

Design of a Web-Based E-Commerce System for Herbal Tea Products Using the Waterfall Method

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ABSTRACT

The rapid growth of digital technology has encouraged SMEs to adopt e-commerce platforms to improve market reach and service efficiency. However, many SMEs in niche product sectors, including herbal tea businesses, still face challenges in developing structured and user-oriented digital commerce systems. This study aims to design and evaluate a web-based e-commerce system for Acachia herbal tea products using the Waterfall model. Business needs were identified using the Business Model Canvas, while system requirements were translated into a sitemap, use case diagram, activity diagrams, and interface implementation. The evaluation was conducted through scenario-based usability validation involving ten potential end users. The results show that the proposed interface is generally usable for supporting basic e-commerce activities, with an average score of 3.57 out of 5. However, product information completeness, checkout confirmation, payment integration, and order tracking still require improvement. This study contributes a structured design and preliminary usability validation framework for niche SME e-commerce development.

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1. INTRODUCTION

The rapid development of internet technology has transformed conventional business activities into digital platforms. E-commerce has become an important medium for businesses to expand market reach, improve transaction efficiency, and enhance customer service. For SMEs, adopting e-commerce is increasingly necessary to maintain competitiveness in a dynamic market environment [1]. In Indonesia, the growth of internet usage has accelerated the adoption of e-commerce across various sectors. However, many SMEs still face challenges in developing effective digital commerce systems, including limited system planning, unclear navigation structures, and interfaces that are not sufficiently user-centered [2]. This condition indicates that digital transformation is not only necessary but also urgent to maintain market competitiveness, especially for SMEs transitioning from traditional to digital operations.

The success of an e-commerce platform is influenced not only by its functional features but also by the quality of its user interface (UI) and user experience (UX). A well-designed system can improve usability, facilitate product exploration, support efficient transaction processes, and increase user satisfaction [3]. In contrast, poor interface design may lead to user confusion, abandoned transactions, and lower customer retention. Therefore, interface quality becomes an important consideration in designing e-commerce systems, particularly for SME products that rely on clear product presentation and customer trust [4].

In addition to interface quality, developing a web-based e-commerce system requires a structured approach to ensure that business needs are translated into clear system requirements and user interaction models. In this study, business needs are identified using the Business Model Canvas (BMC), while system requirements are represented through a visual sitemap, use case diagram, activity diagrams, and interface implementation [5][6]. Techniques such as sitemap design, UML diagrams, and interface prototyping are widely used to support system modeling, improve usability, and enhance development efficiency [7][8].

Although many previous studies have discussed e-commerce system development, most focus on technical implementation, general interface design, or system modeling without providing early usability validation [9][10]. In the context of niche SME products such as herbal tea, limited studies have integrated business model analysis, structured system design, interface implementation, and scenario-based usability validation in a single development framework. Therefore, this study aims to design and evaluate a web-based e-commerce system for Acachia herbal tea products using the Waterfall model. The main contribution of this study is a structured design framework that connects business needs, system modeling, interface implementation, and preliminary usability assessment to support future e-commerce development for niche SME sectors.

2. METHODS

This study employed the Waterfall model as the system development approach for designing the Acachia web-based e-commerce system. The Waterfall model was selected because the proposed system had relatively stable requirements and clearly defined business processes [11][12]. The main e-commerce functions could be identified from the beginning through business and requirement analysis. Therefore, the Waterfall model was considered suitable for this study because it provides a systematic sequence from requirement identification and analysis to design, interface implementation, and evaluation [11][13][14].

In this research, the development process was organized into five stages: requirements-gathering, analysis, design, interface implementation, and evaluation. These stages were used to produce a structured conceptual design and a visual representation of the proposed e-

commerce platform. The adapted Waterfall model used in this study consists of five stages, as presented in **Figure 1**.

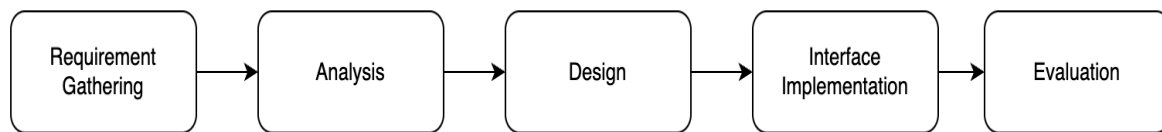


Figure 1. Method flow design web Acachia.

