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CLEARPAY: INNOVATIVE DESIGN OF AN IMPORT INVOICE PAYMENT SYSTEM USING DESIGN THINKING

Dara Pramita Rosliana[-1], Siti Ernawati[-2*]

Sistem Informasi / Fakultas Teknologi Informasi
Universitas Nusa Mandiri
darapramitar@gmail.com, siti.ste@nusamandiri.ac.id

Abstract

The invoice payment process in import activities faces various obstacles, such as limited information, unorganized workflows, difficulty monitoring payment status, and the risk of administrative errors. The purpose of this research is to create a design for the invoice payment system in the import process by applying the Design Thinking method. This method consists of five stages, namely Empathise, Define, Ideate, Prototype, and Test. At the Empathise stage, information is collected through observation and interviews to understand user needs. Define is used to determine the main problems faced by users. Ideate is used to create various creative design solutions. The Prototype phase resulted in a high-fidelity prototype called ClearPay that provides features for invoice management, approval processing, payment processing, status monitoring, and payment confirmation, while Testing to assess the design based on user feedback. Evaluation using the system Usability Scale (SUS) obtained an average score of 82.42, which included Acceptable, Grade A, and the adjective rating Excellent categories. The results show that the ClearPay prototype has a good level of usability and user acceptance and can be the basis for system development at the implementation stage.

Keywords: Design Thinking; Import Invoice; Invoice Payment System; Prototype; System Usability Scale

Abstrak

Proses pembayaran tagihan dalam aktivitas impor menghadapi berbagai kendala, seperti keterbatasan informasi, alur kerja yang belum terorganisasi, kesulitan memantau status pembayaran, serta risiko kesalahan administrasi. Tujuan dari penelitian adalah menciptakan desain untuk sistem pembayaran tagihan dalam proses impor dengan menerapkan metode Design Thinking. Metode ini terdiri dari lima tahapan, yaitu Empathise, Define, Ideate, Prototype dan Testing. Pada tahapan Empathise, dilakukan pengumpulan informasi melalui observasi dan wawancara untuk memahami kebutuhan pengguna. Define digunakan untuk menentukan permasalahan utama yang dihadapi oleh pengguna. Ideate untuk menciptakan berbagai solusi desain yang kreatif. Tahap Prototype menghasilkan high-fidelity prototype bernama ClearPay yang menyediakan fitur pengelolaan tagihan, proses persetujuan, pemrosesan pembayaran, pemantauan status, dan konfirmasi pembayaran, sedangkan Testing untuk menilai desain berdasarkan umpan balik dari pengguna. Evaluasi menggunakan System Usability Scale (SUS) memperoleh skor rata-rata 82,42, yang termasuk kategori Acceptable, Grade A, dan adjective rating Excellent. Hasil tersebut menunjukkan bahwa prototipe ClearPay memiliki tingkat usability dan penerimaan pengguna yang baik serta dapat menjadi dasar untuk pengembangan sistem pada tahap implementasi.

Kata kunci: Design Thinking; Prototype; Sistem Pembayaran Tagihan; System Usability Scale; Tagihan Impor

INTRODUCTION

International trade involves export and import activities that in their implementation face various challenges, such as differences in regulations, currencies, and the number of parties involved. The import process includes various stages and documents, ranging from Purchase Orders (PO), delivery of documents, customs clearance, to the expenditure of goods, so it is necessary to manage a structured process to support the smooth operation of the company (Dea Dellia et al., 2025), (Rifka Alkhilyatul Ma'rifat, I Made Suraharta, 2024), (Q. Setiawan et al., 2022).

One of the important stages in the process is the payment of invoice to vendors and service providers (Fauzia Septiana et al., 2022). Based on the

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observations, the payment process still faces several obstacles, such as duplication of invoice, payment nominal discrepancies, manual invoice verification, the use of physical documents, and the unavailability of an integrated system to monitor the status and proof of payment (Sari & Putri, 2025) (W. Setiawan et al., 2024). These conditions indicate the need for a prototype design that can support the management of Invoice Payments in a more structured and easy to use.

