between customers and semi-finished/final products across various units [26]. The Manage Order page on the Gtrade Argomulyo website gives full access to pond fish farmers and admins in processing orders from customers. This page is designed to make it easier for farmers and administrators to monitor and operate the status of orders from entry to delivery to customers. The manage order page can be seen in Figure 12 below.

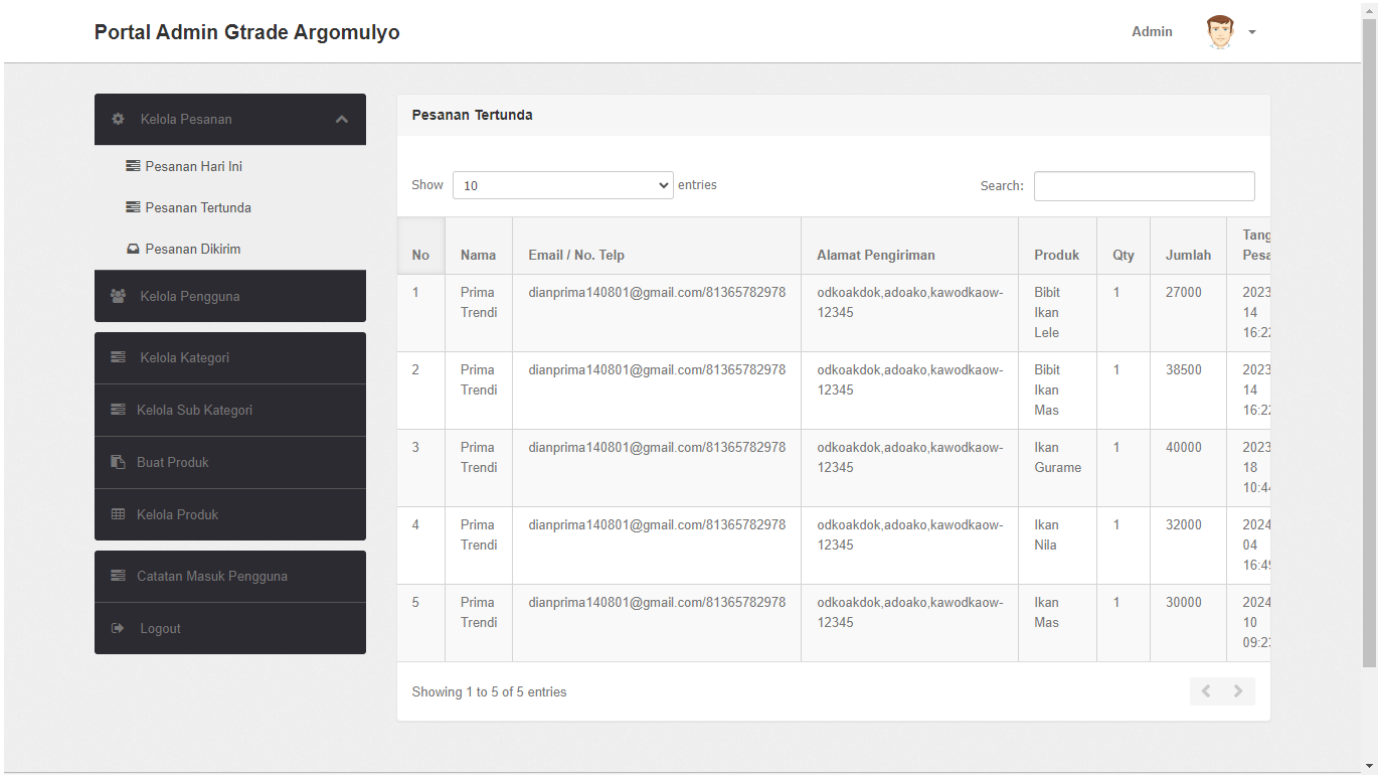

Figure 12. Manage order page

In Fig. 12, it can be seen that on this Manage Orders page, there are three main sections, each of which describes the order stages in the shipping process: Today's Order, Pending Order, and Shipped Order. The first section, Today's Order, serves as a list of orders that have just entered the system. The customer details, order number, order date, and order summary are listed, giving the admin enough information to check for data completeness and product availability.