In the requirements-gathering stage, business needs and system objectives were identified using the Business Model Canvas (BMC). This stage aimed to define the main elements of the business, including value propositions, customer segments, channels, key activities, and revenue streams, which were then used as the basis for determining the required system features [15].

In the analysis stage, the identified business needs were translated into system requirements and navigation structures [16][17]. A visual sitemap was developed for the Acachia e-commerce website to represent the overall system structure and define the navigation flow between pages. The sitemap shows the main pages accessible to users, starting from the home page and continuing to supporting pages such as About, Search, product pages, cart, and history.

In the design stage, system interactions and workflow processes were modeled using a use case diagram and activity diagrams. The use case diagram was used to identify the main interactions between users and the system, while the activity diagrams were used to describe the workflow of core processes such as product browsing and ordering. This stage was intended to provide a structured representation of system functionality and user interaction flow [18].

In the interface implementation stage, the proposed interface design was represented through visual page layouts of the main website pages. These implementations included essential interface elements such as navigation menus, product information, images, prices, and transaction-related components. This stage was intended to show how the proposed system design could be translated into a more concrete and user-oriented web interface [19][20].

In the evaluation stage, scenario-based usability validation was conducted to assess the proposed website interface. The validation focused on several core e-commerce tasks, including accessing the homepage, browsing product categories, reviewing product information, adding products to the cart, reviewing cart contents, preparing for checkout, and reviewing order history. These scenarios were assessed based on interface clarity, ease of navigation, product information, visual appearance, transaction process, and overall satisfaction using a five-point Likert scale [21][22].

3. RESULTS AND DISCUSSION

The results of this study consist of several design artifacts and validation results that represent the proposed e-commerce system for Acachia herbal tea products. The discussion focuses on how these artifacts support structured system design, clear user interaction flow, interface usability, and preliminary scenario-based validation.

3.1. Requirement Gathering

The BMC was developed to identify the core business structure of Acachia and to determine the requirements that should be accommodated by the proposed e-commerce system. Based on the BMC, Acachia's business model emphasizes product quality, product variety, competitive pricing, and product knowledge as its main value propositions. This indicates that the e-commerce platform should not only function as a transactional medium but also as an informational platform that communicates product benefits and differentiates Acachia from competitors.

The BMC also identifies tea enthusiasts, health-conscious consumers, and gift shoppers as the main customer segments. These customer groups indicate the need for a system that supports clear product categorization, detailed product information, and an efficient purchasing process. In this way, the platform can accommodate different user needs, from browsing products to completing transactions, as illustrated in **Figure 2**.



Figure 2. Business model canvas of Acachia.

In addition, the BMC highlights the importance of digital channels, customer communication, and operational resources in supporting the business. This suggests that the proposed website should be designed to integrate product presentation, transaction processes, and customer engagement in a structured manner. Therefore, the BMC serves as the basis for determining the main system features and design priorities in the following stages.

3.2. Analysis

A visual sitemap was developed for the Acachia e-commerce website to represent the overall system structure and define the navigation flow between pages. The sitemap shows the main pages accessible to users, starting with the home page and continuing to supporting pages such as About, Search, product pages, cart, and history. It also illustrates the relationship between authentication pages, product browsing, cart management, and checkout processes.

The sitemap was designed to provide a clear hierarchical structure that helps users navigate the website more easily and access the required information without confusion. In particular, the arrangement of product categories, cart features, and checkout flow reflects

the main user activities in the e-commerce platform. This structure is important for supporting usability, as it helps users move efficiently from product exploration to transaction completion.

In addition, the sitemap serves as an initial reference for the next design stage, especially in developing the wireframe and interface flow of the proposed system. By defining page relationships and navigation paths early, the sitemap helps ensure that the interface design remains consistent with the system structure and user needs, as presented in **Figure 3**.