Prototype design needs to consider the needs, convenience, and user experience during interaction with the system (Rösch et al., 2023; You, 2022), (Priyono et al., 2023). In this study, the user-oriented Design Thinking method is used through five stages, namely Empathise, Define, Ideate, Prototype, and Test (Aurino, 2023), (Epifania & Jatmiko, 2024), (Sreenivasan & Suresh, 2024). This approach allows user needs to be identified and translated into prototype designs that can then be evaluated using the System Usability Scale (SUS) (R Mirza & Ernawati, 2024).

The application of Design Thinking has been carried out on various systems related to financial administration and payment. Applying Design Thinking on logistics financial administration applications and obtaining a SUS score of 86 with the category of Excellent (Satriyo & Razaq, 2024). (Epifania & Jatmiko, 2024) applying the same method to the mobile-based PDAM payment system and obtaining a SUS score of 88 with an Acceptable category and Grade A+. Then, (Sugiharti & Mujiastuti, 2023) apply Design Thinking to the design of Mimopay e-wallet application using Guerilla Usability Test and produce wireframe, high-fidelity design, and prototype.. The study (Destika & Rahmatil Fiska, 2026) Applied Design Thinking to PAMSIMAS administration and payment applications by evaluating using Likert scale questionnaires and Black Box Testing. The results showed that the Design Thinking approach can be used to produce a system design that is oriented to user needs. However, the study has not specifically addressed the import invoice payment workflow involving several actors and stages, such as invoice submission and verification, approval, payment processing, status monitoring, payment proof documentation, and duplication prevention in one integrated design.

Although previous research has discussed prototype design in financial administration and various payment systems, the research focus has remained on the financial administration of logistics in general, public service payments, e-wallet payments, or public payment recording. There are not many studies that specifically discuss the invoice payment workflow in the import process involving several actors and business stages in an integrated manner, such as PPJK/Freight Forwarder, Import Team, Finance, invoice submission and verification process, payment approval, payment processing, documentation, status monitoring, and invoice duplication prevention. These differences indicate the need to design a prototype that specifically accommodates the complexity of the import invoice payment flow.

Based on the problem and research gap, this study aims to design a prototype of a Invoice Payment System in the import process using the Design Thinking method. This research produces the ClearPay prototype as a system interface design that supports invoice management, invoice verification, approval process, payment processing, status monitoring, and proof of payment documentation. The resulting Prototype is then evaluated using the system Usability Scale (SUS) to determine the level of usability and user acceptance of the design developed.

RESEARCH METHODS

This study employed a design-oriented research approach combining qualitative data collection and quantitative usability evaluation. Qualitative data were collected through observation and interviews during the Empathise and Define stages, while quantitative data were obtained through the System Usability Scale (SUS) during the Test stage.

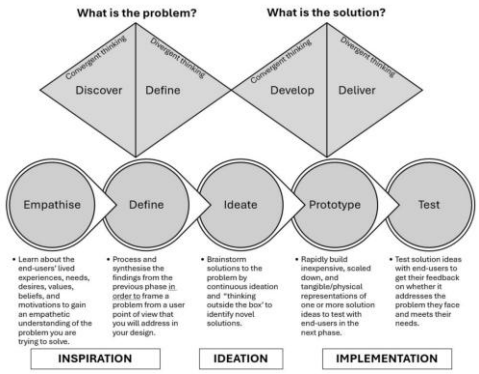


Figure 1. Design Thinking Methods

The design method used in the study is Design Thinking because it is oriented to the needs, experiences, and problems of users. This method consists of five main stages, namely Empathise, Define, Ideate, Prototype, and Test (Rivera et al., 2025), as shown in Figure 1. The five stages are carried out iteratively so that the results of the evaluation at the testing stage can be input into the design improvement.

