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UX Design for an E-commerce Application: A Design Thinking Perspective

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Abstract: - The development of e-commerce applications has revolutionized the way people conduct business, but challenges still exist in designing applications that align with user needs and expectations. This study aims to document the design-thinking (DT) approach used in the development of a customized e-commerce application based on the user's perspective, with the goal of extracting the user experience of traditional commerce processes to identify its features. In this study, we focused on the first four phases of DT, which include empathize, define, ideate, and prototype, to gather insights and understand the experiences, needs, pain points, and solutions of the local producers. The data gathered from interviews and observations was subjected to content analysis to identify patterns and themes related to desired features. After analysis, the researchers identified key app features, including integrating data analytics for product performance and demand forecasting, introducing a peer-vendor marketplace, a vendor-managed inventory management system, and a product verification system for authenticity. A mockup prototype design was created and presented to users for feedback. The study highlights the importance of user perspectives in e-commerce app design and the value of design thinking in creating a customized user experience that aligns with user needs.

Keywords: E-commerce App, Design-Thinking, UX Design.

I. INTRODUCTION

The emergence of e-commerce applications has presented local producers with new opportunities to conduct business, increasing their sales and expanding their reach. This cost-effective and convenient method of selling products has become increasingly popular, particularly in the wake of the COVID-19 pandemic. According to the Department of Trade and Industry (DTI), 67% of customers have shifted to online shopping, citing safety as a key factor in their decision-making process, highlighting the impact of digitalization on the industry's efficiency and profitability [1]. The National Economic and Development Authority (NEDA) recognizes the potential of e-commerce applications to promote economic activity and improve business operations [2]. However, the challenge lies in designing an e-commerce application that is not only easy to use but also meets the needs and preferences of the users [3].

To achieve this, user involvement is crucial to gather their input, needs, and expectations and provide them with an initial understanding of the new system to prevent conflicts between system developers and users [4]. By involving users in the development process and gathering their feedback, the end product can meet their expectations and provide an appropriate solution for enhancing the overall user experience (UX) [5]. By integrating user experience and requirements throughout the UX journey, developers can improve their productivity and self-efficacy by prioritizing user needs and streamlining problem-solving during development. [6]. A good UX is an important factor in an efficient and satisfactory online customer journey [7]. Amazon's whitepaper, titled "The Trillion Dollar UX Problem," highlights that the e-commerce industry loses $1.42 trillion in annual revenue solely due to UX research issues, emphasizing the significant impact of a poor UX on an online business [8][9]. Additionally, studies have shown that useful and desirable applications in e-commerce increase the likelihood of users buying products using the app [10]. Therefore, strengthening the application of the concept of user experience in e-commerce designs is necessary [3].

Design thinking is a user-centered approach to problem-solving that involves understanding the user's needs, questioning assumptions, and exploring alternative strategies to identify solutions, while also being recognized for its ability to frame problems and incorporate the user's perspective into processes and systems [11][12]. This

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approach is aligned with the focus of UX, which is to comprehend the users, their needs, values, abilities, and limitations, while also considering the business goals and objectives of the project management team [13].

The researcher's motivation to conduct the study is the lack of an e-commerce application that adequately caters to the demands of local producers in the province. The study focuses on the user experience (UX) design of the application, which is critical in creating an e-commerce application that aligns with user needs and expectations. To achieve this goal, the study documented the use of the design-thinking approach in developing a customized e-commerce application for local producers. The objective of the study is to extract user experience from traditional commerce processes and identify the features that will best meet the needs and preferences of the intended users for the design of the e-commerce application. The significance of this study lies in its potential contributions to the field of e-commerce in agriculture, locally produced and processed goods, and handcrafts.

II. METHODOLOGY

A. Data Collection

This study utilized the design thinking methodology to uncover the envisioned functionalities of the e-commerce application. In this study, the researchers focused their attention on the initial four stages of the design-thinking process.

