Research Article

Development of an E-commerce Application System for Durian Entrepreneurs in Narathiwat Province, Thailand

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ABSTRACT

This research and development project aims to create an application for managing processed durian products to support B2B2C e-commerce. The objectives are to 1) study relevant data, 2) design the system architecture, and 3) evaluate system efficiency. The sample group consists of the processed durian community in Bukit Subdistrict, Cho-I-Rong District, Narathiwat Province. The development follows the SDLC model, using NextJS with Server-Side Rendering (SSR) for the frontend, Node.js for the backend, and Firestore on Firebase as a NoSQL database. The system comprises seven core modules: member management, product management, order management, payment channels, database management, multi-vendor management, and reporting. Evaluation by two experts and 30 users shows that the system performs excellently, particularly in meeting user requirements ($\bar{x}$ = 4.67, S.D. = 0.49), system functionality ($\bar{x}$ = 4.62, S.D. = 0.55), ease of use ($\bar{x}$ = 4.57, S.D. = 0.49), and data security ($\bar{x}$ = 4.60, S.D. = 0.56). The research results indicate that this system is efficient and can be implemented in real-world scenarios. It helps connect community products to online markets through social media, increases sales channels, and can potentially aid in controlling product prices and quality in the future.

1. Introduction

In the rapidly evolving digital landscape of Thailand, community businesses, particularly those in the local fruit processing industry, face significant challenges in adapting to the online marketplace. Although the e-commerce sector in Thailand has demonstrated remarkable growth (Kemp, 2023), many community businesses still struggle to effectively access digital technologies and markets. The case study of the durian jam processing community in Bukit Village, Cho-airong District, Narathiwat Province, exemplifies the primary obstacles that local entrepreneurs encounter: limited market access, lack of technological skills, and intensified competition from large online retailers. Despite the unique characteristics and cultural value of southern Thailand's native durian, local producers continue to face difficulties in expanding their

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market reach and boosting sales. This research, focused on "Development of an E-Commerce Application System for Durian Entrepreneurs in Narathiwat Province, Thailand," aims to address critical gaps in the existing literature by integrating cutting-edge technology with local contexts. While previous studies have explored e-commerce potential for Thai SMEs (Wongkhamdi *et al*., 2020) and the adoption of serverless e-commerce applications (Athreya *et al*., 2022), this research uniquely applies advanced technologies such as ReactJS, NextJS Server-Side Rendering (SSR), and Firebase to the specific challenges of the durian industry in Narathiwat Province. This approach not only expands the scope of e-commerce studies for specialized agricultural products but also presents novel strategies for developing digital business models tailored to small-scale entrepreneurs. The practical application of e-commerce for community businesses is essential, particularly the implementation of the B2B2C (Business-to-Business-to-Consumer) model. This model facilitates commercial interactions between businesses and aids in selling products directly to consumers, representing a novel business paradigm that unifies customers and sellers on a single platform (Cai *et al*., 2018). This research builds upon this concept by developing a B2B2C e-commerce system specifically for durian jam products from the Bukit community, aiming to solve market access problems, increase operational efficiency, and foster long-term customer relationships. The proposed approach in this research consists of developing an intuitive mobile application, creating an efficient logistics system, and utilizing data analysis technology to enhance marketing strategies. This approach aligns with recent trends in creating positive customer experiences through transparency and efficiency in the ordering process (Dhayfule *et al*., 2022). Moreover, the developed system allows entrepreneurs to act as direct sellers, helping to reduce the complexity of business processes and the number of intermediaries in the sales chain (Kamble *et al*., 2022). Technologically, the developed system leverages web components for faster rendering and uses the React JavaScript library to achieve efficiency comparable to major platforms. Data storage employs real-time NoSQL on Google Firestore, offering

high speed, instant responsiveness, and support for numerous users (Yerlekar *et al*., 2023). The selection of these technologies not only enhances system performance but also contributes to broadening the knowledge base for applying advanced digital technologies in agriculture. The expected outcomes of this research are diverse and significant, including (1) increased sales and revenue for durian jam producers in the Bukit community; (2) expansion of the customer base into new markets, both domestically and internationally; (3) creation of a sustainable business model for local fruit processed products, applicable to other communities in Thailand; (4) generation of new knowledge in applying technology to agriculture, particularly in the context of e-commerce for specialty products; (5) enhancement of competitiveness for small-scale agricultural entrepreneurs in the digital marketplace; and (6) stimulation of the local economy through improved market access and increased sales (Anwar *et al*., 2021; Prakarsa and Hafiz, 2022). The integration of traditional trading strategies with online channels through this specially designed e-commerce platform aims not only to expand customer reach and increase revenue for the Bukit community but also to create a replicable model for the digital transformation of Thailand's agricultural sector (Sirisom, 2017; Pongsak, 2017). Consequently, this research contributes to filling important gaps in the literature by providing in-depth insights into the impact of e-commerce technology on local farming communities and presenting innovative approaches to UX/UI design specifically tailored for durian entrepreneurs (Ngamwannakorn, 2022). In summary, this study has the potential to make significant contributions both in the practical application of e-commerce in community businesses and in the academic understanding of digital transformation in agriculture. The results of this research have the potential for widespread application, leading to comprehensive digital transformation across Thailand's agricultural industry and potentially serving as a model for similar initiatives in other regions (Alsiddiq and Jamail, 2019). This research not only aims to address the immediate problems of the Bukit community but also lays the foundation for long-term sustainable

development of the Thai agricultural sector in the digital era by balancing the preservation of cultural values of local products with the utilization of market opportunities presented by modern technology (Andoyo *et al*., 2020).