1. Empathise

The Empathise stage is performed to understand the needs, constraints, and user

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experience of the ongoing import invoice payment process. Data collection was conducted through observation and interviews with the parties involved, namely the Import Support and Finance team. The results of this stage are used to identify user needs and problems that must be resolved through the system.

2. Define

The define stage aims to analyze and formulate the main problems based on the results of observations and interviews. At this stage, user needs are identified to determine the focus of the problem that will be the basis for the design of the prototype.

3. Ideate

The ideation stage is the process of producing various alternative solutions based on the problems that have been defined. The resulting solution is visualized in the form of a User Persona, how Might we (HMW), AffinityDiagram, Information Architecture, and User Flow as a reference in the interface design process.

Each of these instruments serves a different purpose. User Persona is used to represent users' characteristics, needs, goals, and constraints based on research findings. How Might We (HMW) is used to reframe problems into open-ended questions that encourage the generation of alternative solutions. Affinity Diagram serves to organize observation and interview findings into related themes, making it easier to identify patterns in users' needs and problems. Information Architecture is used to structure information, establish menu hierarchies, and organize system content so that it can be easily understood by users. Meanwhile, User Flow illustrates the sequence of steps and interactions users follow when completing a specific task within the system, from the initial stage to the achievement of their intended goal. These five instruments provide the foundation for developing a user interface design that aligns with users' needs in the import invoice payment process.

4. Prototype

The prototype stage is completed by creating an interface design (high-fidelity prototype) using Figma. The prototype is designed based on user needs and the import invoice payment business flow to describe the appearance and function of the system to be developed.

5. Test

The Test phase aims to evaluate the designed prototype through user testing using the System Usability Scale (SUS) method to measure the prototype's ease of use (Anam et al., 2025), (Deshmukh & Chalmeta, 2024). The SUS instrument consists of ten statements rated on a 5-point Likert scale (Lorincz et al., 2026), which respondents complete after trying the prototype.

Table 1 describes the SUS score was interpreted using three complementary aspects: Acceptability Ranges, Grade Scale, and Adjective Rating. Acceptability Ranges are used to determine whether a system's usability is acceptable to users. Grade Scale categorizes the SUS score into letter grades, while Adjective Rating provides a descriptive assessment of perceived usability, ranging from Worst Imaginable to Best Imaginable. These three aspects were used to provide a more comprehensive interpretation of the usability evaluation results.

Table 1. Interpretability The SUS Score

Interpretation Aspect	Range	Interpretation
Acceptability Ranges	0–50,90	Not Acceptable
	51–70,90	Marginal
	71–100	Acceptable
Grade Scale	0–60	Grade F
	60–69	Grade D
	70–79	Grade C
	80–89	Grade B
	90–100	Grade A
Adjective Rating	0–25	Worst Imaginable
	25,10–38,90	Poor
	39–52,40	Ok
	52,5–73,90	Good
	74–85,50	Excellent
	85,60–100	Best Imaginable

This study involved 30 respondents selected based on the relevance of their roles and involvement in the import invoice payment process. The respondents consisted of 10 employees from the import team, 15 employees from the Finance Division, and 5 individuals whose roles are related to finance and taxation. Involving respondents from these different functional areas aimed to obtain usability evaluations from the perspectives of users with different roles in the import invoice payment workflow.

The test results were then analyzed using validity test, reliability test, descriptive analysis,

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and SUS score calculation to determine the level of user acceptance of the invoice payment system design in the import process.

