Journal of Hypermedia & Technology-Enhanced Learning
Vol. 3, No. 3, October (2025), Pages 223–243
e-ISSN: 2985–9166 | 10.58536/j-hytel.201

RESEARCH ARTICLE

BankCare: A Mobile Complaint Management System for the Banking Sector Using TOPSIS-Based Prioritization

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This article contributes to:

ABSTRACT

Efficient complaint management is critical for maintaining service quality in the banking sector. This study presents BankCare, a cross-platform mobile application developed using the Flutter framework, designed to streamline the handling of customer complaints. The application enables users to submit, edit, and monitor complaints, while administrators can manage, respond to, and prioritize them through a dedicated dashboard. A key feature of BankCare is the integration of the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method, which allows complaints to be automatically prioritized based on urgency level and submission time, supporting objective and data-driven decision-making. Additional features include real-time notifications, user-friendly interfaces, and role-based access control for both users and administrators. Comprehensive testing confirmed the effectiveness, reliability, and usability of core functionalities, including complaint submission, admin responses, and priority-based sorting. User feedback further indicated high levels of satisfaction and ease of interaction. By combining mobile technology with a decision-support algorithm, BankCare offers an intelligent, responsive, and structured solution for optimizing complaint handling in the banking sector.

KEYWORDS

Mobile application; complaint management; decision support system; TOPSIS; Flutter; banking service

Received: Jul. 18, 2025; *Revised:* Aug. 10, 2025; *Accepted:* Sep. 26, 2025; *Published Online:* Oct. 21, 2025

How to Cite: Muadzah, K. N., Samala, A. D., Hendriyani, Y., & Sriwahyuni, T. (2025). BankCare: A Mobile Complaint Management System for the Banking Sector Using TOPSIS-Based Prioritization. *Journal of Hypermedia & Technology-Enhanced Learning*, *3*(3), 223–243. https://doi.org/10.58536/j-hytel.201

Published by Sagamedia Teknologi Nusantara

1. INTRODUCTION

Effective customer complaint management is a critical determinant of service quality, particularly in the banking sector, where frequent and direct interactions with customers are unavoidable. Inefficient

or unstructured handling of complaints not only undermines customer satisfaction but also poses significant risks to institutional reputation [1].

Currently, complaint submission in Bank XYZ is fragmented across multiple channels, including physical forms, phone calls, official emails, and social media, without integration into a centralized digital system. Findings from observations and interviews indicate that the bank receives more than 150 customer complaints monthly, most commonly concerning failed transactions, mobile banking malfunctions, ATM card issues, and other service disruptions. However, many of these complaints remain undocumented or lack systematic prioritization. As a result, approximately 30% of cases experience resolution delays, particularly in remote areas or during peak service hours when accessibility is limited and call queues are prolonged.

Digital complaint management systems have consistently demonstrated greater efficiency compared to manual processes. Such systems facilitate faster responses, improve customer satisfaction, and provide structured mechanisms for determining complaint urgency [2]. Yet, a persistent challenge lies in establishing robust prioritization methods to ensure that critical issues receive timely attention.

To address this gap, a mobile application named BankCare was developed using Flutter, selected for its cross-platform efficiency and responsive user interface [3]. The application integrates a complaint prioritization feature employing the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), a Multi-Criteria Decision Making (MCDM) method that enables objective ranking based on multiple factors such as urgency level and report time [4]. By calculating the relative closeness of each alternative to an ideal solution, TOPSIS supports administrators in identifying which complaints require immediate intervention [5]. This prioritization mechanism is expected to enhance response speed, accuracy, and consistency.

The system development followed the Prototyping model, emphasizing iterative refinement through continuous user evaluation [6]. The front-end was implemented in Flutter, while Firebase was utilized as the cloud backend for data storage and prioritization results. System modeling included use case diagrams, activity diagrams, and responsive UI/UX designs tailored to both customers and administrators.

Previous research supports the applicability of TOPSIS in decision-support systems. For example, one study reported a System Usability Scale (SUS) score of 81.33, indicating strong usability, alongside a user satisfaction rating of 4.23 on a Likert scale [7]. Another comparative evaluation demonstrated that TOPSIS achieved a decision accuracy rate of 84%, outperforming methods such as the Analytic Hierarchy Process (AHP) in prioritization effectiveness [8].