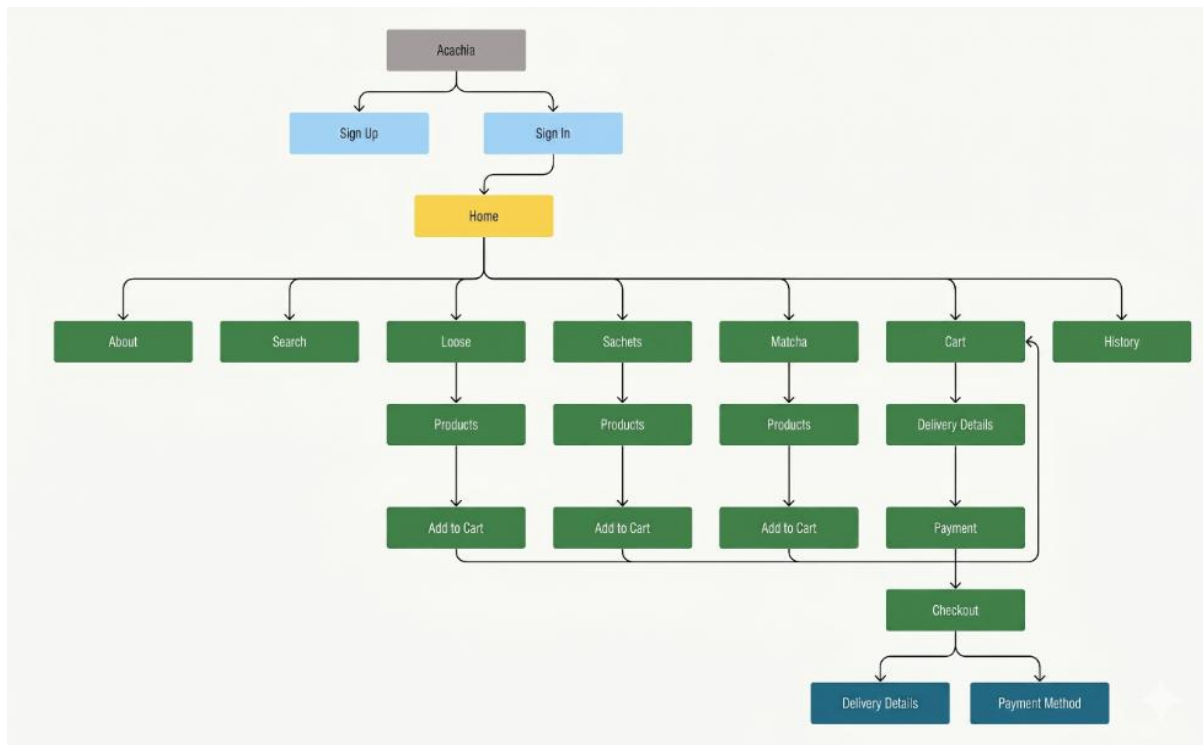


Figure 3. Visual sitemap design Acachia.

3.3 Design

3.3.1 Use Case Diagram

A Use Case Diagram was developed to identify the main interactions between the user and the Acachia e-commerce system. The diagram shows that the user can perform several main activities, including sign up, sign in, accessing the home page, viewing product categories, adding products to the cart, checking out, viewing order details, giving ratings and reviews, viewing order history, and logging out. In addition, the checkout process includes supporting functions such as applying coupons, entering delivery details, and selecting a payment method.

As shown in **figure 4**, the Use Case Diagram provides an overview of the system's functional scope and illustrates how each feature is connected to user needs. By identifying these interactions, the diagram helps ensure that the proposed system supports the main activities commonly performed in an e-commerce platform. Therefore, the Use Case Diagram serves as an important reference for the subsequent interface and process design stages.