Table 2. Table Of Validity Test Results

Item	Item-rest Correlation	Description
Q1	0,668	Valid
Q2	0,515	Valid
Q3	0,384	Valid
Q4	0,300	Valid
Q5	0,608	Valid
Q6	0,473	Valid
Q7	0,755	Valid
Q8	0,555	Valid
Q9	0,752	Valid
Q10	0,311	Valid

Table 2 is the result of the validity test, showing that all items on the questionnaire have a Rest Correlation value that meets the validity criteria. The correlation value of each item is about 0.300- 0.755, with the highest value in Q7 of 0.755 and the lowest value in Q4 of 0.300. Based on these results, all items are declared valid so that they can be used as an instrument to measure the usability level of the ClearPay prototype.

Table 3. Reliability Test Result

Variabel	Cronbach's Alpha	Description
System Usability Scale	0.838	Reliable

Based on Table 3 of the reliability test, it can be seen that the value of Cronbach's Alpha obtained a value of 0.838. The value is in the good category because it exceeds the minimum limit of 0.70. This shows that the SUS instrument used has a good level of internal consistency, so it is feasible to measure the usability level of the ClearPay prototype.

RESULTS AND DISCUSSION

1. Empathise

The empathise stage aims to understand the needs and problems experienced by users directly in the import invoice payment process. The researchers collected data through observation and interviews and compiled an empathy map to obtain a more in-depth picture of the needs and constraints faced by users in the import invoice payment process. The interview process involved the import Admin section and the financial section. Table 4 is the result of observations and interviews, and an Empathy Map was made to understand the needs and user experience in more depth.

Table 4. Interviews Result

Questions	Answer
What is the ongoing import invoice payment process?	The payment process begins with receiving invoice from vendors, verifying, making cover sheets, approval requests, and submitted to finance for payment processing.
What Media is used in the process of filing and paying invoice?	The Media used in Invoice Payment submission are Excel and paper.
Has there ever been an error or duplicate invoice?	Yes, I have. The verification process takes time because documents come from various sources and must be checked one by one manually.
How do you find out the payment status of a invoice?	The import team usually has to ask finance directly via email to find out the status of the payment.
What obstacles are often encountered during the invoice payment process?	It is difficult to know the status of the invoice in real time, and it takes time to find payment information that has been processed.
What features or information are needed in an import invoice payment system?	Features include invoice upload, invoice verification, payment approval, payment status monitoring, due notifications, and proof of payment upload.



Figure 2. Empathy Map

Based on the results of the Empathy Map in Figure 2, it can be concluded that users face various challenges in the import invoice payment process, such as difficulties in tracking payment status, inefficient document searches, and verification processes that are still done manually.

2. Define

The define stage is done to identify and formulate the main problems experienced by users based on the results of observations, interviews, and the empathy map in the previous stage. At this stage, the researcher composes a user persona and

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identifies pain points as the basis for generating a solution at the ideate stage.

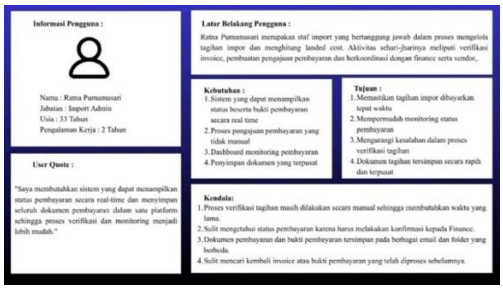


Figure 3.User Persona

The user persona in Figure 3 is created based on the main user of the designed system, namely the import Staff. These users are the parties who most often interact with the import invoice payment system, starting from the invoice verification process, payment submission, and monitoring payment status.

Table 5. Pain Points

No.	Pain Points
1	The invoice verification process is still done manually, so it takes quite a long time.
2	Users have difficulty in monitoring the status of payments.
3	Payment documents and supporting documents are stored in various emails and folders, making them difficult to find.
4	The payment approval process is still done through paper signatures, making it less efficient.
5	The absence of notifications related to invoice that are close to maturity causes delays in payment.
6	There is no system that can help detect invoice that have been submitted before, potentially causing duplication of invoice.
7	Searching for proof of payment and payment history takes quite a long time.