Furthermore, this study plays a crucial role in promoting grassroots economic development and reducing the digital divide by enhancing the technological capabilities of small-scale entrepreneurs in rural communities, aligning with Thailand's digital economy development policy (Digital Economy Promotion Agency, 2019). Ultimately, the results of this research will not only benefit the Bukit community and the durian industry but also have the potential to create a positive impact on Thailand's agricultural sector as a whole by presenting an adaptable model for elevating other local agricultural products to the global digital market.

2. Materials and Methods

The development of an e-commerce application system for durian entrepreneurs in Narathiwat Province, Thailand, was conducted using a six-step research and development process. The system development followed the Systems Development Life Cycle (SDLC) methodology (Boggs, 2004; Agarwal *et al*., 2023; Patel, 2023; Leloudas, 2023). The steps are as follows:

1. Literature Review

A comprehensive study and analysis of literature, research, and technologies related to e-commerce systems for community entrepreneurs was conducted, particularly in the context of the durian industry and processed products. In addition to referencing existing research such as (Kemp, 2023; Wongkhamdi *et al*., 2020; Andoyo *et al*., 2020), the researcher also included contemporary studies on e-commerce systems and their impact on local economies.

Key findings from the literature review:

- (Luo and Niu, 2019) demonstrated the positive effects of e-commerce on rural economies in China, especially in increasing household income.

- (Chen, 2024) highlighted how rural e-commerce has significantly transformed traditional sales patterns of agricultural products, improving market access for farmers and enhancing overall economic diversity in rural areas.

These findings helped define the objectives of the current study, emphasizing the development of a system that responds to the specific needs of durian entrepreneurs in the area and measures the impact on the local economy.

2. System Design

Concepts were developed and an e-commerce system was designed to meet the specific needs of durian entrepreneurs in Narathiwat Province. User-Centered Design (UCD) techniques and Rapid Prototyping were employed to design the User Interface (UI) and User Experience (UX) appropriate for the target group.

3. System Architecture Design

The system architecture was planned and designed using Google's Firebase and Firestore for cloud data storage, aligning with the research of (Andoyo *et al*., 2020; Wongkhamdi *et al*., 2020), who used Firebase in developing e-commerce systems for entrepreneurs and SMEs in the Thai context. The system comprises:

a) Frontend: React Native for mobile applications and Next.js for web applications

b) Backend: Firebase Functions for serverless backend processing

c) Database: Firestore for NoSQL data storage

d) Authentication: Firebase Authentication for user verification

e) Storage: Firebase Storage for image and file storage

f) Hosting: Firebase Hosting for web application deployment

The use of Firebase ensures system flexibility, scalability, and high security, which is suitable for the needs of durian entrepreneurs in Narathiwat Province.

An example of the data structure in Firestore is as follows:

```
//javascript
"products" collection
{
```

```
    "id": "autogenerated_id",

    "name": "Premium Durian Paste",

    "description": "High-quality durian paste
from Narathiwat",

    "price": 250,

    "category": "Processed",

    "producerId": "user_id_reference",

    "createdAt": Timestamp,

  "updatedAt": Timestamp

}
```

This structure allows for efficient storage and retrieval of product information, which is crucial for the e-commerce system's performance.

4. System Development

The application was developed following the Agile Systems Development Life Cycle (SDLC) using the Scrum framework, with the following details:

a) Requirements Analysis: Employed In-depth Interview techniques with durian entrepreneur groups.

b) Design: Used Figma for UI/UX design.

c) Development: Used Git for Version Control.

d) Testing: Black Box Testing was used to test the system from the user's perspective.

e) Evaluation: Used a 5-level satisfaction assessment form following (Boonchom, 2002) method.

f) Improvement: Analyzed evaluation results and feedback in Sprint Retrospective.

5. System Implementation

Firebase Hosting was used for web application deployment, while Google Play Console and App Store Connect were utilized for mobile application distribution. User training was conducted using the Train-the-Trainer method.

6. User Manual Creation

The user manual for the e-commerce system was created using Canva as the main tool, with steps including manual structure design, content creation, and manual distribution through interactive PDF and QR codes.

This application development focused on creating a system that responds to the specific needs of durian entrepreneurs in Narathiwat Province, taking into account the cultural context, language, and technological limitations in the area. The study used Purposive Sampling, selecting 10 groups of durian entrepreneurs in Narathiwat Province. The expected outcomes of this research are increased sales and income for the community, expansion of customer base to new markets, and the creation of a sustainable business model for local fruit processed products, which can be applied to other communities in Thailand.

3. Results and Discussion

This study focuses on developing an e-commerce system for durian entrepreneurs in Narathiwat Province, utilizing the B2B2C model. The results of the study are divided into four main sections: 1) the prototype of the durian processed product management system, 2) the system development architecture, 3) the user interface design, and 4) the system performance evaluation results.