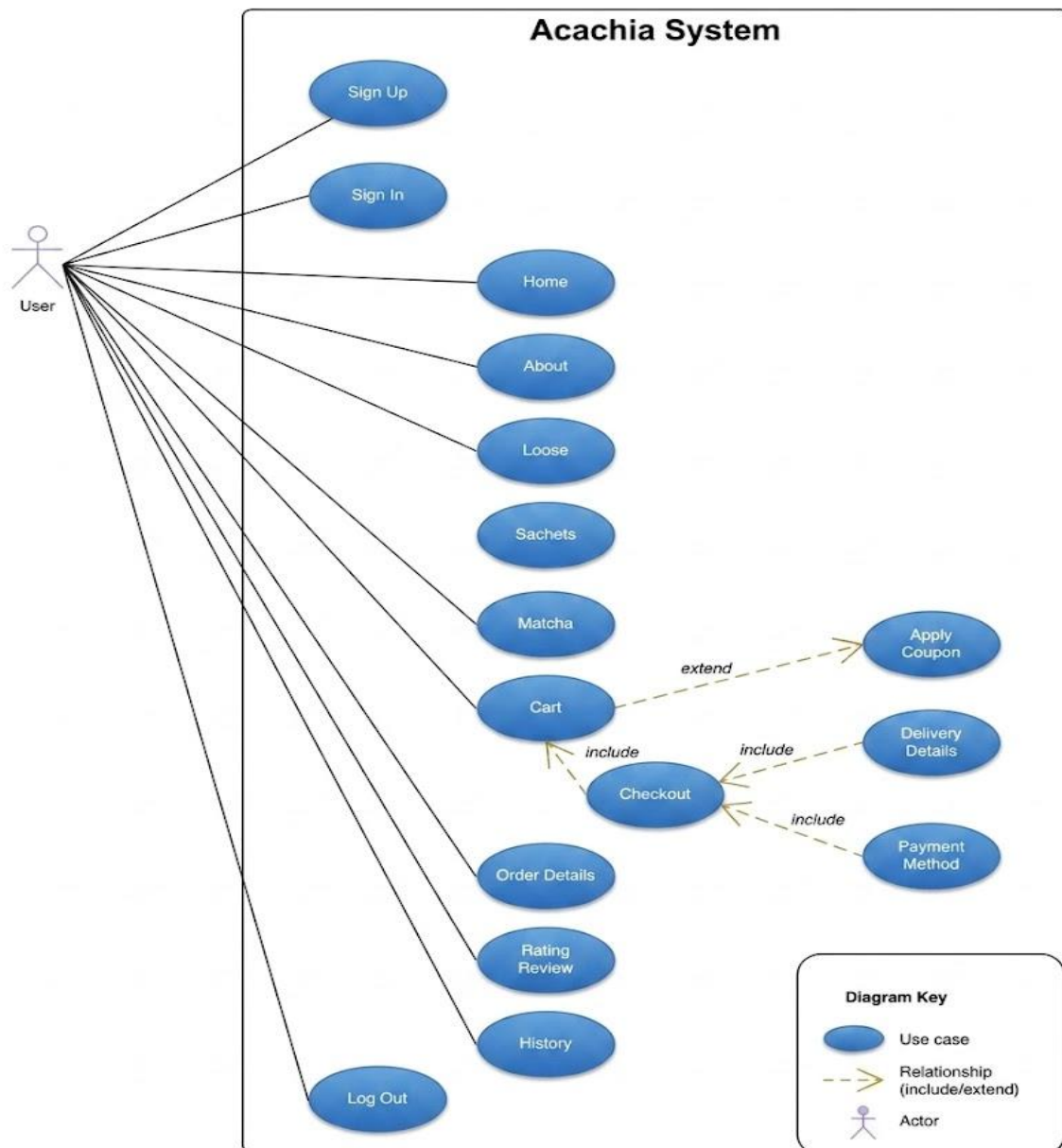


Figure 4. Use Case Diagram of Acachia.

3.3.2 Activity Diagram

Two Activity Diagrams were selected to represent the main workflows of the Acachia e-commerce system, namely the homepage and product browsing process, and the ordering process. These diagrams were considered sufficient to illustrate the core user activities in the platform, from product exploration to transaction completion. The homepage and product browsing activity diagram shows how users navigate the website and select products, while the order activity diagram describes the sequence from adding items to the cart to completing checkout and payment. Together, these diagrams provide a clear representation of the main process flow of the proposed system and support the development of a structured and user-centered e-commerce design, as presented in **Figure 5 and 6**.

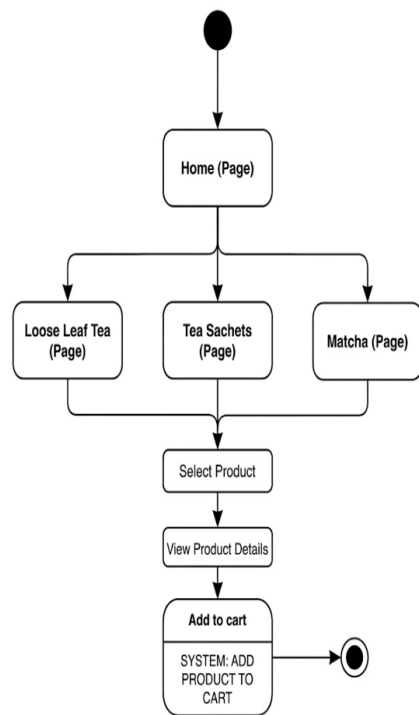


Figure 5. Activity Diagram homepage and products.