The admin's main task at this stage is to ensure that the information provided is complete, and the products are available. The second section, Pending Orders, houses orders that require further verification or have information discrepancies. Admins can re-verify this by contacting customers or matching order data with internal systems in this section.

Meanwhile, the Shipped Orders section is the final destination for complete, valid, and verified orders. The admin can change the order status in the Shipped Order, indicating that the order is ready to be processed in the packaging and shipping stages. In this section, admins can also track receipt numbers and update shipping information to provide clarity to customers.

With the well-organized structure of the Manage Orders page, admins can ensure that every order is handled efficiently and promptly. This transparency benefits not only the admin but also the customers who can easily

monitor the status of their orders. This increases the trust and transparency in transacting on the Gtrade Argomulyo platform, creating a more positive shopping experience for all parties involved.

3.11 Blackbox Testing

Testing this website uses black box testing. Blackbox testing is a software testing method that tests functional specifications without examining the design and program code. Blackbox testing is a software quality test that focuses on software functionality. Black box testing aims to find incorrect functions, interface errors, errors in data structures, performance errors, initialization and termination errors [27]. This test determines whether the functions, inputs, and outputs match the required specifications. Argomulyo website, ensuring a better and more satisfying shopping experience for customers.

3.11.1 Equivalence Partitioning Testing: Equivalence Partitioning is a software testing technique that involves dividing the input value into valid and invalid values and selecting representatives from each test data [28]. Equivalence Partitioning Testing is one of the software testing methods used to identify and test similar groups of data in a single partition to determine. In the context of testing the Login page, Equivalence Partitioning Testing aims to test the validity and legitimacy of the input entered by users when they attempt to log into the system in Figure 13 below.

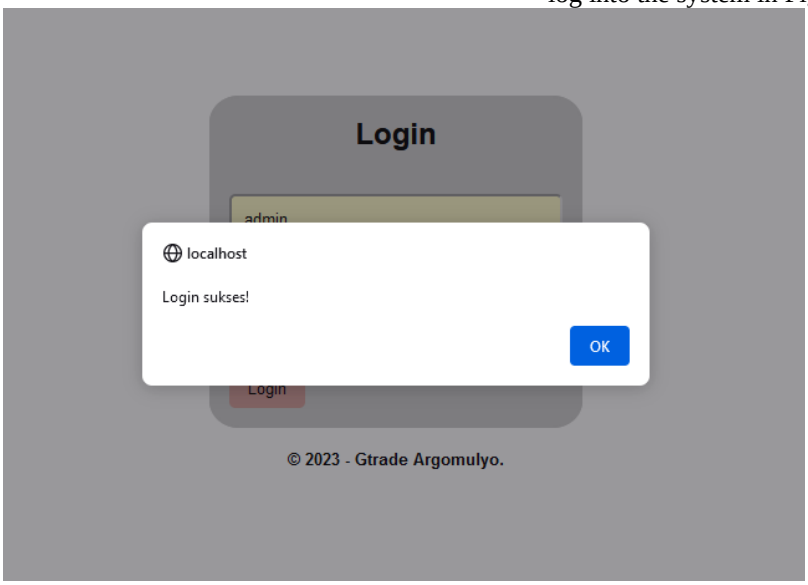

Figure 13. Successful and failed login

Table 2. Login Page Test Scenario Table

No	Test Scenarios	Test Case	Expected results	Test Results	Conclusion
1	Email and Password are not filled then click the Login button	Email : (empty) Password : (empty)	The system will deny the user login access.	Appropriate	Valid
2	Enter Email and Password is not filled then click the Login button	Email: Gtradecangkringan@gmail.com Password : (empty)	The system will deny the user login access	Appropriate	Valid
3	Email is not filled in and enter the Password	Email: (empty) Password :	The system will deny the user	Appropriate	Valid
4	Enter your email address and password, then click the sign-in button.	Email: Gtradecangkringan@gmail.com Password : Cangkringan 123	The system will accept or allow the user's sign-in access	Appropriate	Valid

3.11.2 Sample Testing: This test is to verify the functionality of selected values, ensuring they generate accurate data and align with user input [29]. Sample Testing, a method in software testing, involves examining a subset of features or functions within an application. When applied to testing the checkout page, Sample Testing concentrates on critical features like the necessity to input a shipping address and choose a payment method. Through this test, the checkout page's proper functionality and user experience are

validated, aiming to deliver a seamless checkout process as given in Figure 14 below.