During the empathize phase, a series of interviews were conducted with local producers and buyers, with each interview lasting between twenty and thirty minutes. The purpose of these interviews was to gain a deeper understanding of the pain points and challenges faced by these individuals. In the define phase, the researchers consolidated the findings derived from the empathize phase, encompassing user requirements, preferences, and behaviors. The present study employed a synthesis approach to establish the problem statement and construct a point-of-view statement.

In the ideation phase, the researchers engaged in brainstorming sessions to generate ideas for the functionalities of the application. This phase aimed to tackle the challenges identified in the previous phase. In the subsequent phase of the project, the prototype development stage was initiated, wherein a low-fidelity mockup of the e-commerce application was designed in accordance with the concepts and ideas generated during the earlier ideation phase.

B. Data Analysis

The data collected from the interviews and observations was analyzed using content analysis, which includes empathy mapping and the creation of personas to represent the different user groups. This method involves categorizing the data into themes to identify patterns and relationships in the responses. After coding, the data was tabulated and analyzed for frequencies and percentages of the different themes that emerged. These themes were interpreted and compared to the research questions and objectives to determine how they aligned. The synthesized insights were used to define the problem statement and create a point-of-view statement. A How Might We (HMW) statement was created to frame the ideation phase. The findings were presented in tables and figures appropriately. The results were used to create a low-fidelity prototype of the application that incorporates the desired features and functionalities identified in the data analysis.

C. Participants and Sampling

The sampling method utilized in this study is purposive sampling, which involves selecting participants based on specific characteristics relevant to the study. The study selected local product producers and some business owners who have experience selling their products through traditional commerce processes.

To identify potential participants, a list of individuals who meet the inclusion criteria was obtained from local trade associations and craft organizations. A total of twenty participants were selected based on their willingness to participate and availability during the data collection period.

The participants were informed about the study's purpose, their role in the study, and their right to withdraw at any point in the study. Informed consent was obtained from each participant before the data collection process commenced. The researchers also ensured the confidentiality and anonymity of the data analysis and report writing.

III. RESULTS, DISCUSSIONS AND CONCLUSION

A. Empathy

In this section, we present Table 1, which showcases the personas that have been identified during the empathy phase of our research. The individuals were systematically classified and organized based on their background, goals, challenges, specific needs, and objectives.

Table 1. Personas

Persona	Vendor A	Vendor B	Vendor C	Vendor D
Background	An online entrepreneur engaged in the sale of self-manufactured or retail products.	An independent producer engaged in the production of small or medium-scale products	A local artisan that crafts unique handcrafted goods that reflect cultural or traditional heritage.	A small or medium business owner
Goals	To find a user-friendly e-commerce platform and increase customer base.	To increase their revenue by selling directly to customers eliminating middlemen	To expand market reach and assure product authenticity.	To efficiently manage inventory, grow business, and boost revenue.
Challenges	Complexity of existing e-commerce platforms, which often require technical expertise to navigate and market presence.	Overreliance on intermediaries leading to profit loss.	Building trust and online presence while maintaining the authenticity of products	Struggling with inventory management and online sales.
Needs	Increase their customer base by selling products online.	Sell their products directly to customers eliminating middlemen to increase revenue.	Sell their products online through a trusted e-commerce platform that can verify the authenticity of their products.	Sell their products online and increase revenue by expanding their customer base, while also ensuring that they are able to efficiently manage their inventory to prevent overstocking or understocking.

