Available online at: http://e-jurnal.lppmunsera.org/index.php/JSMI

Jurnal Sistem dan Manajemen Industri
(Journal System and Management of Industries)

ISSN (Print) 2580-2887 ISSN (Online) 2580-2895

# Design thinking for digital levy

**Rista Reza Virzinia Agustin*, Ilma Mufidah, Sri Martini, Dino Caesaron**
Department of Industrial Engineering, Telkom University, Jl. Telekomunikasi, Bandung 40257, Indonesia

## ARTICLE INFORMATION

Article history:

Received: June 20, 2024
Revised: November 11, 2024
Accepted: December 14, 2024

Keywords:

Design thinking
Levy
Usability testing
User experience questionnaire

## ABSTRACT

A market levy is a type of general service levy collected from traders to cover the costs of using market facilities and obtaining permits from the local government. The benefit of implementing digital levy payment is that the levy payment service can be accessed online, facilitating payment transactions for traders. However, the researchers observed issues in the Trade Sector of the West Bandung Regency's Department of Industry and Trade, particularly regarding the inefficient collection of market levies. Using a digital fee collection system can reduce several risks for the government, such as preventing leakage of fees that generally occurs with manual collection, errors in refunds and calculations, and providing protection during cash collection. The implementation of this digital levy aims to maximize Regional Original Revenue and reorganize the market system. This digital payment system was designed using the design thinking method. The design thinking method has effectively helped identify user needs and create solutions. The usability testing results using the Useberry application for the West Bandung Industry and Trade Office's levy application received positive responses, as all 10 respondents of end users completed the tasks given. Furthermore, the 26 UEQ items were grouped into six categories. The assessment of the six categories is generated good scores. Based on this, the user experience of the West Bandung Industry and Trade Office's levy application can be categorized as good.

*Corresponding Author

Rista Reza Virzinia Agustin
E-mail: ristareza6@gmail.com



## 1. INTRODUCTION

A region is defined by its economic capabilities, regional potential, socio-cultural and socio-political aspects, population and area sizes, and other aspects supporting regional autonomy. Regional autonomy is expected to help regions become more independent in managing their authority, including financial management, which relies partly on local revenue sources [1], [2]. To implement regional autonomy, the financing sources for local governments depend on the role of Regional Original Revenue. Local government administration focuses on enhancing community welfare through improved services, empowerment, community involvement, and regional development [3], [4], [5]. Regional development can be accelerated by improving local government efficiency and effectiveness through local resources and support from central government infrastructure investments [6], [7], [8]. Regional Original Revenue refers to the local government's entitlement, comprising revenue streams such as local taxes, levies, asset management, and other authorized sources. It is in accordance with Law Number 23 of 2014 on Regional Government, Article 285, Paragraph (1), Government Regulation Number 58 of 2005 on Regional Financial Management, Article 21, Paragraph (1), and Minister of Home Affairs Regulation Number 13 of 2006 on Guidelines for Regional Financial Management, Article 26, Paragraph (1). One of the revenue objects for the region is levy.

In West Bandung Regency, local levies are a key source of revenue that is expected to contribute significantly to regional original revenue. As a result, the local government continues to formulate effective policies to enhance local levy revenue. One type of local levy that is continually developed is the market levy. A levy is a local levy imposed on individuals or organizations for specific services or permits the local government provides. In essence, a levy refers to a fee


http://dx.doi.org/10.30656/jsmi.v8i2.8924

paid by the public to the local government. A market levy is a form of public service levy widely used by the community. A market levy is intended to pay for market services. According to the explanation in Government Regulation No. 66 of 2001, market services refer to traditional market facilities such as open spaces and stalls managed by the local government, provided explicitly for sellers, excluding those managed by State-owned Enterprises and private entities.

A market levy is a form of public service levy charged to traders for using market facilities and obtaining placement permits from the local government. Thus, market levy consists of placement permits, booth levy, stall levy, ground levy, and parking area levy [9], [10]. The benefit of implementing digital levy payment includes providing an online service for levy payments, including transactions made by traders. As the researchers observed, it was found that there are issues in the Trade Sector of the West Bandung Regency's Department of Industry and Trade regarding the collection of market levy, which has not yet been optimized. As public compliance with regulations is generally low, and unauthorized collections by levy officers persist, adopting a digital levy collection system was later aimed at optimizing regional revenue [11]. It is supported by data on local revenue in Indonesia by the Directorate General of Fiscal Balance Indonesia, which has recently achieved a realization rate of 97.50%, with levy revenue realization at 71.25% for the year 2023.

Meanwhile, regarding local levy revenue, especially for all areas in West Java province, the realization of revenue is 74.75%. Based on the Central Bureau of Statistics Indonesia data, the realization of revenue for the West Bandung Regency government itself from 2020 to 2022 has declined by 54.89%. Therefore, using a digital levy collection system can reduce several risks for the government, such as preventing leakage of levies that are still manually conducted, facilitating refunds, and minimizing calculation errors [11]. Additionally, it provides security during cash collection. The implementation of digital levy aims to maximize Regional Original Revenue and restructure the market system. Accordingly, in the effort to implement an open, transparent, effective, and efficient government, the researchers were interested in developing a system for managing market levy payments. This system provides convenience for the government and market traders by offering information and payment systems through information technology.

This research aims to develop an information management system for market levy payments to achieve a transparent, effective, and efficient government in managing levy funds. Furthermore, this research's benefit lies in facilitating easier payment processes for the community and improved access to information related to market levy management. The information system can assist in improving the service for market levy payments using web-and-android-based technology. The design of this digital payment system employed the Design Thinking method. Design thinking refers to a way of thinking or cognitive process manifested in the action of designing thought processes [12], [13], [14]. Design thinking is also described as a thought pattern from the perspective of a designer who, in solving problems, always takes a human-oriented approach [15], [16], [17], [18]. Based on this description, a digital levy payment system was designed using design thinking to align with user needs. Addressing the management of market levy payments by integrating access to information digital systems helps streamline the process of managing regional revenue and increases the revenue. Using Design Thinking in the digital market, the information system design of levy management increases the chance that the designed information system will be approved and understood by users, as it aligns with their needs.

The main contributions of this research are as follows:

1. Levy payments are implemented digitally to reduce dependence on cash payments, which are often time-consuming and prone to errors. Automation reduces the time needed to manage payments, allowing market managers to focus on other aspects of market management.
2. An integrated reporting system provides full transparency in the market levy management. Every transaction is recorded digitally, minimizing the risk of data manipulation or fraud. It facilitates audits and reporting to stakeholders.
3. Enforcing policies and regulations related to market levies is supported by providing accurate and easily accessible data.
4. Creating user-centred solutions ensures that the developed application is relevant, beneficial, and well-received by all stakeholders.
5. Providing insights into using the design thinking method to enhance the success potential of user-centred information system design.
6. Providing detailed visualizations of the interactions between users and the designed information system.
7. Increasing Regional Original Revenue.