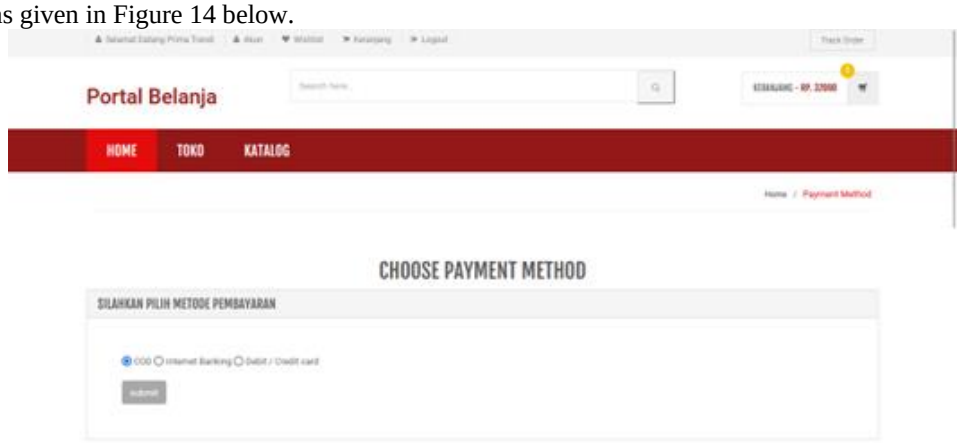

Figure 14. Sample testing error and sample testing success

Table 3. Checkout Page Test Scenario Table

No	Test Scenarios	Test Case	Expected results	Test Results	Conclusion
1	The checkout page is not filled in completely, then click the checkout button	Address: Babsari Country: (empty) City : (empty) Postcode :(empty)	The system will reject the user's checkout process.	Appropriate	Valid
2	The checkout page is not filled in completely, then click the checkout button	Email: Symbol: Babsari Country: Indonesia City : (empty) Postcode : (empty)	The system will reject the user's checkout process.	Appropriate	Valid
3	The checkout page is not filled in completely, then click the checkout button	Symbol: Babsari Country: Indonesia City: Sleman Postcode : (empty)	The system will reject the user's checkout process.	Appropriate	Valid
4	The checkout page is not filled in completely, then click the checkout button	Symbol: Babsari Country: Indonesia City: Sleman Postcode: 12345	The system will accept the user's checkout process.	Appropriate	Valid

Using Equivalence Partitioning Testing, it is necessary to test one input representing each valid and invalid partition for each feature being tested. This helps reduce the number of testing scenarios that must be performed, thereby saving time and resources required in checkout page testing.

3.11.3 *Robustness Testing:* Robustness testing presents challenges due to the complexity of specifying robustness properties, as various definitions exist in the literature, spanning from recovering after unexpected inputs to system resilience in unreliable environments [30]. This type of software testing assesses the website's ability to endure and operate effectively under unforeseen circumstances or adverse environmental conditions, as shown in Table 4.

Table 4. Robustness Testing Scenario Table

No	Test Description	Testing Steps	Expected Results	Test Results	Conclusion
1	Invalid Data Input	Try entering special characters or unformatted data.	The website gave a good response and did not crash.	Appropriate	Valid
2	Poor Network Condition	Temporarily turn off the internet connection, then try to access the website.	The website provides good responses or error messages accordingly.	Appropriate	Valid
3	Server Failure	Disable the server or database, then try to access the website.	The website displays error messages that are polite and informative.	Appropriate	Valid

3.11.4 *Behavior Testing:* Behavior Testing, in the context of the Gtrade Argomulyo freshwater fish sales website, refers to testing the functionality and responsiveness of various features and elements on the website. It ensures that the website can operate properly and according to user expectations. It identifies bugs, errors, or other issues that may affect the user experience or

performance of the website. By doing behavior testing, we can find errors in the system created and improve the quality of the system [31], as shown in Table 5.