The results of the empathy phase are visually depicted in Figure 1 through the utilization of an empathy map. This strategic tool serves as a visual representation of the comprehensive dataset gathered during the research process. The empathy map is a comprehensive tool that effectively captures and delineates the intricate emotional and behavioral aspects inherent in the experiences of participants. This invaluable tool provides a holistic understanding of the participants' goals, frustrations, motivations, and pain points, thereby facilitating a comprehensive analysis of their experiences. By encompassing these diverse dimensions, the empathy map enables researchers to gain profound insight into the details of the participants' subjective experiences. It was utilized to guide the development of the e-commerce application in order to cater to the needs of its users.
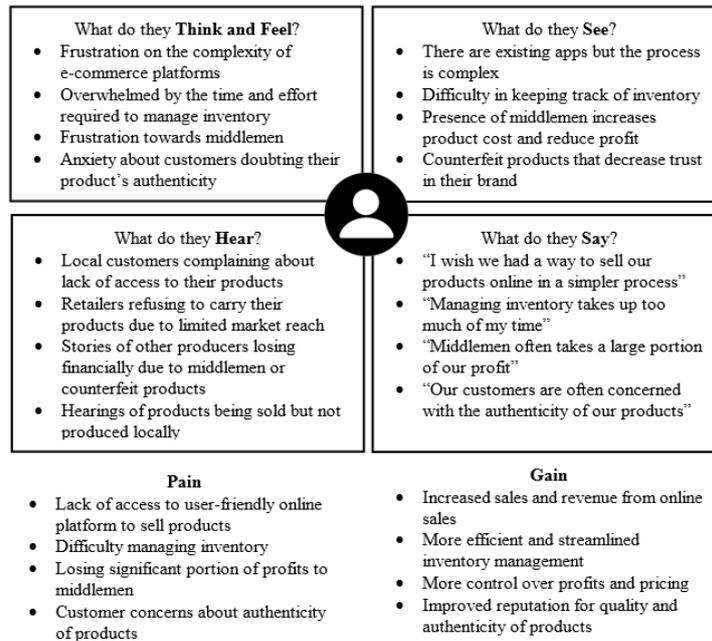
What do they Think and Feel?
- Frustration on the complexity of e-commerce platforms
- Overwhelmed by the time and effort required to manage inventory
- Frustration towards middlemen
- Anxiety about customers doubting their product's authenticity

What do they See?
- There are existing apps but the process is complex
- Difficulty in keeping track of inventory
- Presence of middlemen increases product cost and reduce profit
- Counterfeit products that decrease trust in their brand

What do they Hear?
- Local customers complaining about lack of access to their products
- Retailers refusing to carry their products due to limited market reach
- Stories of other producers losing financially due to middlemen or counterfeit products
- Hearings of products being sold but not produced locally

What do they Say?
- "I wish we had a way to sell our products online in a simpler process"
- "Managing inventory takes up too much of my time"
- "Middlemen often takes a large portion of our profit"
- "Our customers are often concerned with the authenticity of our products"

Pain
- Lack of access to user-friendly online platform to sell products
- Difficulty managing inventory
- Losing significant portion of profits to middlemen
- Customer concerns about authenticity of products

Gain
- Increased sales and revenue from online sales
- More efficient and streamlined inventory management
- More control over profits and pricing
- Improved reputation for quality and authenticity of products

Figure 1. Empathy Map

B. Define

1. Problem Statement

Local producers face several challenges in selling their products, including limited access to online e-commerce platforms, profit losses associated with middlemen, and customer concerns about product authenticity. These challenges lead to a limited market reach, which makes it difficult to expand their customer base and increase revenue. Additionally, local producers find inventory management overwhelming, and they are searching for solutions to streamline the process. To overcome these challenges and achieve their business goals, local producers need solutions that provide easy access to e-commerce platforms, streamline inventory management, and build trust with customers by ensuring product authenticity.

2. Point-of-View (POV) Statement

The point-of-view (POV) statements of the various vendor personas of this business are summarized in Table 2. These POV statements represent the needs and wants of the different vendor sectors, and they are essential for understanding the target market and determining the features of the application.

Table 2. Persona's Point of View Statement

Persona	POV Statement
Online Entrepreneur	I need to discover a user-friendly e-commerce platform that enables me to streamline the management of my product offerings and expand my customer reach
Independent Producer	I need to increase my revenue by selling directly to customers and eliminate middlemen to maximize my profits. I am frustrated by the amount of profit I lose to middlemen and need to find effective ways to reduce my dependency on them.
Local Artisan	I need to expand my market reach by selling my products on a trusted e-commerce platform. However, I am facing a challenge in building trust with potential customers due to concerns about the product's authenticity. I need to find a solution that assures customers of the quality and authenticity of my products, while also allowing me to reach a wider customer base.

