

Research and Development of e-Marketplace for Community

Enterprises in Loei Province Using the PDCA Process

การวิจัยและพัฒนาตลาดกลางพาณิชย์อิเล็กทรอนิกส์สำหรับ กลุ่มวิสาหกิจชุมชนจังหวัดเลย โดยใช้กระบวนการ PDCA

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Abstract

The development of e-Marketplace, which serve as online marketing channels, has increased business opportunities for community entrepreneurs in the digital age. This research aimed to: 1) assess development needs, 2) develop user interface (UI) and user experience (UX), and 3) examine components and evaluate user satisfaction in using e-Marketplace for community-based businesses in Loei province. The PDCA process was utilized. The qualitative data-gathering group comprised 6

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personnel driving e-Marketplace in Loei province, while quantitative data included 89 community entrepreneurs in Loei province. Data were collected through focus group discussions and questionnaires. Qualitative data analysis employed content analysis, while quantitative data were statistically analyzed using percentage, mean, standard deviation, and exploratory factor analysis.

Research findings revealed that the development of the user interface and user experience of e-Marketplace, utilizing the PDCA process, included: 1) Plan: There was needs to improve and develop the website's user interface and user experience. 2) Do: Design and development of the UI included logo, color, typography, and icons. Regarding UX design, it included the structure of UX components, such as product search, promotion display, store status changes, visitor count display, order progress bar for product purchases, and approval of product orders. 3) Check: From the perspective of community entrepreneurs, factors could be defined, including user interface design, system operation efficiency, and system security. Regarding user satisfaction with system usage, entrepreneurs were most satisfied with system security, followed by user interface design and system operation efficiency. And 4) Act: Regarding usage, after the improvement, there were conditions and guidelines for website usage.

Keywords: Phanichshoploei, E-Marketplace, User Interface, User Experience

บทคัดย่อ

การพัฒนาตลาดกลางพาณิชย์อิเล็กทรอนิกส์ซึ่งเป็นช่องทางการตลาดออนไลน์จะช่วยให้ผู้ประกอบการชุมชนมีโอกาสทางธุรกิจในยุคดิจิทัลมากขึ้น การวิจัยนี้มีวัตถุประสงค์เพื่อ 1) ประเมินความต้องการในการพัฒนา 2) พัฒนาส่วนประสานผู้ใช้งาน และส่วนประสบการณ์ผู้ใช้งาน และ 3) ตรวจสอบองค์ประกอบและประเมินความพึงพอใจในการใช้งานของผู้ประกอบการชุมชนของตลาดกลางพาณิชย์อิเล็กทรอนิกส์สำหรับกลุ่มวิสาหกิจชุมชนจังหวัดเลย โดยใช้กระบวนการ PDCA กลุ่มผู้ให้ข้อมูลเชิงคุณภาพ คือ บุคลากรในหน่วยงานที่ขับเคลื่อนการพาณิชย์อิเล็กทรอนิกส์จังหวัดเลย 6 คน สำหรับข้อมูลเชิงปริมาณประกอบด้วยผู้ประกอบการชุมชน 89 รายในจังหวัดเลย เก็บรวบรวมข้อมูลการวิจัยด้วยการสนทนากลุ่มเฉพาะและแบบสอบถาม การวิจัยข้อมูลเชิงคุณภาพใช้การวิเคราะห์เนื้อหา และข้อมูลเชิงปริมาณใช้การวิเคราะห์ข้อมูลทางสถิติได้แก่ ค่าร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และการวิเคราะห์องค์ประกอบเชิงสำรวจ

ผลการวิจัย พบว่า การพัฒนาส่วนประสานผู้ใช้งานและส่วนประสบการณ์ผู้ใช้งานของตลาดกลางพาณิชย์อิเล็กทรอนิกส์โดยใช้กระบวนการ PDCA ประกอบด้วย 1) ด้านการวางแผน พบว่า มีความต้องการในการปรับปรุงและ