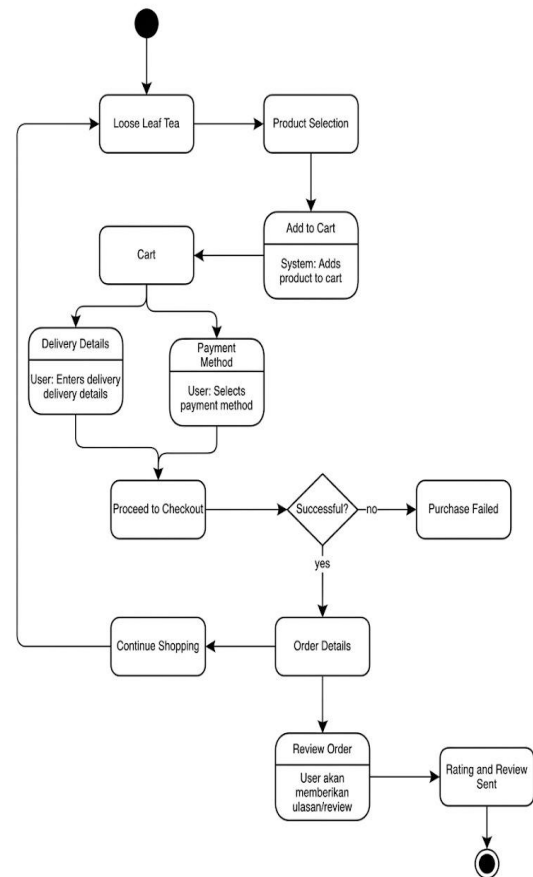


Figure 6. Activity Diagram order.

3.4 Interface Implementation

The implementation stage involves applying the interface design to visual page layouts for the Acachia e-commerce website. This stage focuses on demonstrating how the proposed design is implemented across the system's main pages, including the Matcha product page and cart page. Each page contains essential interface elements such as product images, descriptions, prices, navigation menus, and action buttons.

The implemented interface was designed with an emphasis on clarity, readability, and consistency to support user interaction. Through these page implementations, the proposed system can be represented in a more concrete and structured form, providing an overview of how users may interact with the platform in practice.

Figure 7 illustrates the implementation of the Matcha page in the proposed system. The page integrates product information, navigation features, and product listings in a structured interface to support usability and improve the user browsing experience.