## 2. RELATED WORK

Design Thinking is described as a way of thinking or a cognitive process manifested in designing thought processes [16], [19]. Design Thinking helps in the process of questioning to inquire about problems, assumptions, and their interconnections. Design thinking is particularly effective for addressing unclear or unknown problems by reframing them with human-centred methods, which involve generating numerous ideas through brainstorming and adopting a direct

**Table 1.** Literature review

| Author | Year | Method | Product | Testing | | |
|---|---|---|---|---|---|---|
| | | | | Interactive usability testing | Questionnaire | Test type |
| Jadhav and Kalita [19] | 2019 | Design Thinking | Domestic Plumbing Services | - | - | - |
| Makalalag *et al.* [14] | 2021 | Design Thinking | Mobile Based Project Management | | √ | User Satisfaction Questionaire |
| Nasution and Nusa [20] | 2021 | Design Thinking | Web-Based Learning Application | | √ | System Usability Scale (SUS) |
| Darmawan et al. [16] | 2022 | Design Thinking | Campus Academic | √ | | Interactive Usability Testing |
| Setiyani and Tjandra [21] | 2022 | Design Thinking | Student Complaint Handling Application | - | - | - |
| Dewi *et al.* [22] | 2022 | Design Thinking | Mobile Application for Marketing of Small and Medium Enterprises (SMEs) | | √ | User Satisfaction Questionaire |
| Purwanti *et al.* [23] | 2022 | Design Thinking | Mosque Prosperity Council | - | - | - |
| Sriardi *et al.* [24] | 2023 | Design Thinking | Job Searching Application | | √ | User Satisfaction Questionaire |
| This Research | 2024 | Design Thinking | Levy Market Management | √ | √ | Interactive Usability Testing and User Experience Questionnaire (UEQ) |

approach to creating prototypes and testing. Design thinking also involves ongoing experiments: sketching, creating prototypes, testing, and exploring various concepts and ideas. Systems can be implemented in the application development process, but sometimes they fail to address user needs fully. The objective of any application is to meet user needs and ensure its continued usability.

The analysis in previous studies shows that the design thinking method has been widely used to design information systems (Table 1). Previous researchers have utilized the design thinking method to create an information system design based on the needs of its users. Additionally, some studies have conducted tests to evaluate how easily and efficiently a product or system can be used by end users. The aim is to ensure the product is easy to operate and effectively meets user needs. In this testing process, several researchers used usability testing, where several types of testing were conducted, such as Interactive Usability Testing, User Satisfaction Questionnaires, and the System Usability Scale (SUS).

## 3. RESEARCH METHODS

This study employed the Design thinking methodology. Design Thinking is an iterative approach that involves multiple steps [15], [16], [17]. The process generally begins with a briefing establishing a framework for the team's future work. Once the brief is defined, the team defines everything related to the design. It serves as a solid foundation for the next stage, a divergent phase where the team generates a wide range of ideas that will be refined in a subsequent selection stage. These ideas will then be further developed throughout the selection process. Before the selection stage, Design Thinking emphasizes a prototyping phase. Once the ideas are chosen and the product's specifications are defined, the team must determine who will do what, within what timeframe, and with what resources. Importantly, the team should not consider the design complete until it is developed and used. The team needs to assess whether the product aligns with the needs of its intended users. Design thinking can be divided into the following stages [14], [19]:

a. Emphatize: This phase is used to understand the problem. Emphatizing is carried out through observation, involvement through conversation, and in-depth interviews. Observations are made to understand customer needs.
b. Define: This is the first stage of design thinking, which falls under the analysis and design stage. Here, the product developer grasps the user's issues and needs and outlines the solution to guide product creation.
c. Ideate: Here, the solution from brainstorming and the preceding stage are described to ensure they


http://dx.doi.org/10.30656/jsmi.v8i2.8924

meet the user's needs. A user flow and sitemap are created by evaluating the generated ideas, providing an important framework for the next stage.

d. Prototype: illustrates an innovative idea until the product is realized.
e. Test: This stage involves testing the application with various users to measure its quality from the user's viewpoint. Developers will gain valuable feedback to evaluate the developed applications or products, especially from users who have shared their impressions on previous similar applications, particularly in the case study of application redesign or improvement.

Data was collected through observation and Focus Group Discussion (FGD) with employees of the market levy collection and Trade Sector of the West Bandung Regency's Department of Industry and Trade to discover the problems in the market levy payment system. The FGD results were later converted into customer needs and used as product attributes in each design thinking phase.

## 4. RESULTS AND DISCUSSION

### 4.1. Empathize

Empathize is the initial stage of design thinking, which aims to understand the users and the context of the problem they face more deeply [14], [21]. In this stage, the researchers conducted observations and an FGD related to the complaints of the levy fee collection officers. The observations conducted by ten levy officers include leakage of fees that generally occur with manual collection, errors in refunds and calculations, and protecting cash collection. The results of observation became the subject of FGD. The FGD was conducted during the Industry and Trade Service's monthly meeting regarding changes in the market management's bureaucratic system. Twenty people, including heads and structural officials of the Industry and Trade Service, attended the meeting. The second FGD was held with five government agencies, regional banks, and vendors regarding agencies' involvement in coordinating the management information system of the levy market. Observations and FGD were used to gather insights into the needs and expectations of users, especially the levy fee collection officers. In the empathize stage, several problems faced by the levy fee collection officers were identified:

a. Levy fee leakage due to manual collection
b. Errors in the return and calculation process
c. Lack of protection during cash collection

### 4.2. Define

The defined stage in the design thinking method focuses on collecting and analyzing data gathered in the previous stage, which was the empathize stage. The objectives of this stage involve identifying and formulating the problems or needs faced by the users of the application being designed [14], [25]. The way to define customer needs is by using a user persona. User Persona is a summary of information about users obtained from research using previous interview and survey methods, including methods that function to record needs and approaches to the relationship between computers and humans so that developers can know the behaviour and characteristics of these users related to this problem [26]. Referring to the survey results that have been analyzed and defined previous problems, a user persona is created that contains an imaginative picture of the user, the difficulties faced by the user, and the needs or desires expected by the user. The user persona in this research is described in Fig. 1 and Fig. 2.