Based on the identification of pain points in Table 5, it is known that the main problems experienced by users are related to the payment process, which is still done manually, the lack of transparency of payment status information, and document management that has not been integrated.

3. Ideate

At this stage, the process involves formulating solutions that can answer user problems based on the results of the Needs Analysis. The resulting solution then becomes the basis for feature design and prototype design. Figure 4 is the information architecture, that will be designed in the Clearpay website.

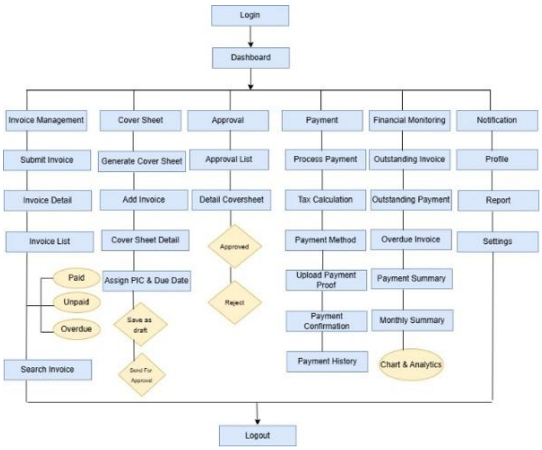


Figure 4. Information Architecture

Figure 5 is the user flow of the Clearpay application. The process starts when the Freight Forwarder/ PPJK uploads the invoice into the system; then the Import Team verifies it, creates a cover sheet, fills in the payment data, and submits it to the manager for approval. Once approved, Finance processes the payment and uploads the proof of payment. Furthermore, the system updates the status of payments in real time, so that all users can monitor the progress of payments and access proof of payment through the Invoice Paid list menu.

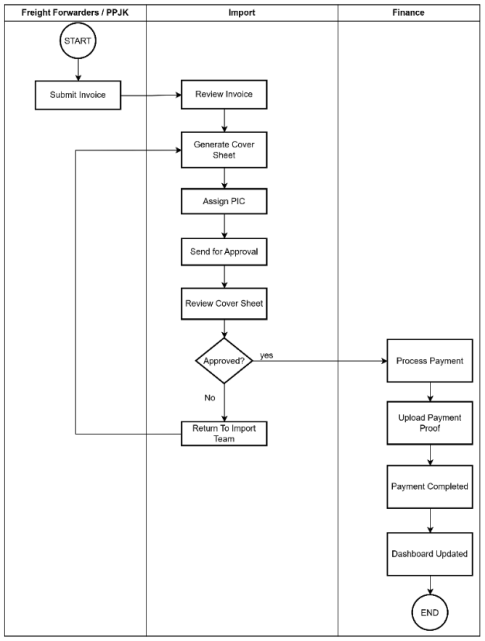


Figure 5. User Flow

4. Prototype

At this stage, the solution that has been formulated is realized in the form of a high-fidelity

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prototype using the Figma application. Figure 6 is the user interface login, used as user authentication to enter the system in accordance with the role and access rights respectively.



Figure 6. User Interface Login

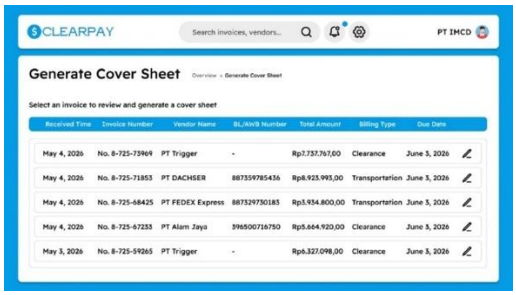


Figure 7. User Interface Generate Cover Sheet

Figure 7 shows the Generate Cover Sheet User Interface, which is used by the Import team after receiving invoices from Freight Forwarders/PPJK. This interface is designed to support the process of reviewing and managing invoices before they are submitted to the Finance team for further processing. Users can select invoices for review based on information such as the receipt date, invoice number, vendor name, BL/AWB number, total invoice amount, invoice type, and due date. Presenting this information within a single interface is intended to facilitate the initial verification process and ensure the completeness of invoice information before the payment process proceeds. In addition, the Generate Cover Sheet feature is used to generate supporting documents for payment submissions, thereby making the administrative process more structured and well documented. The interface design also supports transparency in the workflow between the Import and Finance teams, particularly in the submission, review, and monitoring of invoices to be paid.