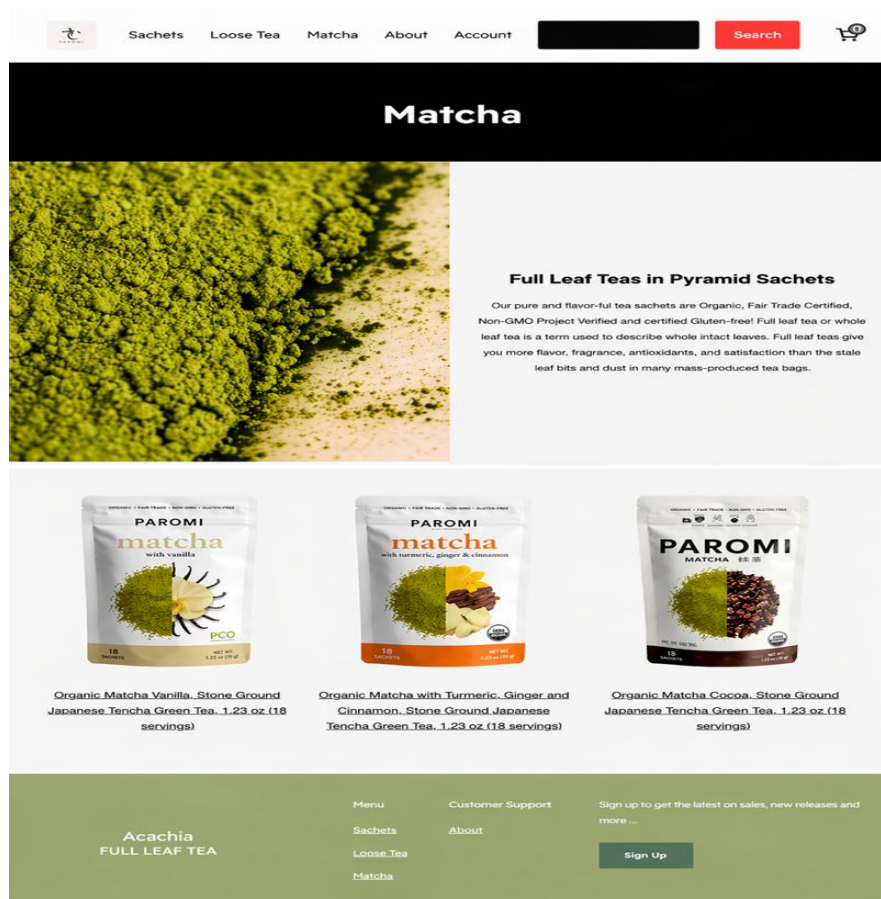


Figure 7. Interface implementation of matcha home page.

Figure 8 shows the implementation of the cart page in the proposed Acachia e-commerce system. This page displays the products selected by the user along with relevant purchase information, allowing users to review their orders before proceeding to checkout. The interface is designed to support clarity and ease of use by presenting product details, quantity, and transaction-related actions in a structured manner.

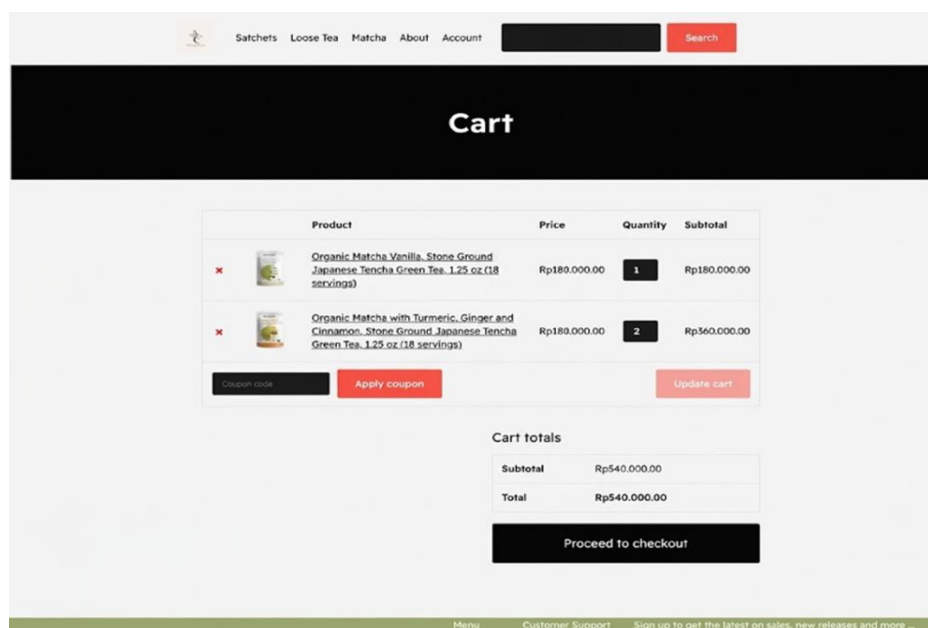


Figure 8. Interface implementation of cart page.

3.5 Evaluation

The evaluation stage was conducted using scenario-based usability validation to assess whether the proposed interface could support the main tasks commonly performed by e-commerce users. The evaluated scenarios included accessing the homepage, browsing product categories, reviewing product information, adding products to the cart, reviewing cart contents, preparing for checkout, and reviewing order history.

The assessment focused on six aspects, namely interface clarity, ease of navigation, product information, visual appearance, transaction process, and overall satisfaction. Each aspect was assessed using a five-point Likert scale, where 1 indicated very poor, and 5 indicated very good, as presented in **Table 1**.

Table 1. User satisfaction evaluation aspects.

No.	Evaluation Aspect	Description
1	Interface clarity	Ease of understanding the layout and displayed information
2	Ease of navigation	Ease of moving between pages and accessing features
3	Product information	Clarity and completeness of product details
4	Visual appearance	Attractiveness of the interface design
5	Transaction process	Ease of using cart and checkout features
6	Overall satisfaction	General satisfaction with the website implementation

The validation involved ten respondents who were selected as potential end users of the Acachia e-commerce website. The respondents were asked to review the proposed interface based on predefined e-commerce scenarios. The score in **Table 2** represents the average score obtained from the respondents for each scenario.