พัฒนาเว็บไซต์ ในส่วนประสานผู้ใช้งานและส่วนประสบการณ์ผู้ใช้ 2) ด้านการปฏิบัติการออกแบบและพัฒนาส่วนประสานผู้ใช้งาน ได้แก่ โลโก้ สี แบบอักษร และไอคอน สำหรับการออกแบบส่วนประสบการณ์ผู้ใช้งาน ได้แก่ โครงสร้างขององค์ประกอบของประสบการณ์ผู้ใช้ รวมถึงการค้นหาสินค้าบนเว็บไซต์ การแสดงสินค้าโปรโมชั่น การเปลี่ยนแปลงสถานะของร้านค้า การนับและแสดงจำนวนผู้เข้าชม การแสดงแถบความคืบหน้าสำหรับการสั่งซื้อสินค้า และการอนุมัติคำสั่งซื้อสินค้า 3) ด้านการประเมิน พบว่า ในมุมมองของผู้ประกอบการวิสาหกิจชุมชนสามารถกำหนดองค์ประกอบของปัจจัยด้านตลาดกลางพาณิชย์อิเล็กทรอนิกส์ ได้แก่ การออกแบบส่วนประสานผู้ใช้งาน ประสิทธิภาพการใช้งานของระบบ และความปลอดภัยของระบบ สำหรับความพึงพอใจของผู้ประกอบการวิสาหกิจชุมชนที่มีต่อการใช้งานระบบ พบว่า ผู้ประกอบการวิสาหกิจชุมชนพึงพอใจด้านความปลอดภัยของระบบมากที่สุด รองลงมา ได้แก่ การออกแบบส่วนประสานผู้ใช้งาน และประสิทธิภาพในการใช้งานของระบบตามลำดับ และ 4) ด้านการใช้งาน ภายหลังจากปรับปรุงได้มีเงื่อนไขและกฎเกณฑ์การใช้งานบนเว็บไซต์

คำสำคัญ: พาณิชย์ซื้อขาย ตลาดกลางพาณิชย์อิเล็กทรอนิกส์ ส่วนประสานผู้ใช้งาน ส่วนประสบการณ์ผู้ใช้งาน

Introduction

The rise of digital businesses, particularly e-Commerce, has seen rapid growth since 2016, aligning with the digital economy era. From the survey results in 2020, it was found that internet access among the Thai population was as high as 88%. However, when considering the number of B2C e-Marketplace developments, there were only 213 platforms, which was relatively low compared to other countries. Furthermore, when considering the proportion of the types of stores in the e-Marketplace, it was found that the online shopping mall type of business, which involves trading between buyers and sellers, ranked second after the classified site business (33.40% and 58.20%, respectively). However, in terms of usage or service utilization, it was found that people were highly interested in the online shopping mall business, accounting for up to 81.40% of the data. This indicates that the online shopping mall e-Marketplace format was the dominant online business model in terms of market share (Economic and Social Commission for Asia and the Pacific, 2024). This trend underscores the importance of e-Marketplaces in a geography-free digital economy, facilitating the distribution of community products and offering new business opportunities. Thai consumers favor online shopping for its convenience, with the growth of digital technology fostering diverse digital marketing platforms (Khamchan & Kullimratchai,

2022; Rungsisawat, Sriyakul, & Jermisittiparsert, 2019). From the aforementioned advancements in online marketing, the pivotal aspects of success in developing an e-Marketplace website, as identified by Ramadhanti and Slamet (2020), were usability, information, and service interaction. It was emphasized that the quality metrics of the website should be validated by user trust and satisfaction. Consequently, designing UI/UX for e-Marketplaces becomes crucial, focusing on usability, system quality, and aesthetics to engage users (Berni, Borgianni, Basso, & Carbon, 2023).