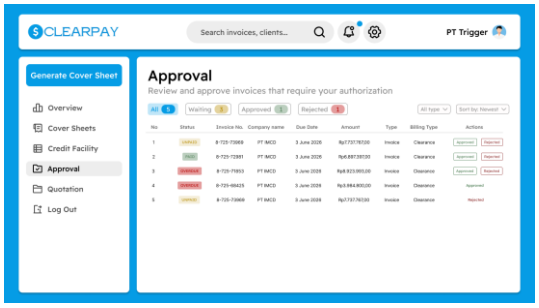


Figure 8. User Interface Approval

After the cover sheet is generated by the Import team, the document is forwarded to the manager for approval before the payment request is processed further. Figure 8 presents the Approval User Interface, which is designed to support a structured payment authorization process. Through this interface, the manager can review payment requests based on available information, including the invoice number, company name, due date, invoice amount, invoice type, and request status. The system provides Approve and Reject options, allowing decisions for each request to be made directly and documented within the system.

The design of the Approval interface aims to improve traceability and transparency throughout the payment approval process. By presenting invoice-related information in a centralized interface, the manager can conduct the necessary verification before making a decision without relying on separate documents or communication channels. In addition, the separation of access rights between the Import team as the request initiator and the manager as the approver reflects the need for process control within the invoice payment workflow. Thus, this feature supports a more structured and well-documented payment process that is aligned with the designed approval mechanism.

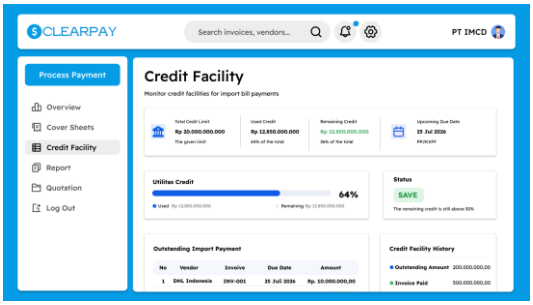


Figure 9. User Interface Credit Facility

Figure 9 shows the Credit Facility User Interface, which is used by the Import and Finance teams to monitor the condition and availability of

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credit facilities associated with the invoice payment process. The interface presents centralized information, including the credit limit, used credit, remaining credit, upcoming due date, credit facility utilization percentage, and facility status. The presentation of this information is designed to provide a concise overview of the current credit condition, enabling users to identify the remaining credit capacity and upcoming payment obligations.

In addition to summary information, the Credit Facility page provides details on outstanding import payments and the credit facility usage history. These features assist the Import and Finance teams in monitoring ongoing payment obligations and anticipating upcoming payment requirements. Thus, the interface design supports a more structured financial monitoring process and provides relevant information as an integral part of the invoice payment workflow.

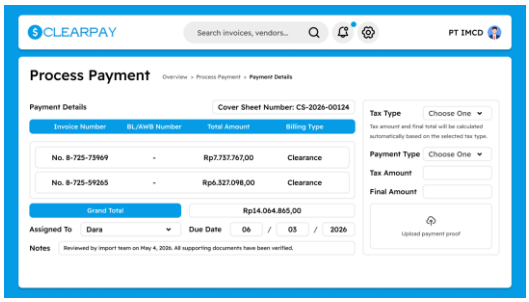


Figure 10. User Interface Process Payment and Tax Calculation

After the cover sheet is approved by the manager, the invoice and its supporting documents are forwarded to the Finance system for verification and payment processing. Figure 10 presents the Process Payment and Tax Calculation User Interface, which is designed to support the payment processing stage after the request has been authorized. The interface displays key invoice information, including the invoice number, BL/AWB number, invoice amount, invoice type, cover sheet number, and the total amount to be processed.