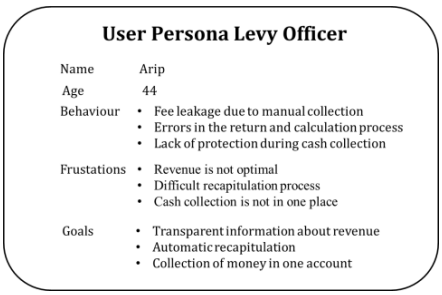



**Fig. 1.** User persona levy officer

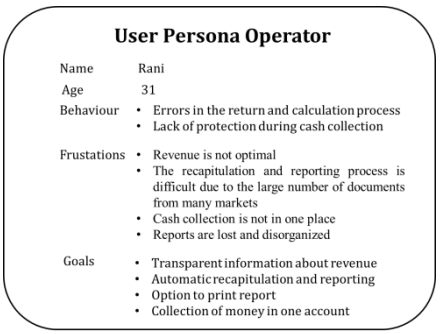



**Fig. 2.** User persona operator

### 4.3. Ideate

The ideate stage in the design thinking method is crucial in creating innovative and creative solutions to solve the problems that have been previously identified [14], [15]. In this stage, the primary focus of the research is to generate new ideas that can solve the problems encountered. The ideating process began with identifying problems and user needs through data collection and observation. Subsequently, this research used brainstorming to generate ideas without considering their practicality. The objective was to produce as many new and creative ideas as possible that could provide solutions to the problems encountered. Overall, the ideate stage aimed to generate creative and innovative ideas and provide solutions for the problems encountered. By following a systematic ideating process, the researchers were able to generate better

solutions that positively impact the users. The ideas and solutions that had been generated were then recorded in Table 2. Subsequently, the researchers used these ideas as a basis for designing a prototype tested on the users in the next stage, which was the prototype stage.

**Table 2.** Ideas and solution

| No. | Ideas and solutions |
|---|---|
| 1. | User-friendly UI display |
| 2. | Providing a recapitulation and reporting menu |
| 3. | Providing a report printing feature |
| 4. | Providing digital payment and escrow account |

### 4.4. Prototype

Prototype is a crucial stage within the design thinking process [15]. The researchers created a model or prototype based on the ideas generated in the previous stage, Ideate. The main objective of the prototype stage is to refine and develop these ideas into a more concrete form that the users easily understand. This application was made in two types: application for officer and operator. The prototype stage consists of several important steps that must be carried out.

a. **User flow**: The researchers created a diagram (Fig. 3 and Fig. 4) explaining the user's sequence of actions. This diagram provides a clearer picture of how the users will use the application.

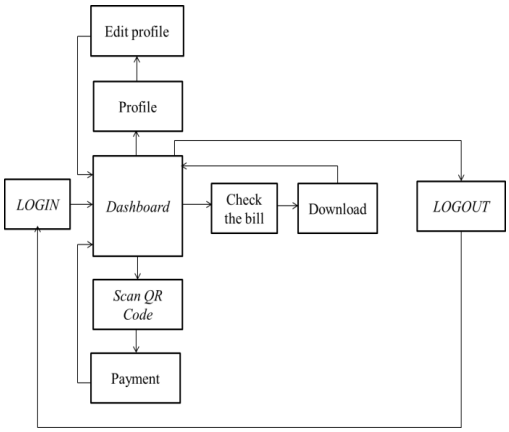



**Fig. 3.** Officer levy user flow diagram

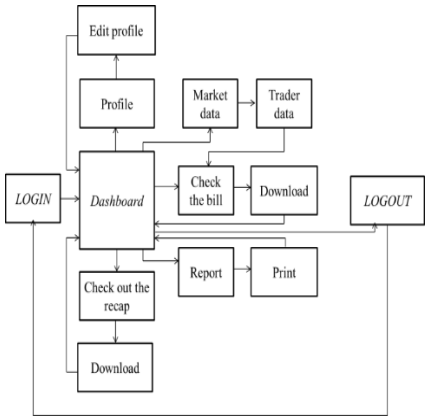



**Fig. 4.** Operator user flow diagram

b. **Wireframe:** The researchers created a rough depiction of the application interface in this stage. In this stage, the researchers sketched a simple layout and application interface components, paying attention to detailed visual aspects [14], [24]. This wireframe was used to ensure that the structure of the application interface was in line with user needs before designers started adding more complex visual elements [27]. In addition, this wireframe was used to show the position of important elements in the application display, such as buttons and menus.

c. **Mockup:** In this stage, the researchers created a more detailed model or prototype of the application interface. This mockup was used to test and visualize the ideas generated in the previous stage [16]. In this stage, the researchers added more specific details to the application display, such as colour, font, and element size, as shown in Fig. 5 and Fig. 6 [27].

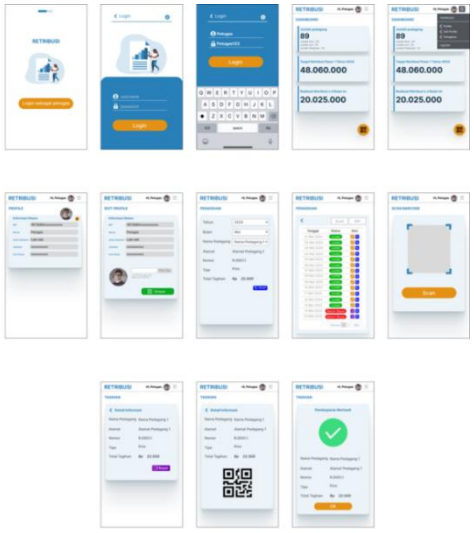


**Fig. 5.** Levy officer application mockup

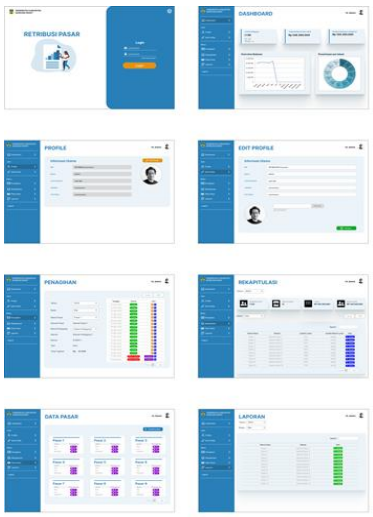


**Fig. 6.** Operator application mockup


http://dx.doi.org/10.30656/jsmi.v8i2.8924

One reason for creating a minimalist display is to facilitate user understanding and usage [28]. A simple display with minimal unnecessary elements can also speed up loading time and improve application performance. After making a mockup, before continuing to the testing stage, a prototype is made using the Figma application to provide a realistic appearance to respondents, which can be connected to the Useberry application as a usability testing application.

### 4.5. Test

The application was tested on 10 end users. These 10 respondents consisted of 5 officers and 5 levy operators. Who could represent the use of the application for the end user. This testing is intended to determine the application's usability before it is deployed on a larger scale. This testing is an experimental assessment of the application's functionality [29]. The sample size can be as little as 10-30 respondents. This testing assists the development team in identifying usability flaws, functionality, and technical mistakes that must be addressed before moving on with the application. Highlights that the goal is the depth of understanding rather than huge sample sizes, which can often be achieved with smaller samples [29]. The testing is carried out using usability testing, including giving several tasks to the user when the application is being tested [16]. These tasks are detailed in Table 3.