The concept of the PDCA (Plan-Do-Check-Act) quality cycle originated in the 1950s, aiming to establish a systematic approach to product creation that adhered to predefined standards and could be monitored and evaluated. Widely embraced across various sectors such as industry, business management, education, and tourism, the PDCA cycle has been instrumental in driving quality improvement and development (Gupta, 2006; Isniah, Purba, & Debora, 2020). However, the adoption of the PDCA concept for integrating work between system designers and relevant units to develop e-Marketplace was still very limited, as there was a predominant use of Software Development Life Cycle (SDLC) principles for website design and development, tailored to various situations.

For the digital marketing situation of the community in Loei Province, most entrepreneurs primarily used online marketing channels, such as Facebook, Line, etc. Additionally, there were websites that promoted community products according to missions, such as the Community Development Office of Loei Province. Therefore, the implementation of this research project was a collaboration between the research team and the Loei Provincial Commerce Office to improve and develop the e-Marketplace as an online marketing channel for community enterprise entrepreneurs in Loei Province. From the importance mentioned above. The primary objective was to develop the e-Commerce as a distribution channel for community businesses in Loei province, using a quality management perspective based on the PDCA cycle. This research will be beneficial in creating business opportunities for community enterprises, promoting a positive attitude towards using technology for income generation, developing online marketing strategies, and preparing the public for entry into the digital age.

Research Objectives

The main objective of the research was to develop the e-Marketplace of community enterprises in Loei Province using the PDCA process. The sub-objectives were as follows:

1. To assess the needs for developing the user interface (UI) and user experience (UX) of the e-Marketplace of community enterprises in Loei Province.
2. To design and develop the user interface (UI) and user experience (UX) of the e-Marketplace of community enterprises in Loei Province.
3. To investigate the components and satisfaction of community enterprise operators towards the e-Marketplace of community enterprises in Loei Province.

Literature Review

1) Concepts of the e-Marketplace

The e-Marketplace serves as a platform where a multitude of products, stores, or companies converge to facilitate buying and selling transactions. One type of e-Marketplace is online shopping malls, which offer a wide range of primarily new products from various sellers (Economic and Social Commission for Asia and the Pacific, 2024).

The research covered two e-Commerce development projects. One focused on community-based home bakeries, involving front-end and back-end system development for product display, user registration, ordering, and management tasks. The other project aimed to create an e-Marketplace for farmers in Chiang Mai, incorporating features for users, administrators, and sellers, with an emphasis on system quality in design, functionality, and data security, all reaching top levels (Kraisanti et al., 2020). Additionally, UI design responsibilities involved designing colors, icons, and typography, while UX was linked to users' usage, feelings, thoughts, and perception of the design, as well as the interaction between users and the system (Sharma & Tiwari, 2021). This encompassed affective response, cognitive perception of information, comfort, safety, and system efficiency perceived by users (Berni et al., 2023).

2) The concept of PDCA within the context of an e-Marketplace

Jagusiak-Kocik (2020) summarized the key principles of continuous improvement and development management, widely recognized in organizations, as the PDCA (Plan-Do-Check-Act) quality cycle. From the application of the PDCA process in developing the e-Marketplace system, the related research findings are as follows: 1) *Plan stage*: According to the research conducted by Andreswari et al. (2020), the first step in developing an e-Marketplace for village-owned small, micro, and medium enterprises involved identifying the requirements for system development through collaboration between customers and system designers, aiming to enhance the UI/UX system. 2) *Do stage*: UI/UX played a crucial role in e-Marketplace development, requiring designs for usability and attractiveness to engage users. According to relevant research findings, key steps in UI/UX design included requirement analysis, design, evaluation, and practical implementation, with overall satisfaction with design and system usage reaching the highest level (Chandraramya & Thammaditiroj, 2021). 3) *Check stage*: As a process in examining the prototype system, from the evaluation results of user satisfaction, it was found that an efficient operating system, which facilitates ease of use, influenced user satisfaction with system usage (Sfenrianto, Wijaya, & Wang, 2018). 4) *Act stage*: The final step focused on preparing to apply the results in real-world situations. The key consideration that administrators had to bear in mind when leveraging e-Marketplace for benefits included trust in the purchasing system, personalization, and security concerns (Radziszewska & Czestochowska, 2013). In the application of the PDCA quality cycle to technology-related work, Kurnia, Jaqin, and Purba (2021) conducted applied research that leveraged technology in the manufacturing industry, particularly in Industry 4.0 (i4.0). This approach aimed to manage production by eliminating waste and continuously enhancing quality. Moreover, It was aligned with Internet of Things (IoT) technology concepts and PDCA process (Peças, Encarnação, Gambôa, Sampay, & Jorge, 2021).