1. Prototype of the Durian Processed Product Management System

The system prototype consists of three main components: input, process, and output. The system can comprehensively manage data related to entrepreneurs, products, manufacturers, customers, and orders. The main functional features include a member management system, product management system, order management system, multi-vendor management system, reporting system, and database management system.
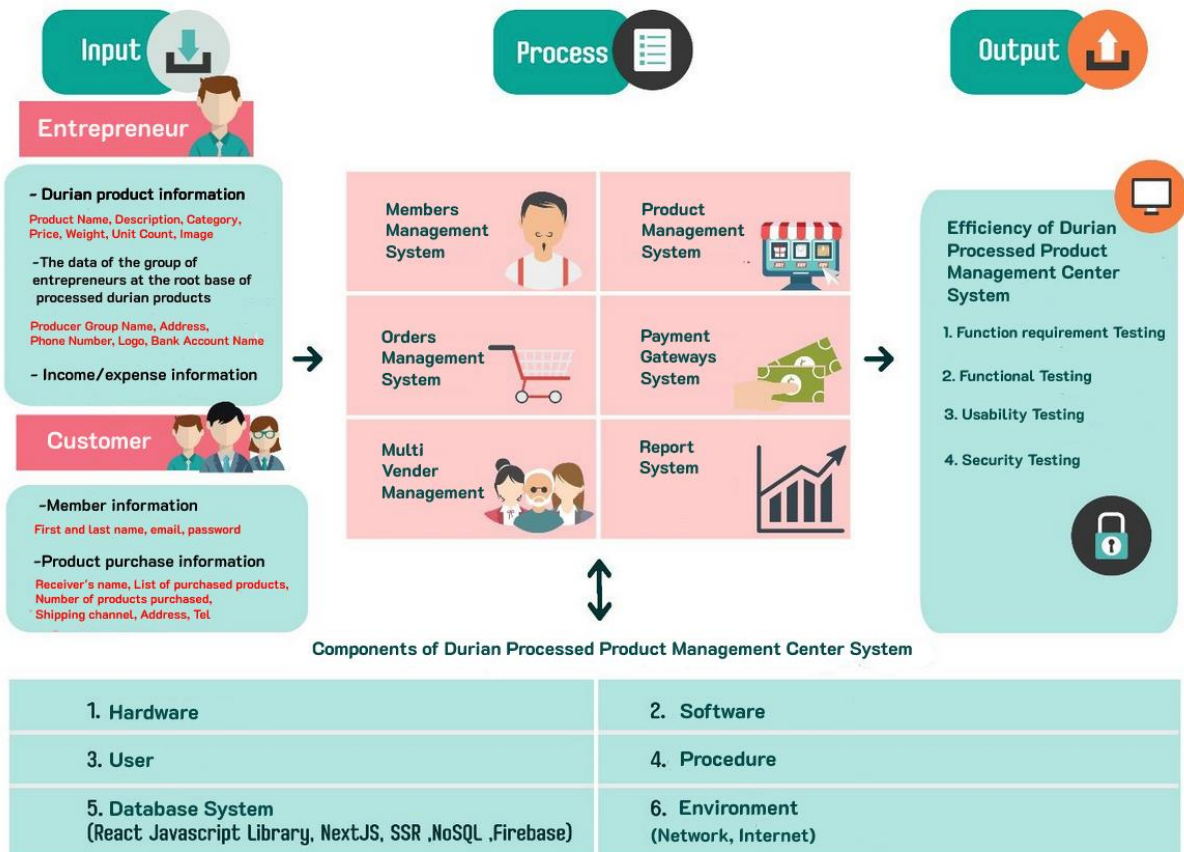
Figure 1 Prototype of the durian processed product management system

The details of Figure 1 are as follows: The input data for the system can be organized in the following manner: Company details: Durian Product Details: The information provided includes the product's name, description, category, price, weight, quantity per unit, and a picture of the product. Information about manufacturers of processed durian products includes the group's name, address, phone number, logo, bank account name, and income and spending data. Client Details: Member Details include the individual's name, email, and password. Purchase Information: Please include the recipient's name, the item(s) purchased, the quantity of products purchased, the delivery method, the delivery address, and the phone number. The journal describes a system development approach that has many components: 1) Members Management System: This system incorporates features such as Google Mail login, assignment of roles and permissions, and registration of memberships for various user roles (Admin, Vendor/Seller, User). The functionality of the system includes the management of member information,

with the ability to display, add, delete, amend, and search for information. 2) Product administration System: Incorporates a range of features for efficient product administration, such as product display, addition, removal, modification, and search capabilities. Additional functionalities encompass inventory management, product commenting, reviewing, rating, sorting, filtering, and issuing notifications for low inventory. Product picture zoom facilitates an improved user experience by enhancing the ability to view and examine the product in detail. 3) Orders Management System: Provides features for managing orders, such as the ability to view, add, remove, modify, and search. Automated notifications of order status via email and SMS enhance contact with users. Order history tracking is active, and secure payment transactions are handled by the Payment Gateways System. 4) Multi-Vendor administration: Facilitates efficient administration of many suppliers by providing functionalities for displaying, adding, deleting, modifying, and searching. 5) Reporting System: Enables comprehensive analysis and evaluation