Small Business Owner	I am struggling to sell my products online and expand my customer base because I am unable to efficiently manage my inventory. I need to streamline my inventory management process to prevent overstocking or understocking and increase revenue. However, I am overwhelmed by the time and effort required to manage inventory, which is hindering my ability to grow my business.

3. How-Might-We Statement

Small businesses rely on their ability to sell products directly to customers, but they often lack the resources to develop and maintain e-commerce platforms. This can lead to a reliance on middlemen, which can reduce profits and make it difficult to compete. Additionally, small businesses may have difficulty managing inventory and ensuring product authenticity.

This how-might-we statement addresses these challenges by exploring the design of a user-friendly e-commerce application that would give local producers direct access to customers, eliminate the need for middlemen, automate inventory management, and ensure product authenticity. This would help small businesses to improve their sales and market reach.

How might we design a user-friendly e-commerce application that gives local producers direct access to customers, eliminates the need for middlemen, automates inventory management, and ensures product authenticity, therefore improving their sales and market reach?

C. Ideate

The ideation phase involved a collaborative effort among the researchers, who used brainstorming techniques to generate and evaluate multiple solutions that would cater to the unique needs of the local producers. The output of this phase is presented in Table 3, which is a list of potential solutions that were evaluated based on their feasibility, desirability, and viability.

Table 3. List of potential solutions

Developing a user-friendly e-commerce application that allows local producers to sell their products online.
Implement analytics that provides insights into product performance to aid vendors in inventory management decisions
Implementing a real-time, vendor-managed inventory system that keeps track of their stock levels
Establish a multivendor marketplace, empowering sellers to manage their own stores, product listings, and transactions.
Implementing a product verification system to ensure the authenticity of the products sold on the e-commerce platform.

D. Prototype

In this phase, the researchers created a low-fidelity prototype of the e-commerce application with the key features identified in the previous phase. At first, wireframing was employed to develop a fundamental, visual depiction of the application's layout and structure. Subsequently, mockup designs were used to create a tangible representation of the application's user experience.

The application functions as a multivendor marketplace designed to serve a diverse array of users, including local producers, online entrepreneurs, artisans, and small to medium business owners within the province. It has two distinct interfaces: the vendor screens and the buyer screens. Upon signing up for an account, users are directed to the default buyer side. To access the vendor side, users can easily navigate to the My Account screen, where a dedicated button is provided for store creation. This streamlined approach ensures seamless switching between buyer and vendor roles within the app.

The system's key features are displayed on the mockup designs along with a description of the user experience.
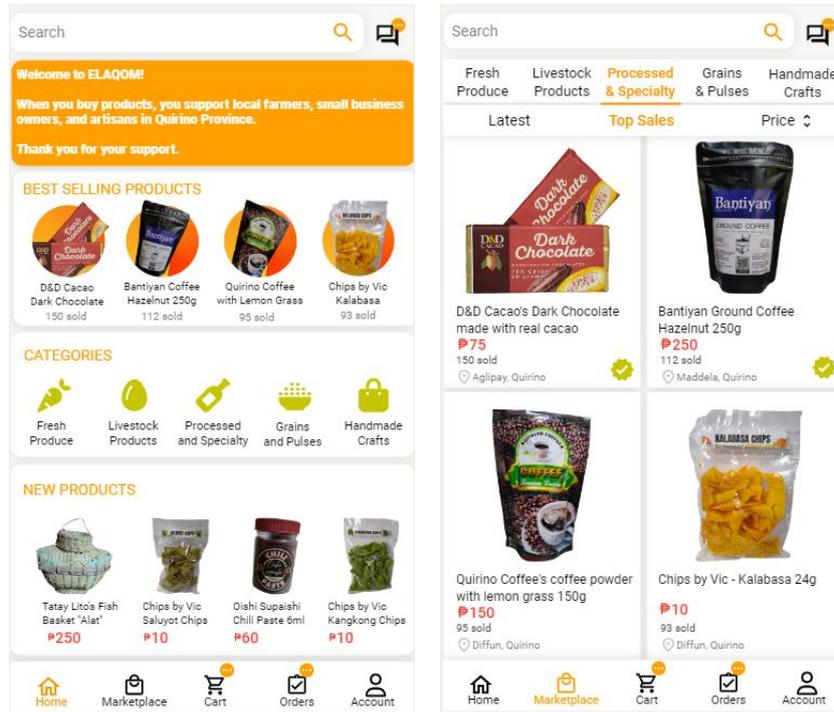
Figure 2. Home and Marketplace screen