The literature and research on the PDCA quality cycle reveal that developing an e-Marketplace aligns with its four stages: 1) Requirement identification: Planning stage, identifying system improvement needs. 2) System design and development: Implementation based on specified requirements. 3) Trial use and evaluation: Involving user experimentation and evaluation, allowing defect rectification. And 4) Actual deployment: Preparing the improved system for practical use.

Methodology

This research was a research and development (R & D) study. Both qualitative research methods for collecting necessary data and quantitative research methods for data evaluation were used in this study.

As the research was a collaboration between researchers and organizations driving e-Commerce initiatives, the main key informant groups for qualitative research included: one organization executive, two department heads, and three personnel related to the organization's information system. The target population for quantitative research comprised entrepreneurs of community enterprises or community businesses in Loei Province aiming to engage in product sales via the e-Marketplace, particularly the platform phanichshoploei.com. The researchers invited 108 community business entrepreneurs to participate in the training program. There were 89 individuals who responded and joined the program to enhance their digital marketing skills. So data were collected from 89 individuals, exceeding the absolute minimum sample size of 50 observations required for conducting an Exploratory Factor Analysis (EFA) on the component structure (Hair, Black, Babin, & Anderson, 2019).

Data collection was accomplished through qualitative research, specifically focus group discussions, to assess needs for developing and preparing to implement the e-Marketplace, while for quantitative research, questionnaires were employed. The questionnaire consists of two sections: 1) general information about the respondents in the form of a checklist, and 2) satisfaction with the use of the website, measured on a 5-point rating scale, including 'very satisfied,' 'satisfied,' 'neutral,' 'dissatisfied,' and 'very dissatisfied,' with a total of 16 items (Adapted from Wongtha, 2020). Additionally, the researchers assessed the quality of the tools, including content validity through the evaluation of three computer business design experts and reliability testing using Cronbach's alpha coefficient is 0.82. The results showed a reliability level greater than 0.70, which is considered acceptable (Hair et al., 2019).

Qualitative data from the focus group discussions were analyzed using content analysis. Quantitative data analysis involved utilizing statistical techniques such as percentage, mean, standard deviation, and exploratory factor analysis to examine the components of user interactions.

Results

1) The research findings from the assessment of needs for e-Marketplace development, derived from focus group discussions and related to development planning, revealed that,

1.1) Designing a website: participants emphasized the importance of creating a website with a unique design that is easy to navigate and visually appealing to users. This suggests a focus on aesthetics and UI design. 1.2) Enhancing existing system functions for better UX: there was a consensus among participants regarding the need to improve the functionality of the current system to enhance user experience. This likely involves optimizing features such as product search, order processing, and payment methods to make them more efficient and user-friendly. 1.3) Incorporating elements like logo, colors, and layout for usability, and 1.4) Participants identified specific areas for improvement within the e-Marketplace, including enhancing product search capabilities, promotional features, providing real-time updates on store status, visitor count, and streamlining the ordering and approval process.