In addition to supporting the verification process, this page provides components for calculating taxes associated with the invoice being processed. Users can select the applicable tax type, enter the tax rate or tax amount, and obtain the final amount as the final value to be used in the payment process. This feature is designed to reduce the need for separate calculations and help ensure that the payment amount accounts for the relevant tax components.

By integrating invoice information, cover sheet documentation, verification, and tax calculation within a single interface, the proposed design supports a more structured and well-documented payment process. This integration also enables the Finance team to access the information required before the payment is executed according to the predetermined schedule, thereby strengthening process traceability throughout the invoice payment workflow.

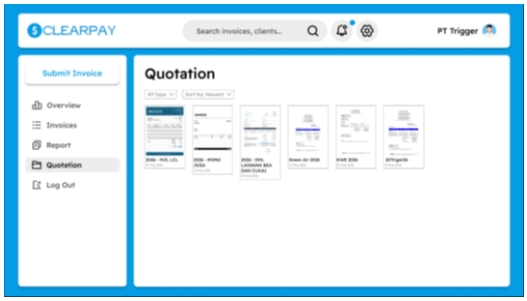


Figure 11. User Interface Quotation

Figure 11 shows the Quotation User Interface, which is used to view and manage cost quotation data related to the import process. This interface provides a centralized view of quotation documents, enabling users to review various cost quotations received from relevant parties. Quotation information is presented as a list of documents that can be selected based on the invoice or vendor, facilitating the search and retrieval of quotation data.

The Quotation page is designed to support the management of cost information before it is used in the payment process. Storing and presenting quotation documents within a single interface can help reduce users' dependence on scattered documents and facilitate information retrieval when needed. Thus, the Quotation feature in the ClearPay prototype serves as a supporting component for managing cost-related documents and information throughout the overall import invoice payment workflow.

5. Testing

The testing process begins with providing usage scenarios for respondents to try each key feature on the Clearpay application. After all scenarios were completed, respondents were asked to fill out a system Usability Scale (SUS) questionnaire consisting of ten statements to measure the level of ease of use of the system. The results of the questionnaire will then be calculated

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and analyzed to obtain the usability value of the Clearpay application.

Based on Table 6, the results of the System Usability Scale (SUS) evaluation involving 30 respondents show that the SUS scores ranged from 52.50 to 100.00, with a total score of 2,472.50 and an average score of 82.42. This average score indicates that the ClearPay prototype achieved a good level of perceived usability and user acceptance. Most respondents obtained scores above 70, indicating that the prototype was generally usable and understandable for supporting the import invoice payment process.

Nevertheless, several respondents obtained relatively lower scores, including R11 with 52.50, R16 and R23 with 62.50, and R5 with 70.00. This variation in scores indicates differences in users' perceptions regarding the ease of use of certain interface components and interaction flows. Overall, the average SUS score of 82.42 indicates that the ClearPay prototype has adequately addressed usability requirements at the initial evaluation stage and can serve as a basis for further system development and refinement.