As the users launch the app, the home screen of the e-commerce application offers an easy and enjoyable experience that encourages online sales as seen in Figure 2. Its visually appealing layout presents "New Products" to highlight the most recent uploaded products of vendors, product categories, and "Best Selling" products. The bottom of the screen's main menus makes navigation simple.

The app's marketplace screen offers categorized products, filters based on "Latest," "Top Sales," and "Price," and a dedicated search button for quick product discovery. The "Messages" button ensures easy communication between vendors and buyers, fostering connection and trust in the online selling process. The simple interface allows vendors to showcase their products on the intuitive home screen and marketplace.
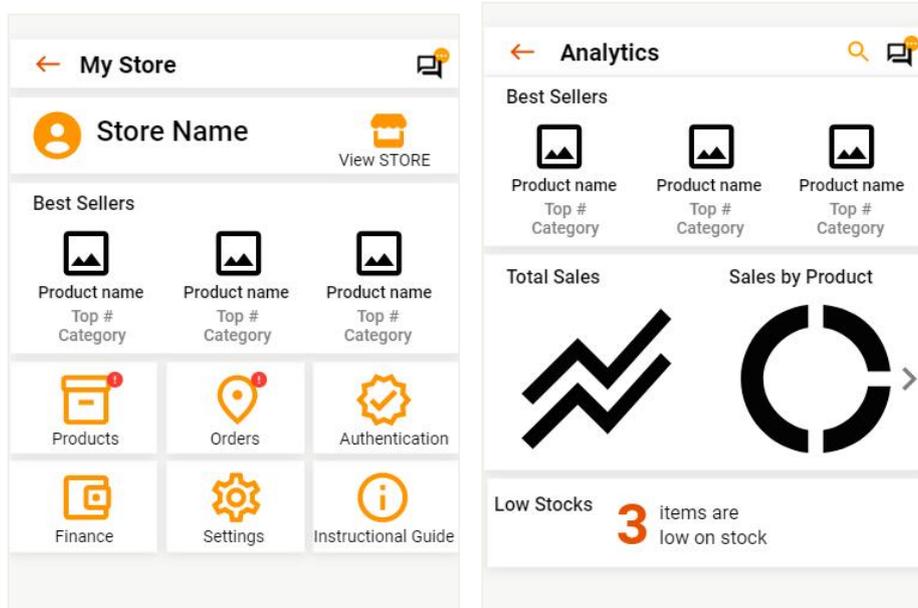

Figure 3. Store Analytics

The store screen simplifies managing functionalities like product listings, orders, authentication, financial management, and settings for vendors as seen in Figure 3. It provides an instructional guide to assist vendors in effectively utilizing the app's features.

The Store Profile allows the vendor to modify the store's name, logo, and description. The functionality of the "View Store" button enables vendors to navigate through the storefront and evaluate its visual appeal.

The inclusion of the "Best Seller Products" section facilitates the identification of top-performing products and when clicked, the user will be redirected to the "Analytics" screen.

The analytics screen as seen in Figure 3 provides valuable insights into your store's performance, enabling you to make informed decisions to boost sales and improve inventory management. It provides a list of best-selling products, a total sales graph, a sale by product graph, and a section for low-stock items. By monitoring inventory levels using stock thresholds, users can efficiently replenish low items, ensuring optimal inventory management within the Products module.

The products module as seen in Figure 4 simplifies the complex task of managing your store's listings, empowering sellers to efficiently handle their product inventory. It offers categorized listings, such as All, Sold Out, Draft, Low on Stock, Return/Refund, Reported, and Add a New Product.