2) Designing and developing the UI and UX of the e-Marketplace, the research findings including:

2.1) The UI design effectively integrated the Phi-Ta-Khon mask symbolizing Loei province into the logo, utilizing vibrant orange (#F15A29) and calming blue (#000eef) colors for energy and tranquility, respectively. Sans-serif fonts enhanced readability, while icons maintained a cohesive visual style for easy comprehension and navigation. The page layout consisted of a banner, category layout, promoted products, top-rated stores, new stores, bulletin board, articles, as shown in Figure 1.



Figure 1 Logo, color, font, and Icons

Source: Author

2.2) The UX features included product search, promotional product display, store status, visitor count display, order progress bars, and order approval, some examples as illustrated in Figure 2.



Figure 2 User experience (UX) components of the platform

Source: Phanichshoploe (n.d.)

3) Investigating the components and satisfaction of community enterprise operators towards the e-Marketplace of community enterprises, which constituted a process of checking or evaluation, the research findings revealed: Majority of respondents were female (66.30%) and aged 36-55 (39.30%). Most had completed undergraduate education (42.70%). Processed food/beverages were the most popular product category (67.30%), followed by textile weaving products (24.70%) and clothing/blankets (21.30%). Facebook was the most used online platform (93.30%), followed by Line (83.10%). Majority used the internet daily (86.70%), with over 2 hours spent per day by most (42.20%). Primary internet access device was a smartphone (96.60%), mostly Android (78.70%).

Before collecting data on entrepreneur satisfaction with phanichshoploe.com, 16 questions were posed. Exploratory factor analysis, followed by factor rotation using the Varimax method, identified 13 variables categorized into three groups. The criteria for grouping component factors involved assessing eigenvalues greater than 1. The findings revealed that user interface design (questions 1-4), system operation efficiency (questions 5-10), and system security (questions 11-13) were significant factors. Results indicated high entrepreneur satisfaction with system security, closely followed by user interface design and system operation efficiency, as illustrated in Table 1.

Table 1 Factor loading, eigenvalue, % of variance, mean, and standard deviation of components

Component (N)	Factor loading	Eigenvalue	% of Variance	Mean	Standard deviation
User interface design (4)	0.561-0.744	1.749	13.45	4.49	0.34
System operation efficiency 6)	0.500-0.825	2.729	20.99	4.45	0.30
System security (3)	0.601-0.808	1.592	12.25	4.54	0.49

4) Based on the evaluation results, the researchers and the main informant group involved in the development of the e-Marketplace for community enterprise passed a resolution to establish usage conditions for the website. This process was akin to translating assessment findings into actionable steps. These conditions were established with legal and ethical considerations in mind, ensuring product quality and integrity in electronic commerce transactions between sellers and buyers.

Discussion

The main objective of the research was to develop the e-Marketplace of community enterprises in Loei Province using the PDCA process. The research results can lead to the following discussions.

The research findings from the assessment of needs for e-Marketplace development or Planning stage indicated the need for improvement and development in two main aspects: 1) User Interface (UI): The findings revealed a need for enhancement in UI elements such as logo, color, typography, and icons. These findings align with previous research, which confirms that the UI, as a design component of the screen, directly impacts usability through factors like color, typography, and icons. The UI serves as the interface between the system and users, significantly influencing usability. Therefore, it was deemed critical to ensure an attractive and user-friendly design (Khamchan & Kullimratchai, 2022). 2) User Experience (UX): Research results identified key factors conducive to appropriate UX system development, including alignment between user needs and usage. This alignment adds value to the platform in terms of usability, ease of use, and user perception of convenience and satisfaction during use (Berni et al., 2023).