**Table 3.** The task of usability testing

| Officer | Operator |
|---|---|
| 1. Log in to the user account. | 1. Log in to the user account. |
| 2. View the user's data. | 2. View the user's data. |
| 3. Edit user personal data. | 3. Edit user personal data. |
| 4. View all merchant bills. | 4. View all merchant bills. |
| 5. Scan the barcode to see the merchant's bill. | 5. View market data, traders, and print billing. |
| 6. Log out of the user account. | 6. Print a recapitulation |
| | 7. Print a report |
| | 8. Log out of the user account. |

#### a) Usability testing

All evaluators were assigned tasks based on the features included in the application design. The tool used to carry out this test is Useberry. Based on the results received from testing carried out on the levy officer application, it was found that all evaluators completed the tasks given with an average time to complete the test of 10 minutes 36 seconds. The test results from the operator's application were also the same; all evaluators successfully completed the task with an average time of 15 minutes and 59 seconds. However, in one of the tasks, which was looking at market data, 90% were successful, and 10% were unsuccessful. It proves that while the application is effective, one of the processes remains somewhat confusing for users [30].

Heatmaps were also obtained from this test, a technique for visualizing user clicks or cursor tap patterns to locate frequently chosen points (Fig. 7 and Fig. 8). Heatmaps provide a more precise display evaluation based on user behaviour [16].

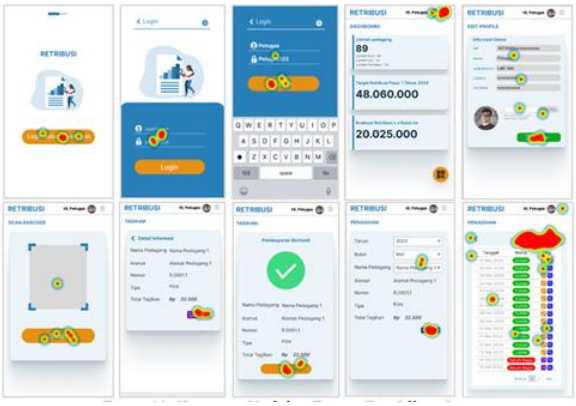


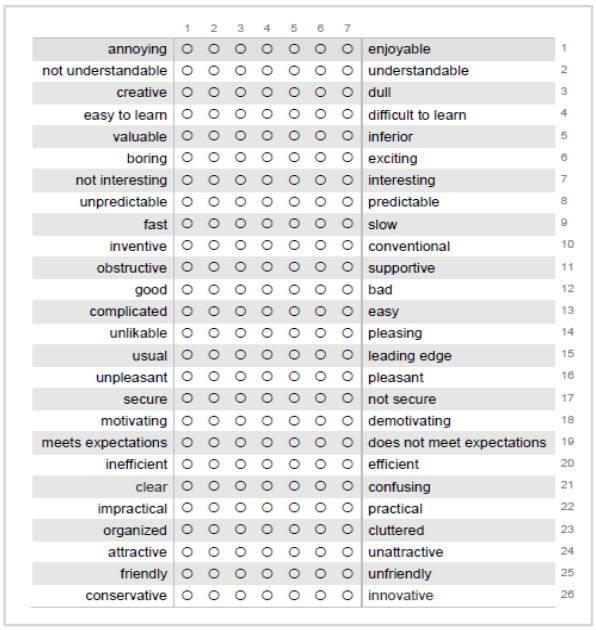

**Fig. 7.** Heatmaps of levy officer application


**Fig. 8.** Heatmaps of operator application

#### b) User experience questionnaire

The User Satisfaction Questionnaires (UEQ) method uses a subjective quality assessment survey to provide a thorough and practical overview of the usability and experience features [30], [31]. It is feasible to predict regions where improvement will significantly impact based on the evaluation results obtained using the UEQ [32]. Based on the measuring scales found in UEQ, six scales totaling 26 items are

categorized. The 26 items utilized in this research are listed in Fig. 9.



| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
|---|---|---|---|---|---|---|---|---|---|
| annoying | ○ | ○ | ○ | ○ | ○ | ○ | ○ | enjoyable | 1 |
| not understandable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | understandable | 2 |
| creative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | dull | 3 |
| easy to learn | ○ | ○ | ○ | ○ | ○ | ○ | ○ | difficult to learn | 4 |
| valuable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | inferior | 5 |
| boring | ○ | ○ | ○ | ○ | ○ | ○ | ○ | exciting | 6 |
| not interesting | ○ | ○ | ○ | ○ | ○ | ○ | ○ | interesting | 7 |
| unpredictable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | predictable | 8 |
| fast | ○ | ○ | ○ | ○ | ○ | ○ | ○ | slow | 9 |
| inventive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | conventional | 10 |
| obstructive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | supportive | 11 |
| good | ○ | ○ | ○ | ○ | ○ | ○ | ○ | bad | 12 |
| complicated | ○ | ○ | ○ | ○ | ○ | ○ | ○ | easy | 13 |
| unlikable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasing | 14 |
| usual | ○ | ○ | ○ | ○ | ○ | ○ | ○ | leading edge | 15 |
| unpleasant | ○ | ○ | ○ | ○ | ○ | ○ | ○ | pleasant | 16 |
| secure | ○ | ○ | ○ | ○ | ○ | ○ | ○ | not secure | 17 |
| motivating | ○ | ○ | ○ | ○ | ○ | ○ | ○ | demotivating | 18 |
| meets expectations | ○ | ○ | ○ | ○ | ○ | ○ | ○ | does not meet expectations | 19 |
| inefficient | ○ | ○ | ○ | ○ | ○ | ○ | ○ | efficient | 20 |
| clear | ○ | ○ | ○ | ○ | ○ | ○ | ○ | confusing | 21 |
| impractical | ○ | ○ | ○ | ○ | ○ | ○ | ○ | practical | 22 |
| organized | ○ | ○ | ○ | ○ | ○ | ○ | ○ | cluttered | 23 |
| attractive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | unattractive | 24 |
| friendly | ○ | ○ | ○ | ○ | ○ | ○ | ○ | unfriendly | 25 |
| conservative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | innovative | 26 |

**Fig. 9.** UEQ

Based on the result of the questionnaire, the six UEQ scales can be categorized into three categories, including the aspect of attractiveness, the aspect of pragmatic quality, and the aspect of hedonic quality [33]. Perspicuity, efficiency, and dependability fall within the pragmatic quality aspect. The hedonic quality aspect relates to stimulation and novelty [34]. The data were selected based on the level of consistency. The consistency observed was whether the respondents answered randomly or not. The data were then transformed to determine each item's negative and positive values. The transformed data were then grouped according to six scales. These six scales are presented in Fig. 10 and Fig. 11.