Table 5. Behavior Testing Table

No	Features/Elements Tested	Test Description	Result	Information
1.	Home Page	Ensure that the home page loads correctly and contains key elements such as logos, navigation, fish category listings, and attractive offers.	Valid	The home page loads correctly and all the main elements are present.
2.	Fish Search	Test the search function to ensure users can search for fish by keyword and relevant search results are displayed.	Valid	The search works fine and the results match the keywords entered.
3.	Shopping Cart	Test shopping cart functionality, add multiple products, change quantities, and remove products from the cart.	Valid	The shopping cart works well, products can be added, renumbered, and removed.
4.	Process Checkout	Test the checkout process, enter your shipping address, choose a payment method, and complete your payment.	Valid	Users make the checkout process easy and can complete the payment.
5.	Website Speed	Measures page load times and response speeds from websites.	Valid	Website acceptable limits, no excessive page load times.

3.11.5 *Performance Testing:* Performance Testing is the process of software testing performed to measure the performance of a system or application in a specific load situation. It tests the speed, response time, stability, reliability, scalability, and resource usage under a specified workload. The higher the value obtained from the Performance Testing test results, the better the server's ability to handle requests. In the context of Gtrade Argomulyo, Performance Testing is conducted to evaluate and test the speed, responsiveness, and scalability of the website, to ensure that the website can handle high user loads without experiencing a decrease in service quality, as shown in Table 6 and the view can be seen in the Fig.15.

Table 6. Gtrade Argomulyo Website Performance Testing Table

No	Test Scenarios	Test Case	Expected results	Test Results	Conclusion
1	Open *website* Gtrade Argomulyo in All web Browser	Using Google Chrome, Mozilla Firefox, and so on	The system can operate properly	Appropriate	Valid

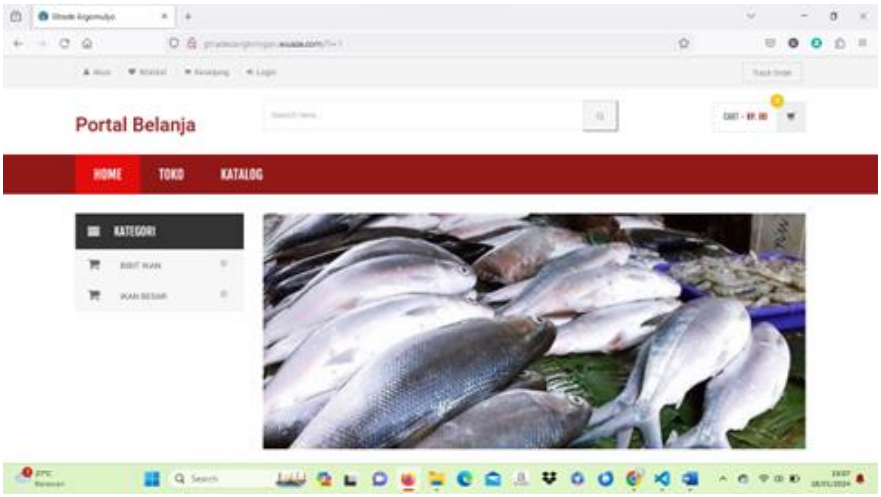

Figure 15. Performance testing

3.11.6 *Requirements Testing:* Requirements testing is an integral part of requirements engineering (RE) in software engineering. It is a stage in ensuring that the software system meets the specified user needs and requirements. Starting with the elicitation stage, where all user requirements are gathered, requirements testing plays a pivotal role in validating whether the system adequately fulfills these requirements [32]. In the context of the Gtrade Argomulyo website development, requirements testing is essential to guarantee that the website functions effectively and aligns with the predefined functional and non-functional criteria, as shown in Table 7.

Table 7. Requirements Testing Table

Hardware	Database	Language Programming	Method Testing
Intel Core i3 Gen 10th Memory 8 GB SSD 256 GB	MySQL version 10.4.22 – MariaDB	PHP version 8.1.1	Black Box Testing with 5 types Testing

3.11.7 Endurance Testing: Endurance testing, also known as stress testing, is a crucial aspect of software evaluation. It involves subjecting a system or application to prolonged periods of heavy usage to assess its performance and reliability under sustained stress [33]. At the Gtrade Argomulyo Pond Fish Sales website, Endurance Testing is indispensable. It aims to ascertain the website's ability to function seamlessly and reliably amidst prolonged periods of intense and continuous usage. This testing methodology determines the anticipated number of users participating in the simulated testing process within a predefined timeframe and establishes the duration of the testing process itself. Through Endurance Testing, the website's capacity to maintain stable and efficient operation under high loads is thoroughly examined, ensuring a seamless user experience and bolstering, as shown in Table 8.