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To design and develop the user interface (UI) and user experience (UX) of the e-Marketplace, which were part of the improvement and development process, the implementation phase was employed. This involved designing and creating UI/UX prototypes, evaluating prototypes with small groups, and making improvements based on feedback. The principles of UI/UX design included reviewing goals and requirements, designing and implementing based on what designers needed to deeply understand, such as the characteristics of the organization, testing, and managing the development of relevant documents for usability (Cho & Kim, 2020). Furthermore, the details of UI/UX design should have considered readable fonts, attractive color schemes, analyzed brand identity into colors, fonts, and mockups, placed icons, logos, texts, and designed website structure to ensure intuitive navigation (Vlasenko et al., 2022).

The research findings highlighted design trends for UI, emphasizing clear and crisp color palettes, duotones, and bold gradient colors, along with modern and legible typography to convey content effectively (Joo, 2017). Regarding UX, the research focused on product search, promotion display, store status change, visitor count, order progress bars, and product order approval, aligning with Saengsri's research (2022).

To investigate the components and satisfaction of community enterprise operators towards the e-Marketplace or check stage found that the perspectives of community enterprise entrepreneurs in Loei province regarding the e-Marketplace system can be categorized into three aspects: user interface design, system operation efficiency, and system security. The results of the factor analysis revealed that factors related to UI design, system operation efficiency, and system security were aligned with factors pertaining to usability, security, and design based on the findings of the cross-border e-commerce research by Taherdoost and Madanchian (2021). The average satisfaction scores for the system security ranks highest which is consistent with the research work of Srinuanpan et al. (2018), and Kosajan, Natsuwan, Inlupet, and Khonchalad (2023). This can be explained by the critical importance of designing a secure system for e-Marketplace, which involves buying and selling products and services. In addition, when considering the general characteristics of survey respondents, it was found that community entrepreneurs were mostly interested in using online platforms for their marketing channels, such as Facebook and Line, which they could access and control themselves. However, when participating in

e-Marketplace marketing channels, they then placed high importance and attention on the security aspects of the system.

Apart from the usual development assessments, UI/UX design, and user satisfaction evaluations, this research also highlighted the operational process. It revealed that, besides addressing minor system flaws, researchers prepared for system usage by setting access conditions, aiming to filter products and instill consumer confidence. Based on the research findings, the preparation for implementing e-Marketplace usage was addressed by the United Nations Conference on Trade and Development (2018), which highlighted the impact of digital marketing channels on the economy, society, and politics. Policymakers involved should have prioritized and adapted policies to align with the changes in the digital context, focusing on protecting consumers and fostering fair competition, as well as safeguarding user data. This aligns with findings from research on ethical issues in Lithuanian e-Commerce, indicating that seller conditions in e-Marketplaces mirror online business ethics (Greblikaite & Pervazaite, 2014). Similar conclusions were drawn by Aisyah, Harahap, and Salsabila (2020), who emphasized that imposing conditions on sellers in large e-Marketplaces fosters customer trust. Compliance with platform conditions strengthens trust over time.

Conclusion and Suggestions

This research indicated that applying the PDCA process, which is widely recognized at both the managerial and operational levels, to develop an e-Marketplace, particularly in collaboration with a relevant organization, was successful. It started by planning collaboratively with stakeholders to assess development needs and establish mutual understanding of development goals (Plan). Then, it proceeded to design and develop the e-Marketplace to align with the defined objectives (Do). Next, it evaluated user satisfaction among community enterprise operators in Loei Province (Check), and prepared for implementation (Act) by setting conditions related to legal and ethical considerations in conducting electronic commerce and driving e-Marketplace usage. Additionally, user satisfaction assessments highlighted the importance of system security, system interface design, and operational efficiency from the users' perspective.

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Recommendations for management-oriented research: The responsible e-Marketplace entity develops the backend system to integrate with the logistics system for delivering products to customers. Promote community entrepreneurs' involvement in driving e-Marketplace activities by inviting them to participate in the form of committees within the organization responsible for oversight. Academic recommendations include: Conduct a study on success factors affecting the distribution of products through the e-Marketplace community-based groups. Investigate consumer intentions to purchase products that impact product consumption through the e-Marketplace of community-based.

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