| Item | Mean | Variance | Std. Dev. | No. | Left | Right | Scale |
|---|---|---|---|---|---|---|---|
| 1 | 2.00 | 0.44 | 0.67 | 10 | annoying | enjoyable | Attractiveness |
| 2 | 2.00 | 0.67 | 0.82 | 10 | not understandable | understandable | Perspicuity |
| 3 | 2.20 | 0.62 | 0.79 | 10 | creative | dull | Novelty |
| 4 | 1.90 | 1.66 | 1.29 | 10 | easy to learn | difficult to learn | Perspicuity |
| 5 | 2.50 | 0.28 | 0.53 | 10 | valuable | inferior | Stimulation |
| 6 | 1.70 | 2.68 | 1.64 | 10 | boring | exciting | Stimulation |
| 7 | 2.10 | 0.54 | 0.74 | 10 | not interesting | interesting | Stimulation |
| 8 | 1.40 | 1.38 | 1.17 | 10 | unpredictable | predictable | Dependability |
| 9 | 0.80 | 2.62 | 1.62 | 10 | fast | slow | Efficiency |
| 10 | 1.30 | 3.12 | 1.77 | 10 | inventive | conventional | Novelty |
| 11 | 2.10 | 0.54 | 0.74 | 10 | obstructive | supportive | Dependability |
| 12 | 2.10 | 0.54 | 0.74 | 10 | good | bad | Attractiveness |
| 13 | 1.90 | 1.43 | 1.20 | 10 | complicated | easy | Perspicuity |
| 14 | 2.40 | 0.27 | 0.52 | 10 | unlikable | pleasing | Attractiveness |
| 15 | 2.30 | 0.68 | 0.82 | 10 | usual | leading edge | Novelty |
| 16 | 2.40 | 0.49 | 0.70 | 10 | unpleasant | pleasant | Attractiveness |
| 17 | 2.20 | 0.40 | 0.63 | 10 | secure | not secure | Dependability |
| 18 | 1.90 | 0.77 | 0.88 | 10 | motivating | demotivating | Stimulation |
| 19 | 1.90 | 0.54 | 0.74 | 10 | meets expectations | does not meet expectations | Dependability |
| 20 | 2.30 | 0.23 | 0.48 | 10 | inefficient | efficient | Efficiency |
| 21 | 1.80 | 0.40 | 0.63 | 10 | clear | confusing | Perspicuity |
| 22 | 2.30 | 0.23 | 0.48 | 10 | impractical | practical | Efficiency |
| 23 | 2.40 | 0.71 | 0.84 | 10 | organized | cluttered | Efficiency |
| 24 | 2.10 | 0.99 | 0.99 | 10 | attractive | unattractive | Attractiveness |
| 25 | 2.20 | 0.62 | 0.79 | 10 | friendly | unfriendly | Attractiveness |
| 26 | 2.50 | 0.28 | 0.53 | 10 | conservative | innovative | Novelty |

**Fig 10.** 26 UEQ items result (levy officer app)

| Item | Mean | Variance | Std. Dev. | No. | Left | Right | Scale |
|---|---|---|---|---|---|---|---|
| 1 | 2.10 | 0.54 | 0.74 | 10 | annoying | enjoyable | Attractiveness |
| 2 | 1.90 | 0.99 | 0.99 | 10 | not understandable | understandable | Perspicuity |
| 3 | 1.50 | 2.50 | 1.58 | 10 | creative | dull | Novelty |
| 4 | 1.90 | 0.99 | 0.99 | 10 | easy to learn | difficult to learn | Perspicuity |
| 5 | 2.10 | 0.77 | 0.88 | 10 | valuable | inferior | Stimulation |
| 6 | 1.90 | 0.54 | 0.74 | 10 | boring | exciting | Stimulation |
| 7 | 1.90 | 0.77 | 0.88 | 10 | not interesting | interesting | Stimulation |
| 8 | 1.20 | 2.62 | 1.62 | 10 | unpredictable | predictable | Dependability |
| 9 | 0.70 | 4.23 | 2.06 | 10 | fast | slow | Efficiency |
| 10 | 1.80 | 0.84 | 0.92 | 10 | inventive | conventional | Novelty |
| 11 | 1.40 | 2.93 | 1.71 | 10 | obstructive | supportive | Dependability |
| 12 | 1.80 | 1.07 | 1.03 | 10 | good | bad | Attractiveness |
| 13 | 0.90 | 3.21 | 1.79 | 10 | complicated | easy | Perspicuity |
| 14 | 2.10 | 0.54 | 0.74 | 10 | unlikable | pleasing | Attractiveness |
| 15 | 1.70 | 0.46 | 0.67 | 10 | usual | leading edge | Novelty |
| 16 | 1.90 | 0.77 | 0.88 | 10 | unpleasant | pleasant | Attractiveness |
| 17 | 1.80 | 0.84 | 0.92 | 10 | secure | not secure | Dependability |
| 18 | 1.90 | 0.99 | 0.99 | 10 | motivating | demotivating | Stimulation |
| 19 | 2.60 | 0.27 | 0.52 | 10 | meets expectations | does not meet expectations | Dependability |
| 20 | 2.00 | 0.44 | 0.67 | 10 | inefficient | efficient | Efficiency |
| 21 | 1.20 | 3.51 | 1.87 | 10 | clear | confusing | Perspicuity |
| 22 | 2.20 | 0.40 | 0.63 | 10 | impractical | practical | Efficiency |
| 23 | 2.20 | 0.62 | 0.79 | 10 | organized | cluttered | Efficiency |
| 24 | 2.00 | 0.67 | 0.82 | 10 | attractive | unattractive | Attractiveness |
| 25 | 2.00 | 0.67 | 0.82 | 10 | friendly | unfriendly | Attractiveness |
| 26 | 1.20 | 2.84 | 1.69 | 10 | conservative | innovative | Novelty |

**Fig 11.** 26 UEQ items result (operator app)

Fig. 10 and Fig. 11 present the mean, variance, and deviation results for the 26 UEQ items of the levy application for officers and operators. The values of each category determine the threshold for assessment (positive or negative) of an information system. The criteria state that if the value is > 0.8, the results obtained are positive, and if the value is < 0.8, the results will fall into the negative category [34]. Each of the 26 items has a value above 0.8, except for item number 9 for the officer application, which requires improvement.