Table 2. Scenario-Based Usability validation results.

No.	User Scenario	Observation Result	Score
1	Accessing the homepage	The homepage provides clear branding and main navigation.	4
2	Browsing product categories	Product categories are visible and support product exploration.	4
3	Reviewing product information	Product name, image, and price are clear, but ingredients and product benefits need improvement.	3
4	Adding products to the cart	Cart-related actions are easy to identify.	4
5	Reviewing cart contents	The cart page displays selected products and transaction information clearly.	4
6	Preparing for checkout	Checkout flow is represented, but payment confirmation needs further development.	3
7	Reviewing order history	Order history is included, but tracking status is not yet fully represented.	3
Total			25
Average			3.57

Based on Table 2, the proposed interface achieved a total score of 25 and an average score of 3.57 out of 5. The highest scores were found in homepage access, product browsing, cart interaction, and cart review, each receiving an average score of 4. These results indicate that the system provides a clear navigation structure and supports the main user flow from

product exploration to cart review. However, product information, checkout preparation, and order history received lower average scores, each receiving a score of 3. This indicates that the proposed system still requires improvement in product detail completeness, payment confirmation, and order tracking features.

3.6 Discussion

The results of this study show that the proposed Acachia e-commerce system was developed through a structured process that connects business needs, system modeling, interface implementation, and usability validation. The Business Model Canvas identifies the main business requirements, including product quality, product variety, competitive pricing, and product knowledge. These requirements were then translated into design artifacts, including the sitemap, use case diagram, activity diagrams, and interface pages. This indicates that the proposed system was designed not only as a transaction platform but also as an information platform for herbal tea products.

The sitemap and use case diagram show that the system provides a clear navigation structure and covers essential e-commerce activities. The sitemap supports user navigation from the homepage to product pages, cart, checkout, and order history. Meanwhile, the use case diagram describes the main interactions between users and the system, such as sign up, sign in, product browsing, cart management, checkout, rating and review, order history, and logout. These results indicate that the proposed system has a coherent structure for supporting the main user journey in an e-commerce platform.

The activity diagrams further explain the workflow of the main processes, particularly product browsing and ordering. The ordering process shows a logical flow from product selection to checkout preparation. However, this process still needs further improvement, especially in payment confirmation, delivery status, and transaction notification. Therefore, the current design can be considered an initial validated design that still requires full functional implementation before real deployment.

The scenario-based usability validation produced a total score of 25 and an average score of 3.57 out of 5. The highest scores were found in homepage access, product browsing, cart interaction, and cart review, each receiving a score of 4. These results indicate that the proposed interface is generally usable for supporting basic e-commerce activities. However, product information, checkout preparation, and order history received lower scores, each receiving a score of 3. This shows that several aspects still need improvement, particularly ingredients and product benefit information, payment confirmation, and order tracking.

Compared with previous studies that mainly focus on general e-commerce design or technical implementation, this study integrates business analysis, system modeling, interface implementation, and preliminary usability validation for a niche SME product. Therefore, the contribution of this study lies in the structured development framework and initial validation results that can support future development of e-commerce systems for specialized SME products. However, this study is still limited because the validation involved only ten respondents and was conducted as a preliminary scenario-based usability validation. Future studies should implement the system fully and conduct broader empirical usability testing with more respondents.

4. CONCLUSION

This study designed and evaluated a web-based e-commerce system for Acachia herbal tea products using the Waterfall model. The Waterfall model was considered suitable because the proposed system had relatively stable requirements and clearly defined business processes. The integration of the Business Model Canvas, sitemap, use case diagram, activity diagrams, interface implementation, and scenario-based usability validation produced a structured representation of an e-commerce system that supports both business needs and user interaction.

The scenario-based usability validation involving ten respondents showed that the proposed interface achieved a total score of 25 and an average score of 3.57 out of 5. These results indicate that the proposed interface is generally usable for supporting basic e-commerce activities, particularly homepage access, product browsing, cart interaction, and cart review. However, several aspects still require improvement, especially product information completeness, checkout confirmation, payment integration, and order tracking.

This study contributes a structured design and preliminary usability validation framework for developing e-commerce systems for niche SME products such as herbal tea. Future studies are recommended to develop the system into a fully functional application, integrate database and payment features, and conduct broader empirical usability testing with more respondents using established usability measurement instruments.

5. AUTHOR'S NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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