Basic product information, stock, variation, shipping and delivery information, and product authentication settings are all required in the Add a New Product module.
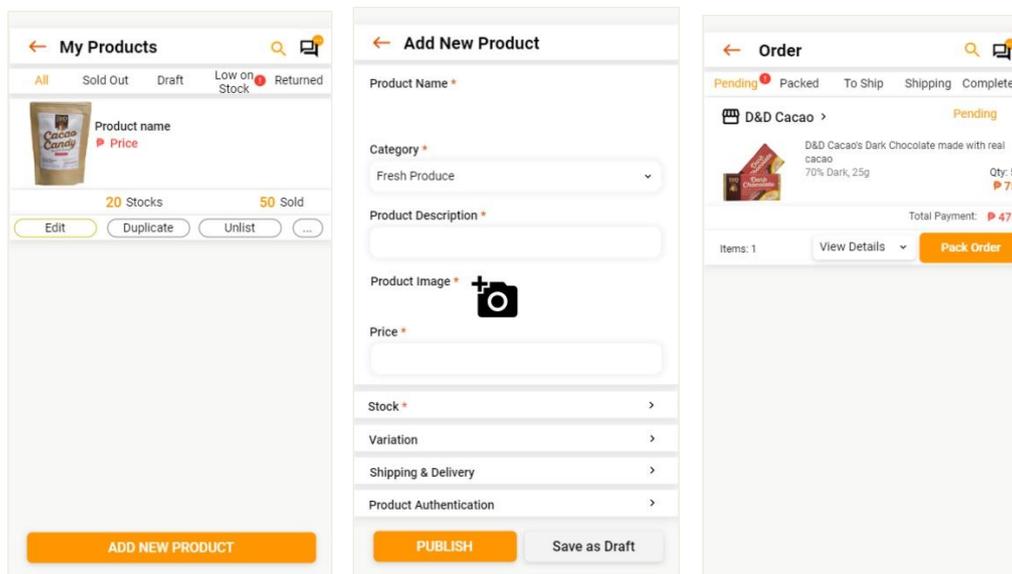
Figure 4. Product Listing and Order Screen

By using the set stock feature to define thresholds and set stock quantities for each product, you can avoid missing out on out-of-stock items.

The built-in authentication system enhances trust in your products, allowing you to enable or disable it for individual products.

The orders module on the vendor side offers a streamlined and organized way for vendors to manage their orders efficiently as seen in Figure 4. It is categorized into several sections, including pending, packed, ready to ship, shipping, completed, return/refund, and cancelled orders. The module also provides detailed information about each order, including customer details, shipping address, order date, and product list. Vendors can perform actions like confirming, packing, marking as shipped, and completing orders within each order, ensuring efficient order fulfillment from one location.
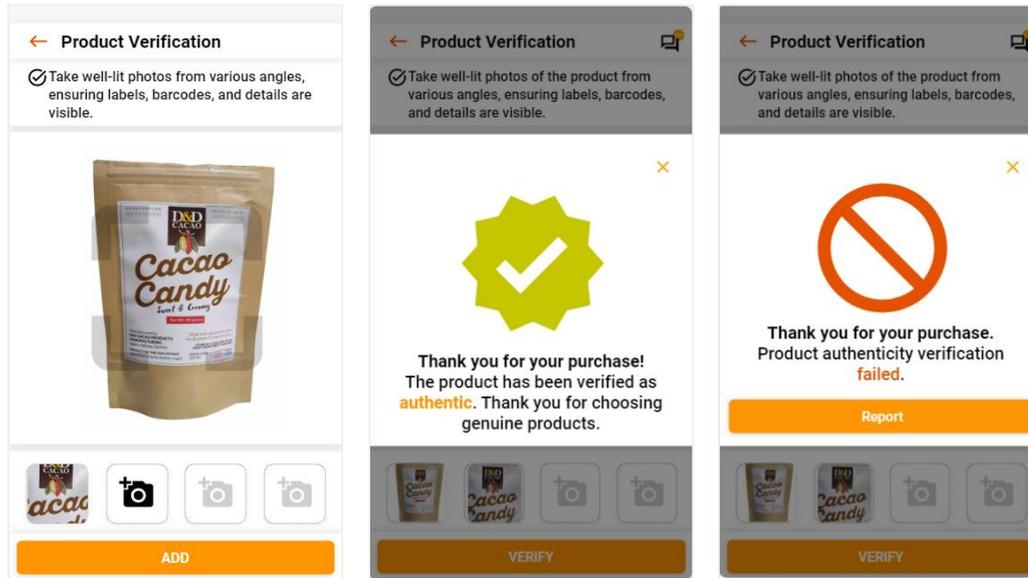
Figure 5. Product Authentication