**Table 4.** UEQ scales

| | Mean | | Variance | |
|---|---|---|---|---|
| | **Levy officer app** | **Operator app** | **Levy officer app** | **Operator app** |
| Attractiveness | 2.20 | 1.98 | 0.23 | 0.50 |
| Perspicuity | 1.90 | 1.48 | 0.52 | 1.05 |
| Efficiency | 1.95 | 1.78 | 0.19 | 0.84 |
| Dependability | 1.90 | 1.75 | 0.11 | 0.25 |
| Stimulation | 2.05 | 1.95 | 0.59 | 0.68 |
| Novelty | 2.08 | 1.55 | 0.15 | 0.53 |

In addition, the evaluation indicates that each question item has a good value. Meanwhile, based on the 6 categories (Table 4), it was found that:

a. Attractiveness category scores are 2.20 for the levy officer application and 1,98 for the operator application, with both evaluation results showing a positive value, as they exceed 0.8. it indicates a very positive response to the user interface of the West Bandung Industry and Trade Office's levy information system.
b. Perspicuity category scores are 1.90 for the levy officer application and 1.48 for the operator application, which means the values obtained are positive since they are more than 0.8. it indicates that respondents find it easy to adapt using the West Bandung Industry and Trade Office's levy information system.


http://dx.doi.org/10.30656/jsmi.v8i2.8924

c. Efficiency category scores are 1.95 for the levy officer application and 1.78 for the operator application. The evaluation results indicate a positive value since it is greater than 0.8. it suggests that respondents can complete their tasks with ease.
d. Dependability category scores are 1.90 for the levy officer application and 1.75 for the operator application, indicating a positive evaluation result since the scores exceed 0.8. Respondents feel in control of their interactions with the system.
e. Stimulation category scores are 2.05 for the levy officer application and 1.95 for the operator application, indicating a positive evaluation result since the scores exceed 0.8. The stimulation category received the highest score compared to the other categories. It suggests that respondents feel highly motivated to use this information system.
f. Novelty category scores are 2.08 for the levy officer application and 1.55 for the operator application. The evaluation results show positive values as the scores are greater than 0.8. it indicates that the West Bandung Industry and Trade Office's levy information system can attract respondents' attention due to its creativity.

The six scales were analyzed to assess the Pragmatic and Hedonic Qualities of the application under review. Pragmatic quality consists of perspicuity, efficiency, and dependability. Stimulation and novelty fall under hedonic quality. The evaluation for attractiveness, pragmatic quality, and hedonic quality are presented in Table 5.

**Table 5.** The evaluation of three qualities

| Pragmatic and hedonic quality | Levy officer app | Operator app |
|---|---|---|
| Attractiveness | 2.20 | 1.98 |
| Pragmatic Quality | 1.92 | 1.67 |
| Hedonic Quality | 2.06 | 1.75 |

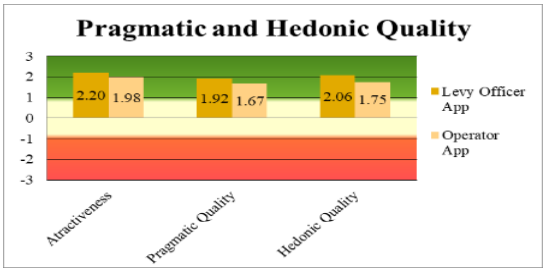



**Fig.12.** Three qualities diagram

Among the three qualities, attractiveness has the highest score. Table 5 shows that the attractiveness scores are around 2.20 for the levy officer application and 1.98 for the operator application, which falls into the good category. It is followed by hedonic quality with a score of 1.92 for the levy officer application and 1.67 for the operator application, as well as pragmatic with sequential values of 2.06 for the levy officer application and 1.75 for the operator application.

Fig. 12 shows the attractiveness, pragmatic quality, and hedonic quality evaluation. The scores obtained fall within the good category. It can be seen in the bar chart, where the peak of each bar is in the light green area. Light green represents the good category, while dark green represents a very good category.

Another analysis conducted was the benchmark analysis. The analysis compared this study's evaluation with similar studies reported on the UEQ online. The benchmark analysis was carried out by categorizing each scale into the following categories [33]:

1. Excellent: in the range of the 10 % best result.
2. Good: 10% of results are better, and 75 % of results are worse.
3. Above Average: 25% of results better, 50 % of result worse.
4. Below Average: 50% of the results in the benchmark are better than those for the evaluated product, and 25% of the results are worse.
5. Bad: In the range of the 25% worst results.

The benchmark for the user experience of the West Bandung Industry and Trade Office's levy application can be seen in Fig. 13 and Fig. 14, which show the position of the UEQ assessment of the levy application compared with similar studies.

| Scale | Mean | Comparisson to benchmark | Interpretation |
|---|---|---|---|
| Attractiveness | 2.20 | Excellent | In the range of the 10% best results |
| Perspicuity | 1.90 | Good | 10% of results better, 75% of results worse |
| Efficiency | 1.95 | Excellent | In the range of the 10% best results |
| Dependability | 1.90 | Excellent | In the range of the 10% best results |
| Stimulation | 2.05 | Excellent | In the range of the 10% best results |
| Novelty | 2.08 | Excellent | In the range of the 10% best results |

**Fig. 13.** Benchmark evaluation (levy officer app)

| Scale | Mean | Comparisson to benchmark | Interpretation |
|---|---|---|---|
| Attractiveness | 1.98 | Excellent | In the range of the 10% best results |
| Perspicuity | 1.48 | Above Average | 25% of results better, 50% of results worse |
| Efficiency | 1.78 | Good | 10% of results better, 75% of results worse |
| Dependability | 1.75 | Excellent | In the range of the 10% best results |
| Stimulation | 1.95 | Excellent | In the range of the 10% best results |
| Novelty | 1.55 | Good | 10% of results better, 75% of results worse |

**Fig. 14.** Benchmark evaluation (operator app)

Fig. 13 shows the benchmark evaluation for the levy officer application. Based on Fig. 13, one category received good scores, and five categories received excellent scores. The attractiveness, efficiency, dependability, stimulation, and novelty categories achieved excellent scores. Meanwhile, the perspicuity category received good scores. Fig. 14 presents the results of the benchmark evaluation diagram for the operator application, where the evaluation results based on user respondents obtained good scores for the categories of efficiency and novelty. The categories of attractiveness, dependability, and stimulation received excellent scores, while the category of perspicuity received above-average scores. It indicates that the quality of the West Bandung Industry and Trade Office's information system is already running well.

However, the Perspicuity category requires improvement to clarify and ease the information provision process in the retribution application system, thereby better satisfying and assisting the public in seeking permits in West Bandung Regency.

### 4.6. Discussion

Unlike the research conducted by Wisda *et al*. [11], this study considers the user experience in using the designed application in more detail by providing in-depth analytical data such as heatmaps, clicks, user flows, and task completion times. This data is beneficial for understanding how users interact with the user interface and where they encounter difficulties. However, the results obtained from the research conducted by Wisda *et al*. [11] and this study share similarities in that the information system design received positive feedback from users, indicating that the information system is suitable for use, easy to operate, and can facilitate the management of levy and its reporting. Based on the research by Darmawan *et al*. [16], the design of the information system using Design Thinking was regarded as very good and successful, achieving 100% and 90% user testing percentages. This study similarly shows that applying design thinking to information system design increases the likelihood of user acceptance and understanding, as it aligns with their needs.