of many components of the system, such as product reports, administrative insights (Admin Dashboard), user activities (User Dashboard), vendor performance (Vendor Dashboard), and real-time sales tracking. 6) Database Management System: Ensures optimal administration of databases pertaining to members, items, orders, and payments, and provides features for ensuring the consistency and availability of data. The output evaluation is organized in a journal style and includes the following categories: 1) User Requirement Fulfilment: Comprises of 8 sub-questions evaluating the system's effectiveness in managing members, managing products, processing orders, handling payment channels, managing databases, overseeing multiple vendors, generating sales data reports, and facilitating user registration. System Functionality: The evaluation consists of 8 sub-questions that assess the effectiveness of several aspects, including member administration, product management, order processing, payment handling, database management, multi-vendor management,

sales data reporting, and user registration. User-Friendliness: Comprises 8 sub-questions that assess the ease of use and satisfaction regarding the functioning of the system, the consistency of screen design, the appropriateness of symbols and images, the suitability of font size, the suitability of colors, the relevance of text, and overall user contentment. Data security encompasses four sub-questions that evaluate user authentication through the use of user IDs and passwords, precise user access control, prompt communication of product orders and payments, and timely notification of errors or missing data.

2. System Development Architecture

The system is developed based on the B2B2C model, which interconnects producers, merchants, and consumers. The platform serves as an intermediary, helping to reduce sales processes and enhance logistics management efficiency.
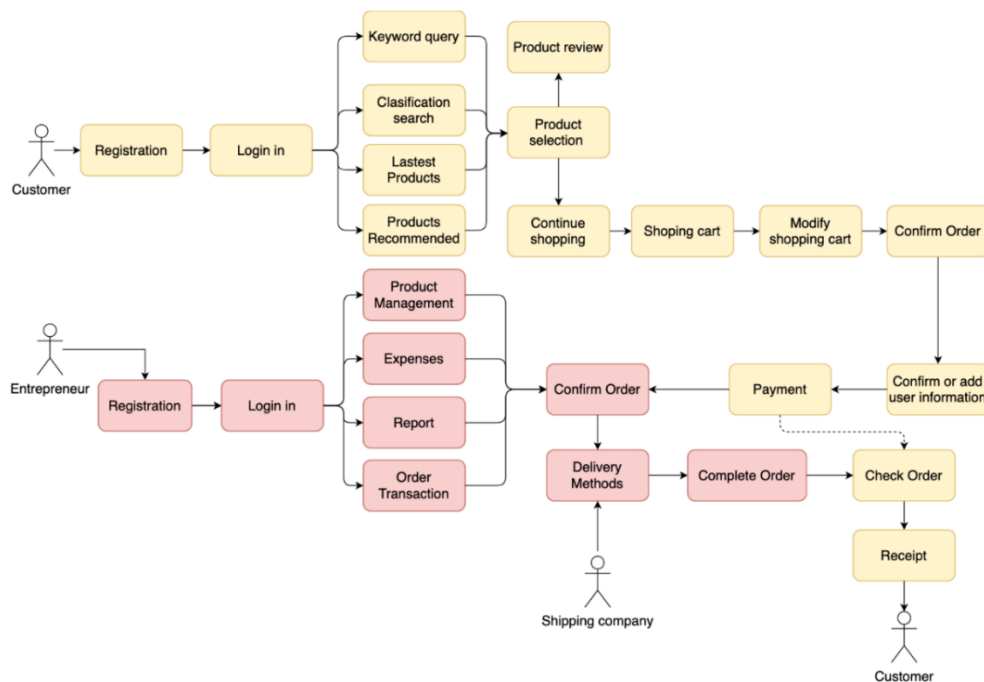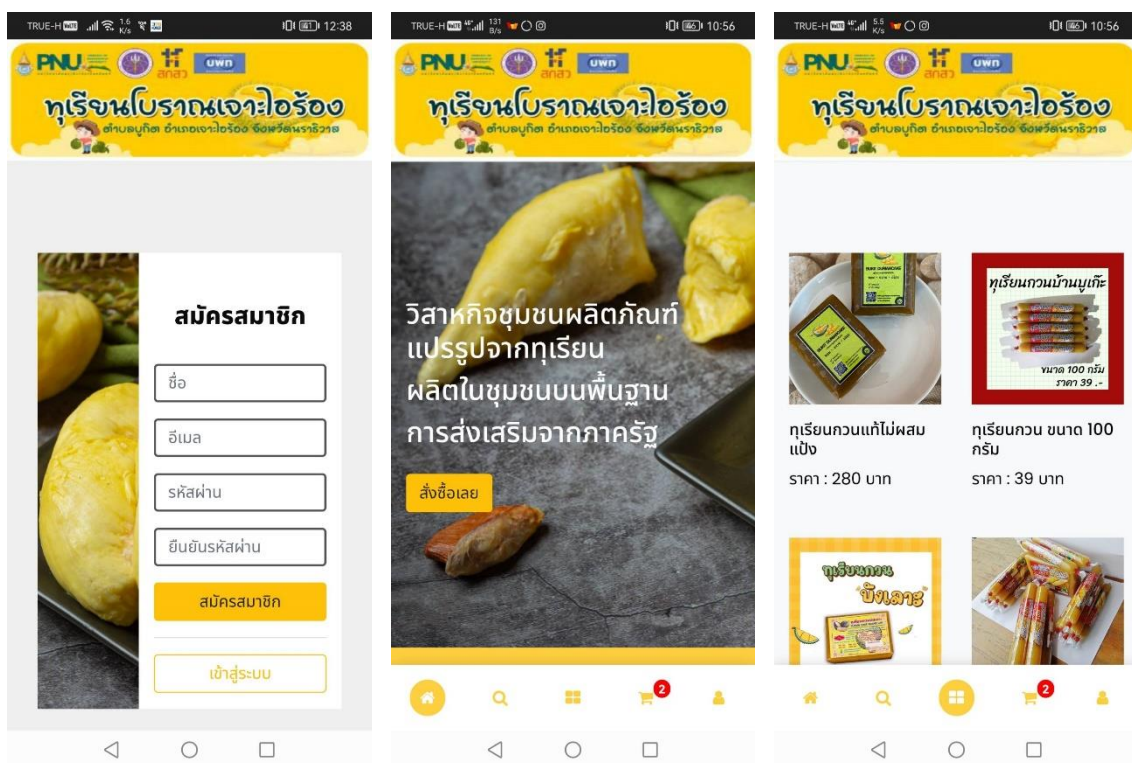