The product authentication feature as seen in Figure 5 adds security and assurance for buyers of products sold. This feature boosts buyer confidence, allowing them to make confident purchases of authentic products and protecting the brand's reputation by demonstrating commitment to quality.

IV.   CONCLUSION

This study highlights the importance of integrating user experience into the design of e-commerce applications, ensuring they are tailored to users' specific needs and preferences. The design thinking approach helps understand user pain points and deliver customized solutions. By empathizing with users, defining challenges, brainstorming innovative solutions, and prototyping, pivotal features for an e-commerce application are identified, aligning with user needs and providing a fulfilling user experience.

The study's primary objective was to develop a user-focused prototype for an e-commerce application featuring a user-friendly interface, a reliable product verification system, and streamlined inventory and order management. This prototype serves as a promising foundation for future development and testing.

While further investigation and testing are needed to ascertain the prototype's effectiveness and suitability in practical e-commerce environments, this research highlights the importance of design thinking in creating products that genuinely meet user expectations and requirements.

REFERENCES

[1]   Baquiran G. Towards digital market [Internet]. PIA. 2022 [cited 2022Nov9]. Available from:https://pia.gov.ph/features/ 2022/08/01/towards-digital-market

[2]   E-commerce seen to sustain ph economy and drive growth [Internet]. National Economic and Development Authority. 2020 [cited 2022Nov13]. Available from: https://neda.gov.ph/e-commerce-seen-to-sustain-ph-economy-and-drive-growth/

[3]   Cai, L., He, X., Dai, Y., & Zhu, K. (2018, September). Research on B2B2C E-commerce website design based on user experience. In Journal of Physics: Conference Series (Vol. 1087, No. 6, p. 062043). IOP Publishing.

[4]   User Involvement, User Involvement in System Development. (n.d.). https://www.civilserviceindia.com/subject/Management/ notes/user-involvement.html

[5]   Fuhrmann, S. (2018). User-Centered Design for Geoinformation Technologies. Comprehensive Geographic Information Systems, 438–445. https://doi.org/10.1016/b978-0-12-409548-9.09608-1

[6]   Kusuma, W. A., Jantan, A. H., Admodisastro, N. I., & Norowi, N. M. (2023). Reframed Design Thinking and Feasibility Analysis of UX Journey: Integrating User Experience and User Requirement for Solo Software Development.

[7]   Ritonummi, S. (2020). USER EXPERIENCE ON AN ECOMMERCE WEBSITE – A CASE STUDY [MA Thesis]. Jyväskylä University.

[8]   Amazon Web Services. (2020). The trillion dollar ux problem: A comprehensive guide to the ROI of UX [White paper]. https://s3.amazonaws.com/coach-courses-us/public/theuxschool/uploads/The_Trillion_Dollar_UX_Problem.pdf

[9]   Maioli, L. (2018). Fixing Bad UX Designs: Master proven approaches, tools, and techniques to make your user experience great again. Packt Publishing Ltd.

[10]   Perlman, D. (2021). The Effect of User Interface, User Experience and Design on Mobile E-commerce Applications in the Fashion Industry.

[11]   Lahiri, A., Cormican, K., & Sampaio, S. (2021). Design thinking: From products to projects. Procedia Computer Science, 181, 141–148. https://doi.org/10.1016/j.procs.2021.01.114

[12]   Interaction Design Foundation, Dam, R. F., & Siang, T. Y. (2021). What is design thinking and why is it so popular?.

[13]   User Experience Basics | Usability.gov. (n.d.). https://www.usability.gov/what-and-why/user-experience.html