Table 6. Results Of Questionnaire Calculation

Responden	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Score
R1	5	1	5	2	5	2	5	1	5	1	95.00
R2	4	2	4	2	5	2	4	1	5	1	85.00
R3	4	2	5	1	4	2	4	2	5	1	85.00
R4	4	2	5	1	5	1	5	2	4	2	87.50
R5	3	2	5	3	4	2	4	2	3	2	70.00
R6	5	1	5	1	5	1	5	1	5	1	100.00
R7	4	2	4	2	4	2	5	1	4	3	77.50
R8	4	1	4	1	5	2	5	1	4	2	87.50
R9	4	1	4	1	4	1	5	2	5	3	85.00
R10	4	2	5	2	4	1	5	1	4	2	85.00
R11	4	2	5	2	4	5	2	4	1	2	52.50
R12	4	1	4	2	4	1	5	1	5	1	90.00
R13	4	1	4	1	4	2	5	1	4	1	87.50
R14	4	1	5	1	4	1	5	1	4	1	92.50
R15	5	1	5	2	5	1	5	1	4	1	95.00
R16	3	2	3	2	3	2	3	2	3	2	62.50
R17	5	2	5	2	5	2	5	2	5	2	87.50
R18	5	1	5	1	5	1	5	1	5	1	100.00
R19	3	1	3	1	3	1	3	1	3	1	75.00
R20	5	1	5	1	5	1	5	1	5	1	100.00
R21	3	1	3	1	3	1	3	1	3	1	75.00
R22	4	2	4	2	4	2	4	2	4	2	75.00
R23	3	2	3	2	3	2	3	2	3	2	62.50
R24	4	1	4	1	4	1	4	1	4	1	87.50
R25	4	1	4	1	4	1	4	1	4	1	87.50
R26	4	2	4	2	4	2	4	2	4	2	75.00
R27	3	1	3	1	3	1	3	1	3	1	75.00
R28	4	1	4	1	4	1	4	1	4	1	87.50
R29	4	2	4	2	4	2	4	2	4	2	75.00
R30	3	2	3	1	3	1	3	1	3	1	72.50
Total											**2,472.5**
Average											**82.42**

Table 7. System Usability Scale Test Results

Testing Method	*System Usability Scale* (SUS)
SUS Average Score	82,42

Grade	A
Acceptability	*Acceptable*
Adjective Rating	*Excellent*

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Based on the calculation of the System Usability Scale (SUS) for the ClearPay prototype in Table 7, the average score is 82.42. Based on the Acceptability Range, the score is included in the Acceptable category, while the Grade Scale is at Grade A, and the Adjective Rating is included in the excellent category. This result shows that the prototype is easy to use, in accordance with user needs, and has a high level of usability. Thus, the ClearPay prototype is considered feasible to be used as a invoice payment system design in the import process.

CONCLUSIONS AND SUGGESTIONS

Conclusion

This study applies the Design Thinking method in the design of Invoice Payment Systems in the import process through five stages, namely empathise, define, ideate, prototype, and test. The results of the identification of user needs indicate several problems in the import invoice payment process, including the submission and verification of invoice that are still done manually, difficulties in monitoring the status and of payment, and the risk of duplication of invoice. Based on these problems, this study produced a high-fidelity prototype that includes invoice management and verification features, an approval process, payment processing, status monitoring, and payment confirmation designed to support a more integrated import invoice payment process.

The scientific contribution of this study lies in translating the needs of multiple stakeholders involved in import invoice payments into a structured prototype that addresses interconnected activities across the payment workflow. Unlike studies focusing on general financial administration or other payment contexts, this study specifically considers the roles of the Import Team and Finance Division, as well as the relationships between invoice verification, approval, payment processing, and payment monitoring.

The evaluation results using the System Usability Scale (SUS) obtained an average score of 82.42, which falls within the Acceptable, Grade A, and Excellent categories. The results show that the prototype has a good level of usability and user acceptance. These findings suggest that ClearPay provides a promising interface design that can serve as a reference for the subsequent development of an integrated import invoice payment system. From a practical perspective, the proposed design offers a structured basis for organizing invoice-related information and supporting payment-status monitoring. However, its impact on operational efficiency, processing time, administrative errors, and invoice duplication must be verified through implementation and evaluation in an actual operational environment.

Suggestion

Further research can be directed to system implementation and testing in an operational environment by involving a larger number of respondents, using additional usability evaluation methods as a comparison, and evaluating aspects of data security, system compatibility, and system performance.

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