Figure 2 Durian Processed Product Management System Development Architecture

The details of Figure 2 are as follows: The B2B2C (Business-to-Business-to-Customer) model is a business approach that facilitates transactions between business owners and enables them to sell products to consumers. This new business model combines both buyers and sellers on a single platform. The business that owns the platform acts as an intermediary, bringing business owners and consumers together with a focus on user behavior. The B2B2C model is a new sales method that has evolved from and improved upon the B2B and B2C models. In the current e-commerce system, a logistics supply chain has been created through the B2B2C model, offering comprehensive services. The innovation of the B2B2C model lies in providing new e-commerce rules for all consumers. The full-service e-commerce platform using the B2B2C model connects producers, sellers, and consumers, fully integrating production and retail resources. This platform allows merchants to act as direct sellers, bringing business directly to consumers and shortening the sales chain. Additionally, it has a complete logistics system that selects appropriate transport companies based on consumer needs. As the number of intermediary connections decreases, consumers can purchase satisfactory products at lower prices, while businesses can also achieve higher profits.
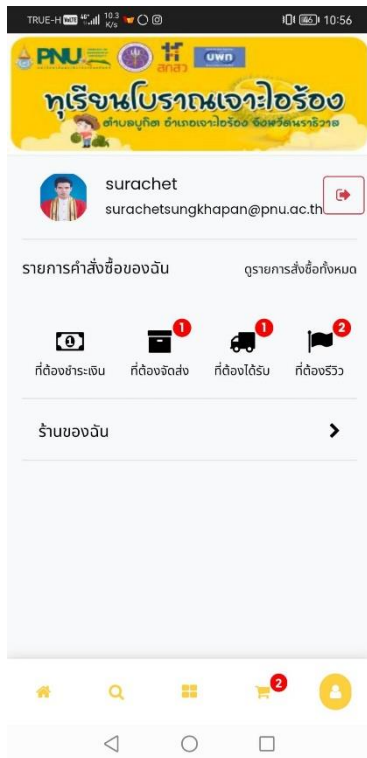
3. User Interface Design

The user interface is designed to be user-friendly for both buyers and sellers. It includes registration pages, sales pages, product listings, order history, shopping cart, payment processing, product reviews, a dashboard for sellers, and a control menu.
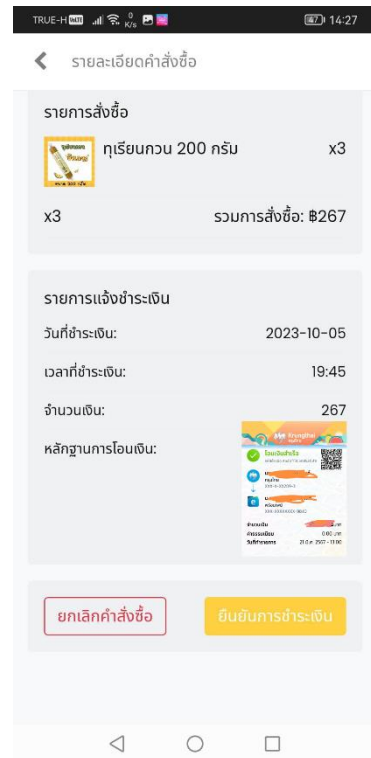