This research has several theoretical implications, including enriching the literature on the application of design thinking in information system development, particularly in the context of digital levies, which can assist other researchers in understanding how design thinking principles are applied to address managerial and technological issues. Additionally, this research contributes to the knowledge of user-centred information system development, which can serve as a reference for further studies on Human-Computer Interaction in public management systems. It contributes to the existing literature, particularly regarding the effectiveness of user-centred approaches in information system development. By integrating design thinking and usability testing, this research offers a more holistic view of how a digital payment system can be developed and optimized for the needs of different users. This research also contains managerial implications, as all stakeholders or market levy managers can utilize the digital information system to enhance management and supervision efficiency. The automated and transparent payment process allows managers to reduce operational costs and allocate resources to areas that require more attention. The automated system provides real-time access to transaction data, supporting faster and data-driven decision-making. However, adjusting market management strategies to reflect actual field conditions is advised. This system also supports the management in ensuring that all traders comply with levy payment regulations. Accurate and structured data facilitates audits and authorities' supervision. This research integrates the design thinking method, which is widely employed in product and service designs, by adding detailed usability testing aspects.

## 5. CONCLUSION

Based on this study, it can be concluded that the design thinking method helps create information systems that are more targeted and aligned with user needs when managing market levy. It is evidenced by the results of usability testing using the Useberry application on the market levy application of the West Bandung Industry and Trade Office, which received positive responses, as all 10 end-user respondents completed the tasks given. Furthermore, 26 UEQ items were grouped into six categories. The evaluation of these six categories resulted in good scores. The results of the analysis for pragmatic and hedonic qualities also received good scores.

Additionally, the benchmark analysis yielded good scores as well. The user experience of the market levy application for the West Bandung Industry and Trade Office can be categorized as good. This testing has shown that the information system designed for market levy management avoids revenue collection and reporting errors more efficiently. Although this research successfully designed a management information system of market levy and obtained positive test results and responses, the system has not been evaluated with a larger sample size, nor has the economic impact of information system implementation, including cost-benefit analysis, return on investment (ROI), and the impact on organizational productivity. As a result, it is advised that future studies include larger-sample testing and analysis of the economic impact of establishing a market retribution management information system.

## ACKNOWLEDGMENT

The authors are grateful for the kind support they received in publishing this research from the Department of Industrial Engineering at Telkom University.

## REFERENCES

[1] T. Talitha, T. Firman, and D. Hudalah, ‘Welcoming two decades of decentralization in Indonesia: a regional development perspective’, *Territ. Polit. Gov.*, vol. 8, no. 5, pp. 690–708, Oct. 2020, doi: 10.1080/21622671.2019.1601595.

[2] N. Dwi Retnandari, ‘Implementation of Strategic Planning in Regional/ Municipal Governments, Obstacles and Challenges’, *Policy Gov. Rev.*, vol. 6, no. 2, pp. 155–175, Jun. 2022, doi: 10.30589/pgr.v6i2.556.

[3] H. M. Syafingi, D. A. S. Dewi, H. Suharso, P. Sulistyaningsih, and U. Rahmawati, ‘Village fund optimization strategy for rural community


http://dx.doi.org/10.30656/jsmi.v8i2.8924

welfare in Indonesia', *J. Crit. Rev.*, vol. 7, no. 07, pp. 580–583, Apr. 2020, doi: 10.31838/jcr.07.07.103.

[4] K. Dimyati, H. Nashir, E. Elviandri, A. Absori, K. Wardiono, and A. Budiono, 'Indonesia as a legal welfare state: A prophetic-transcendental basis', *Heliyon*, vol. 7, no. 8, p. e07865, 2021, doi: 10.1016/j.heliyon.2021.e07865.

[5] C. Corlet Walker, A. Druckman, and T. Jackson, 'Welfare systems without economic growth: A review of the challenges and next steps for the field', *Ecol. Econ.*, vol. 186, p. 107066, 2021, doi: 10.1016/j.ecolecon.2021.107066.

[6] Y. Tian and C. Sun, 'Comprehensive carrying capacity, economic growth and the sustainable development of urban areas: A case study of the Yangtze River Economic Belt', *J. Clean. Prod.*, vol. 195, pp. 486–496, 2018, doi: 10.1016/j.jclepro.2018.05.262.

[7] K. H. Ibrahim, R. D. Handoyo, W. Wasiaturrahma, and T. Sarmidi, 'Services trade and infrastructure development: Evidence from African countries', *Cogent Econ. Financ.*, vol. 10, no. 1, p. 2143147, Dec. 2022, doi: 10.1080/23322039.2022.2143147.

[8] S. N. Khamraeva and M. Y. Alimova, 'Methodological bases for assessing the level of innovative development of agriculture and its service infrastructure activities', *J. Contemp. Issues Bus. Gov.*, vol. 27, no. 02, pp. 4062–4068, Apr. 2021, doi: 10.47750/cibg.2021.27.02.420.

[9] S. Syafruddin, S. Rahayu, and I. P. G. Diatmika, 'The Evaluation of Internal Control System for Market Retribution Collection', *J. Ilm. Akunt.*, vol. 7, no. 2, pp. 254–267, Jan. 2023, doi: 10.23887/jia.v7i2.52842.

[10] N. Istiqomah and I. Mafruhah, 'Analysis of Parking and Market Service Levies Potential for the Improvement of Regional Autonomy in Surakarta', in *5th Global Conference on Business and Social Sciences*, 2017, pp. 1–8. [Online]. Available: https://repository.feb.uns.ac.id/dok/publikasi/843.pdf

[11] W. Wisda, N. Latif, R. Apriana, Neneng Awaliah, Kumar Vivek, and Kamaruddin, 'Waste Service Retribution Management in Selayar Islands Regency through Website-Based Solutions', *Ceddi J. Inf. Syst. Technol.*, vol. 3, no. 1, pp. 1–13, Apr. 2024, doi: 10.56134/jst.v3i1.78.

[12] N. Cross, 'Designerly ways of knowing', *Des. Stud.*, vol. 3, no. 4, pp. 221–227, 1982, doi: 10.1016/0142-694X(82)90040-0.

[13] D. Dunne and R. Martin, 'Design Thinking and How It Will Change Management Education: An Interview and Discussion', *Acad. Manag. Learn. Educ.*, vol. 5, no. 4, pp. 512–523, Dec. 2006, doi: 10.5465/amle.2006.23473212.