Table 8. Endurance Testing Table

No.	Test Scenarios	Testing Steps	Result
1	Product Order	Add products to your cart and complete the payment.	The transaction was completed.
2	Browsing Product Pages	Access various product pages continuously.	Response times remain fast.
3	Activities in the Cart	Add, remove, and modify products in the shopping cart.	The basket works well.
4	Use of Other Features	Use other features like "Wishlist", "Product Reviews", etc.	All features operate normally.

3.11.8 *Cause-Effect Relationship Testing:* Cause-effect relationship testing is a testing process that aims to identify cause-effect relationships between two or more events in a system[34]. In the context of the Gtrade Argomulyo website, this testing process will focus on the feature to edit or delete fish put into the shopping cart. The main purpose of this test is to ensure that the data flow of creating, reading, updating, and deleting runs according to a predefined algorithm. In other words, this test will determine whether the actions performed on the fish in the shopping cart have the expected effect on the system as a whole, as shown in Table 9.

Table 9. Cause-Effect Relationship Testing Table

No	Test Scenarios	Test Case	Expected results	Test Results	Conclusion
1	Adding Fish to the Shopping Cart	Choose fish and add them to the shopping cart.	Fish are successfully added to the basket.	Appropriate	Valid
2	Edit Quantity	Change the quantity of fish in the shopping cart.	The quantity of fish is updated.	Appropriate	Valid
3	Removing Fish from the Shopping Cart	Remove certain fish from the shopping cart.	Fish are removed from the basket.	Appropriate	Valid

4 CONCLUSION

Based on the findings, it can be inferred that the E-commerce platform yields significant advantages for these farmers. This platform facilitates augmented revenue generation and market penetration by surmounting geographical constraints and the limited reach of conventional markets.

Through the E-commerce sales system, pond fish farmers can promote their merchandise online, extend their business networks, and offer consumer benefits through online accessibility to pond fish products, comprehensive product information regarding quality and pricing, and efficient online payment mechanisms. The principal emphasis in crafting this e-commerce platform lies in enabling pond fish farmers to showcase their products online. The design phase entails a profound comprehension of platform operations, addressing potential hurdles, and fulfilling user expectations.

The outcomes of this investigation underscore the critical importance of an intuitive user interface design, cross-device platform accessibility, and rigorous testing of platform performance and resilience for successful development. With the effective deployment of the e-commerce platform, it is envisaged that pond fish farmers can consolidate their presence in the e-commerce arena, unlock novel avenues for business expansion beyond local precincts, and bolster economic empowerment. Furthermore, this platform furnishes consumer advantages such as simplified access, transparent product information, and efficient online payment mechanisms.

Consequently, this study concludes that the web-based e-commerce platform significantly contributes to the economic empowerment of pond fish farmers, surmounts geographical constraints and limited market accessibility, and furnishes consumer advantages through simplified access and transparent product information. This innovative initiative may serve as a blueprint for economic progress in analogous regions grappling with similar challenges.

AUTHOR'S CONTRIBUTION

The research was a collaborative effort with distinct contributions from each member. Dian Prima Trendi Siburian, as the primary author, played a pivotal role in conceptualizing and designing the study, actively participating in data collection, analysis, and interpretation. He took the lead in drafting the initial manuscript, incorporating feedback from co-authors and reviewers, and engaging in discussions with the supervising team. Selvi Dwi Hartiyani, the first supervisor, provided valuable guidance throughout the process, contributing to the research framework, refining questions, and ensuring academic standards were met. Ardy Wicaksono, the second supervisor, shaped the research direction, offering expertise in the field, refining the theoretical framework, and participating in discussions to ensure a holistic approach. Sapriani Gustina, the examining supervisor, critically evaluated the methodology, findings, and implications, contributing to academic rigor and validity. All authors review and approve the final manuscript in adherence to ethical standards.

COMPETING INTERESTS

By the publication ethics of this journal, Dian Prima Trendi Siburian, Selvi Dwi Hartiyani, Ardy Wicaksono, and Sapriani Gustina, as the authors of this article, declare that this article is free from conflicts of interest (COI) and competing interests (CI).

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