(a) Register   **(b)** Sale page   **(c)** Product

(d) Order Detail
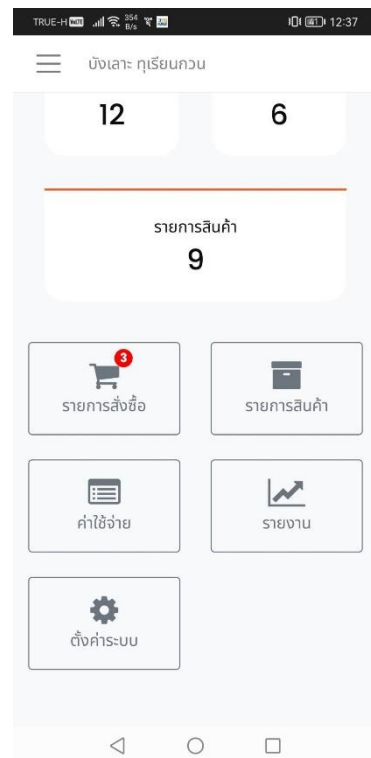

(e) Product cart

(f) Payment

(g) Review

(h) Control page

(i) Menu control page

Figure3 User Interface Design

The details of Figure 3 are as follows: The UI design of the durian processed product management system is customized to provide a smooth and user-friendly experience for both consumers and suppliers. Figure 3 depicts the essential elements of the user interface design. a) User Registration Page: This page facilitates the creation of an account and registration process for new users to have access to the system. b) Sales Page: After logging in, customers are presented with the sales page, where they may see the available items and are encouraged to make rapid purchase selections via a conspicuous "Buy Now" button. c) Product List: Users may access a complete display of all durian processed items that are currently available, allowing them to easily browse and explore the whole variety of products. d) My Orders: Users may view their order history and control their pending, confirmed, and finished orders. f) Shopping Cart: A specialized shopping cart enables customers to review and manage the items they plan to buy. f) Checkout: The checkout procedure directs consumers through the stages of selecting payment alternatives and confirming their orders. Product Reviews: Users have the ability to post reviews and ratings on items, offering useful input to other buyers. The backend dashboard allows vendors to have access to a comprehensive picture of client orders, encompassing pending payments, order confirmations, shipping, and completed orders. Additionally, it indicates the overall quantity of things that have been ordered. i) Menu Page: Vendors can access different menu categories to observe and control their product listings and orders.

4. System Efficiency Evaluation Results

The system's efficiency was evaluated by a sample group of 30 people, consisting of entrepreneurs and general users. The evaluation results are divided into two main parts:

Part 1: General Information about the Respondents

Table 1 General Information about the Respondents results

Gender		Age	Educational qualification			Experience in buying andselling durian (Year)
Male	Female	18-68	Lower than Bachelor's degree	Bachelor's degree	Not specified	3-30
10	20	30	12	17	1	30
33.3%	**66.7%**	**100%**	**40%**	**56.7%**	**3.3%**	**100%**

Table 1 shows the following: Gender: 33.3% of the respondents were male (n=10), and 66.7% were female (n=20). Age: 100% of the respondents were aged 18–68 years (n=30). Educational qualifications: 40% had a bachelor's degree (n=12), 56.7% also had a bachelor's degree (n=17), 3.3% did not specify their qualifications (n=1). Experience in buying and selling durian: 100% had 3–30 years of experience (n=30).

Part 2: Evaluation of the Satisfaction Level with the Efficiency of the Development of the Mobile Application for Durian Processed Product Management Center System Application in Narathiwat Province Towards Driving E-Commerce using the Black-Box Testing Method

2.1 Evaluation of Compliance with User Requirements (Functional Requirement Test)

Table 2 Function requirement testing results

Function requirement Testing	$\bar{x}$	S.D.	Interpret results
1. The system can manage members.	4.73	.58	The most
2. The system can manage products.	4.67	.61	The most
3. The system can manage product orders.	4.70	.60	The most
4. The system provides payment channels.	4.60	.62	The most
5. The system can manage databases.	4.57	.68	The most
6. The system can manage multiple sellers.	4.70	.60	The most
7. The system can generate sales reports.	4.73	.52	The most
8. The system allows user registration.	4.63	.56	The most
Total	**4.67**	**.49**	**The most**

Table 2 shows the following conclusions about the functionality of the system: The system can manage members and generating sales reports was the most valued feature ($\bar{x}$ =4.67, S.D.= .49). The three items with which users were most satisfied were: The system can manage members ($\bar{x}$ = 4.73, S.D. = 0.58) and generate sales reports ($\bar{x}$ = 4.73, S.D. = 0.52). The system can manage product orders and multiple sellers ($\bar{x}$ =4.70, S.D.= .60) and the system can manage products ($\bar{x}$ =4.67, S.D.= 0.61).

2.2 Evaluation of the Efficiency of the System's Functional Performance (Functional Testing)

Table 3 Functional Testing results

Functional Testing	$\bar{x}$	S.D.	Interpret results
1. Accuracy of member management	4.53	.63	The most
2. Accuracy of product management	4.60	.68	The most
3. Accuracy of product order management	4.67	.66	The most
4. Accuracy of payment channels	4.63	.67	The most
5. Accuracy of database management	4.53	.63	The most
6. Accuracy of multiple seller management	4.70	.54	The most
7. Accuracy of sales report generation	4.63	.67	The most
8. Accuracy of user registration	4.63	.62	The most
Total	**4.62**	**.55**	**The most**

Table 3 shows the following conclusions about the functionality of the system: Overall satisfaction with the functionality of the system was the highest ($\bar{x}$=4.62, S.D.= 0.55). The three items that users were most satisfied with were: Accuracy of multiple seller management ($\bar{x}$ =4.70, S.D.= 0.54), accuracy of product order management ($\bar{x}$ =4.67, S.D.= 0.66), accuracy of payment channels ($\bar{x}$= 4.63, S.D. = 0.67), accuracy of sales report generation ($\bar{x}$ = 4.63, S.D. = 0.67), and accuracy of user registration ($\bar{x}$= 4.63, S.D. = 0.62).