[14] A. Makalalag, Y. Ekawardhani, and T. L. Gaol, 'User Interface/User Experience Design for Mobile-Based Project Management Application Using Design Thinking Approach', *Int. J. Educ. Inf. Technol. Others*, vol. 4, no. 2, pp. 269–274, Jul. 2021, [Online]. Available: https://jurnal.peneliti.net/index.php/IJEIT/article/view/762

[15] W. Brenner, F. Uebernickel, and T. Abrell, 'Design Thinking as Mindset, Process, and Toolbox BT - Design Thinking for Innovation: Research and Practice', W. Brenner and F. Uebernickel, Eds., Cham: Springer International Publishing, 2016, pp. 3–21. doi: 10.1007/978-3-319-26100-3_1.

[16] I. Darmawan, M. Saiful Anwar, A. Rahmatulloh, and H. Sulastri, 'Design Thinking Approach for User Interface Design and User Experience on Campus Academic Information Systems', *JOIV Int. J. Informatics Vis.*, vol. 6, no. 2, pp. 327–334, Jun. 2022, doi: 10.30630/joiv.6.2.997.

[17] H. S. Nahatmasuni, A. Herdiani, and A. S. D. Martha, 'UI/UX Design for Student Discussion Applications Based Felder Silverman Learning Style with the Design Thinking Method', *Int. J. Inf. Commun. Technol.*, vol. 9, no. 2, pp. 29–40, Dec. 2023, doi: 10.21108/ijoict.v9i2.754.

[18] C. Mueller-Roterberg, *Handbook of Design Thinking: Tips & Tools for How to Design Thinking*. Independently Published, 2018. [Online]. Available: https://books.google.co.id/books?id=qUQjvwEACAAJ

[19] S. S. Jadhav and P. C. Kalita, 'Design Thinking Approach in Planning E-commerce for Domestic Plumbing Services', in *Proceedings of the 2019 International Conference on E-Business and E-Commerce Engineering*, in EBEE'19. New York, NY, USA: Association for Computing Machinery, 2020, pp. 20–24. doi: 10.1145/3385061.3385067.

[20] W. S. L. Nasution and P. Nusa, 'UI/UX Design Web-Based Learning Application Using Design Thinking Method', *ARRUS J. Eng. Technol.*, vol. 1, no. 1, pp. 18–27, Aug. 2021, doi: 10.35877/jetech532.

[21] L. Setiyani and E. Tjandra, 'UI / UX Design Model for Student Complaint Handling Application Using Design Thinking Method (Case Study: STMIK Rosma Karawang)', *Int. J. Sci. Technol. & Manag.*, vol. 3, no. 3,

pp. 690–702, May 2022, doi: 10.46729/ijstm.v3i3.505.

[22] E. Z. Dewi, M. Fransisca, R. I. Handayani, and F. L. D. Cahyanti, 'Analysis and Design of UI/UX Mobile Applications for Marketing of UMKM Products Using Design Thinking Method', *Sink. J. dan Penelit. Tek. Inform.*, vol. 6, no. 4, pp. 2329–2339, Oct. 2022, doi: 10.33395/sinkron.v7i4.11505.

[23] S. Purwanti, J. Jaja, R. Rakhmayudhi, Dian Perdiansyah, and Sahrul Ramdan, 'Wireframe Website Interface Design Miftahul Huda Mosque Prosperity Council Using The Design Thinking Method', *J. Ekon.*, vol. 11, no. 03 SE-Articles, pp. 1125–1132, Dec. 2022, [Online]. Available: https://ejournal.seaninstitute.or.id/index.php/Ekonomi/article/view/862

[24] M. D. Sriardi, T. Tukino, and F. Nurapriani, 'Implementation of Design Thinking Methods in UI/UX Designing Job Searching Applications', *J. Sist. Inf. dan Ilmu Komput.*, vol. 7, no. 1, pp. 223–240, Aug. 2023, doi: 10.34012/jurnalsisteminformasidanilmukomputer.v7i1.4047.

[25] F. P. A. Praja *et al.*, 'Designing user interface and user experience application of financial management and planning of BUMDes in the mandalika special economic zone using design thinking', *AIP Conf. Proc.*, vol. 3026, no. 1, p. 50009, Mar. 2024, doi: 10.1063/5.0200214.

[26] A. Sundt and E. Davis, 'User personas as a shared lens for library UX', *Weav. J. Libr. User Exp.*, vol. 1, no. 6, 2017. DOI: 10.3998/weave.12535642.0001.601.

[27] Y. Yudhanto, W. M. Pryhatyanto, and W. Sulandari, 'Designing and Making UI/UX Designs on The Official Website with The Design Thinking Method', in *2022 1st International Conference on Smart Technology, Applied Informatics, and Engineering (APICS)*, 2022, pp. 165–170. doi: 10.1109/APICS56469.2022.9918684.

[28] J. Johnson, *Designing with the Mind in Mind*. Boston: Elsevier, 2014. doi: 10.1016/C2012-0-07128-1.

[29] J. Nielsen and T. K. Landauer, 'A mathematical model of the finding of usability problems', in *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '93*, New York, New York, USA: ACM Press, 1993, pp. 206–213. doi: 10.1145/169059.169166.

[30] A. Hidayat and V. G. Utomo, 'User experience measurement of adaptive online module system using user experience questionnaire', *J. Phys. Conf. Ser.*, vol. 1918, no. 4, p. 042146, Jun. 2021, doi: 10.1088/1742-6596/1918/4/042146.

[31] A. Pratama, A. Faroqi, and E. P. Mandyartha, 'Evaluation of User Experience in Integrated Learning Information Systems Using User Experience Questionnaire (UEQ)', *J. Inf. Syst. Informatics*, vol. 4, no. 4, pp. 1019–1029, Nov. 2022, doi: 10.51519/journalisi.v4i4.394.

[32] D. Zhu, D. Wang, R. Huang, Y. Jing, L. Qiao, and W. Liu, 'User Interface (UI) Design and User Experience Questionnaire (UEQ) Evaluation of a To-Do List Mobile Application to Support Day-To-Day Life of Older Adults', *Healthcare*, vol. 10, no. 10, p. 2068, Oct. 2022, doi: 10.3390/healthcare10102068.

[33] M. Schrepp, *User experience questionnaire handbook: All you need to know to apply the ueq successfully in your projects*. 2022. [Online]. Available: https://www.ueq-online.org/Material/Handbook.pdf

[34] E. Erlangga, Y. Wihardi, and E. Nugraha, 'User Experience Evaluation by Using a User Experience Questionnaire (UEQ) Based on an Artificial Neural Network Approach', in *2021 3rd International Conference on Research and Academic Community Services (ICRACOS)*, IEEE, Oct. 2021, pp. 17–22. doi: 10.1109/ICRACOS53680.2021.9702096.


http://dx.doi.org/10.30656/jsmi.v8i2.8924