Table 4 Usability testing results

Usability Testing	$\bar{x}$	S.D.	Interpret results
1. The system is easy to use.	4.47	.63	The most
2. The system works quickly.	4.50	.63	The most
3. The screen design is standardized.	4.60	.62	The most
4. The use of symbols or images is appropriate.	4.60	.56	The most
5. The font size is appropriate.	3.63	.56	The most
6. The use of text and image colors is appropriate.	3.63	.56	The most
7. The use of text to explain the meaning is appropriate.	3.57	.73	The most
8. Overall satisfaction with the system is high	3.57	.68	The most
Total	**4.57**	**.49**	**The most**

Table 4 shows that the overall satisfaction with the usability of the mobile application was the highest ($\bar{x}$ =4.57, S.D.=.49). The three items that users were most satisfied with were: 1) The screen design is standardized ($\bar{x}$ = 4.60, S.D. = 0.62); 2) The use of symbols or images is appropriate ($\bar{x}$ = 4.60, S.D. = 0.56); 3) The system works quickly ($\bar{x}$ = 4.50, S.D. = 0.63); and 4) The system is easy to use ($\bar{x}$ = 4.47, S.D. = 0.63).

2.3 Evaluation of the Efficiency of Data Security in the System (Security Testing)

Table 5 Security testing results

Security Testing	$\bar{x}$	S.D.	Interpret results
1. The system can assign usernames and passwords to verify user access.	4.60	.68	The most
2. The system can control access according to user permissions accurately.	4.60	.56	The most
3. The system notifies when ordering products and making payments.	4.53	.63	The most
4. The system notifies when incorrect or incomplete data is entered.	4.62	.62	The most
Total	**4.60**	**.56**	**The most**

Table 5 shows the following conclusions about the system performance: Overall satisfaction with the system's performance was the highest ($\bar{x}$ =4.60, S.D. = 0.56). The three items that users were most satisfied with were: 1) The system notifies when incorrect or incomplete data is entered ($\bar{x}$ = 4.62, S.D. = 0.62); 2) The system can assign usernames and passwords to verify user access ($\bar{x}$ = 4.60, S.D. = 0.68) and control access according to user permissions accurately ($\bar{x}$ = 4.60, S.D. = 0.56); and 3) The system notifies when ordering products and making payments ($\bar{x}$ = 4.53, S.D. = 0.63).

The research team's comprehensive evaluation of the e-commerce system for durian entrepreneurs in Narathiwat province has yielded impressive results across all four aspects of assessment. Users expressed high satisfaction with the system's alignment to their requirements, awarding it an average score of 4.67. This satisfaction was particularly evident in the system's robust membership management features and its capability to generate detailed sales reports. The system's performance efficiency also received high marks, with an average score of 4.62. Users especially appreciated the accuracy in managing multiple sellers simultaneously. In terms of usability, the system

received a commendable 4.57, with users praising the intuitive screen design and the effective use of symbols and images. Data security, a critical aspect of any e-commerce platform, garnered an average score of 4.60, with users particularly valuing the system's proactive notifications for incorrect or incomplete data entry. These evaluation results paint a picture of a highly efficient system that responds well to user needs. However, it's worth noting that the ease of use score, while still high, is slightly lower than the scores for other aspects. This suggests an area for potential improvement in future iterations of the system. A particularly intriguing finding of this study is the effectiveness of the B2B2C (Business-to-Business-to-Consumer) model in enhancing connections between producers, traders, and consumers. This aligns with previous research by (Cai *et al.*, 2018), which highlighted the model's capacity to reduce supply chain complexity and improve logistics management efficiency. When compared to similar e-commerce systems developed for agricultural products in other regions, this system distinguishes itself through its robust support for multiple sellers and its efficient logistics management capabilities, making it particularly well-suited for the unique context of durian entrepreneurs in Narathiwat province. Despite these positive outcomes, the study does acknowledge certain limitations. Notably, the sample group for system testing did not encompass all user groups, with a particular gap in representation from end customers - a crucial component of the B2B2C model. This highlights the need for more comprehensive customer testing in future system development to ensure a more holistic evaluation. Looking ahead, the research team recommends conducting additional studies to gauge the system's impact on local economic development. They also suggest exploring the possibility of expanding the system to other regions or adapting it for different agricultural products. Such studies would provide a broader perspective on the potential of e-commerce systems for agricultural products across Thailand.

The development of the e-commerce system for durian entrepreneurs in Narathiwat Province has shown promising results, yet it is not without limitations. The study's relatively small sample size of 30 users may limit the generalizability of the findings. Additionally, the lack of input from end customers, a crucial element in the B2B2C model, presents a gap in the evaluation process. The system's slightly lower score in ease of use compared to other aspects indicates potential for improvement in the user interface design. Despite these limitations, the system offers unique features that set it apart from similar e-commerce platforms for agricultural products. Its robust support for multiple sellers directly addresses the specific needs of the Narathiwat durian industry. The integration of a comprehensive logistics management system enhances product delivery efficiency, while the utilization of the B2B2C model, although less common in agricultural e-commerce, significantly reduces supply chain complexity.

User feedback has been largely positive, with particular praise for the system's multiple seller management capabilities. Users have reported that this feature has streamlined their operations and improved communication with customers through the automated notification system.

Looking ahead, there are several potential avenues for future development. The system could be expanded to accommodate a wider range of agricultural products beyond durian. Implementation of machine learning algorithms could provide personalized product recommendations, enhancing the user experience. Integration of blockchain technology could improve supply chain traceability and build trust among users. Developing a mobile application would increase accessibility, catering to the growing trend of mobile e-commerce.

In the results, while the system demonstrates significant improvements over existing solutions, there is room for refinement, particularly in user interface design. More comprehensive user testing, especially including end customers, would be beneficial for future iterations. Despite its current limitations, the success of this system lays a strong foundation for developing similar e-commerce solutions for other agricultural products, not only in Thailand but potentially beyond its borders as well.

4. Conclusion

The development of an e-commerce system through a mobile application for durian entrepreneurs in Narathiwat Province has marked a significant milestone in addressing the challenges faced by local agricultural businesses. This innovative approach has not only successfully resolved the issues identified in the research but has also paved the way for a more efficient and sustainable business model in the region. The system's effectiveness is evident from the overwhelmingly positive user satisfaction ratings across all four dimensions evaluated: alignment with user requirements, system performance efficiency, ease of use, and data security. With mean scores ranging from 4.57 to 4.67, the application has demonstrated its ability to meet and exceed user expectations, providing a robust platform for e-commerce activities. At the heart of this success lies the application's ability to drive the B2B2C (Business-to-Business-to-Consumer) model effectively. By directly connecting producers with traders and enabling traders to showcase products to consumers through a unified platform, the system has significantly reduced supply chain complexity. Furthermore, its integrated logistics management and data analysis capabilities have empowered stakeholders to make informed business decisions, streamlining the entire process from production to consumption. The impact of this e-commerce system extends far beyond mere technological advancement. Economically, it has opened up new market opportunities both domestically and internationally, increasing revenue and profits for local entrepreneurs. This expansion has had a ripple effect on the local economy, fostering growth and development. Socially, the system has catalyzed digital skills development within the community and fostered collaborative networks among various stakeholders in the supply chain. From an industry perspective, this initiative represents a transformative shift from traditional trading methods to digital formats. It serves as a model for e-commerce system development that can be applied to other agricultural products, potentially revolutionizing the entire sector. Moreover, the system's focus on sustainable business growth and support for local entrepreneurship aligns well with broader sustainable development goals. Looking ahead, there are numerous opportunities to build upon this success. Recommendations for future applications include adapting the system for other processed agricultural products and extending its use to other regions of the country. Emphasis should also be placed on continuous skill development through training programs and fostering collaborations among entrepreneurs, logistics providers, government agencies, and educational institutions. To ensure long-term relevance and effectiveness, future research should focus on studying the system's long-term impacts on local economic development and changes in consumer and entrepreneur behavior. Expanding the research scope to other regions and agricultural products will provide valuable insights for broader implementation. Additionally, exploring the integration of advanced technologies such as artificial intelligence and big data analytics could further enhance the system's efficiency and predictive capabilities. Sustainability should remain a key focus, with research efforts directed towards understanding the system's impact on environmental and social sustainability in the durian supply chain. Aligning system development with Sustainable Development Goals (SDGs) will ensure that technological advancements contribute positively to overall societal progress.

In conclusion, the development of this e-commerce system via a mobile application for durian entrepreneurs in Narathiwat Province represents a significant leap forward in addressing the challenges faced by local agricultural businesses. By efficiently connecting producers, traders, and consumers through the B2B2C model, it has not only solved existing problems but also created new opportunities for economic and social development. As this model is refined and expanded, it has the potential to significantly advance Thailand's agricultural industry, setting a new standard for digital innovation in the sector. The success of this initiative underscores the transformative power of technology when applied thoughtfully to address real-world challenges, promising a brighter, more connected future for agricultural communities not just in Narathiwat, but potentially across Thailand and beyond.

5. Suggestion

The implementation of the e-commerce system for managing processed durian products has revealed both immediate operational challenges and opportunities for future enhancement. As with any new technology adoption, a learning curve has emerged, particularly affecting some entrepreneurs who have encountered initial difficulties in data entry. This challenge underscores the importance of intergenerational collaboration within the community. Engaging younger individuals to learn and understand the system, and subsequently assist the entrepreneurs, could significantly smooth the transition process. To ensure a successful integration, researchers and affiliated networks will closely oversee this process during the crucial first six months of implementation. Looking towards the future, there are several avenues for improving the application's functionality and user experience. A key recommendation is the integration of consumer behavior tracking capabilities. This feature would provide valuable insights into purchasing trends, allowing the system to offer personalized product recommendations. Such a development would not only enhance the user experience for consumers but also provide entrepreneurs with data-driven insights to inform their business strategies. Furthermore, centralizing the payment processing within the application emerges as another important suggestion for future development. By streamlining the transaction process, this enhancement would significantly improve customer convenience, potentially leading to increased sales and customer satisfaction. This centralized approach could also provide better oversight and security for financial transactions within the system. These recommendations, both for immediate operations and future development, aim to address current challenges while also positioning the system for long-term success. By focusing on user support, data-driven insights, and improved functionality, the central system for managing processed durian products can continue to evolve, meeting the changing needs of entrepreneurs and consumers alike. This adaptive approach ensures that the system remains not just a tool for current use, but a platform for ongoing innovation in the agricultural e-commerce sector.

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