2. METHODS

This study adopted the Prototyping method, which emphasized rapid development and continuous user involvement to ensure that the final system aligned with actual user requirements [9]. In this approach, a preliminary version of the system was developed to visualize essential functionalities, gather user feedback, and iteratively refine the design. The method was selected to accommodate improvements based on the perspectives of both users and administrators. The prototyping process in this study consisted of three key phases [10]: (1) Listen to Customer, (2) Build or Revise Mock-up, and (3) Customer Test Drives Mock-up.

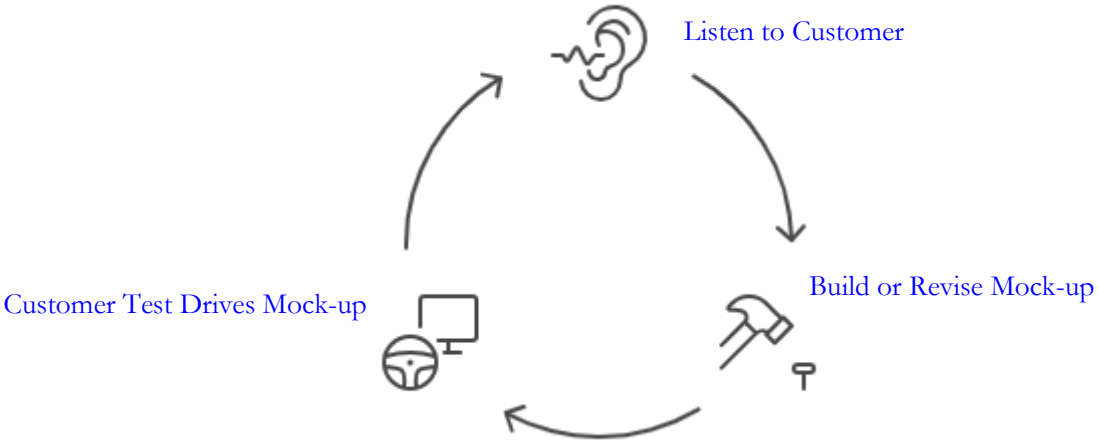


Figure 1. Protoyping method

The iterative cycle accelerated prototype delivery and reduced the risk of mismatched features and user needs. Continuous feedback enabled early detection of usability issues, refinement of technical components, and validation of the TOPSIS integration. This user-centered approach proved valuable for service-oriented applications, enhancing satisfaction, responsiveness, and collaboration between developers and end-users.

2.1. Listen to Customer

In the initial phase, user requirements were gathered through observation, interviews, and literature review. The objective was to identify the challenges encountered by both customers and administrators in managing complaints within the banking context.

Observations revealed that the complaint-handling process was still conducted manually, relying on phone calls and physical forms at branch offices. This approach often led to service delays and the absence of systematic tracking. Interviews with staff from the technology and customer service divisions further underscored the need for a digital system capable of recording complaints, categorizing them by urgency, and prioritizing handling based on predefined criteria.

The literature review supported the integration of decision-support methods, particularly the TOPSIS algorithm, for prioritization tasks, while also affirming the suitability of Flutter for mobile development and Firebase for backend cloud services. A summary of enhanced usability and functionality requirements is presented in Table 1.

These requirements provided a structured foundation for system design, ensuring that both functional and non-functional aspects were addressed systematically. By emphasizing digital submission, prioritization, and real-time communication, the identified features directly targeted the inefficiencies of the manual process. Furthermore, aligning technical choices (Flutter, Firebase, and TOPSIS) with the banking context enhanced scalability, reliability, and decision-making accuracy. This preparatory stage ultimately shaped a development roadmap that balanced technological feasibility with user-centered needs, thereby increasing the likelihood of adoption and sustained use.

Table 1. Additional requirements for enhanced usability and functionality

No.	Feature(s)	Process(es)
1	Complaint Submission	Users submitted complaints digitally (title, description, category).
2	Commenting and Feedback	Admins responded to complaints; users replied via a threaded commenting feature.
3	Complaint Prioritization	Admins viewed and sorted complaints by urgency/timestamp using TOPSIS.
4	User Profile Management	Users viewed/updated profile information (name, email, phone number).
5	Notification Center	A central notification system allowed users and admins to track updates.

2.2. Build or Revise Mock-up

This phase focused on translating user requirements into functional prototypes. The design artifacts included class diagrams, flowcharts, use case diagrams, and activity diagrams to model system behavior and architecture.

2.2.1. Class Diagram

The class diagram represented the structural design of the BankCare application, which was implemented with Firebase as the backend service (Figure 2).

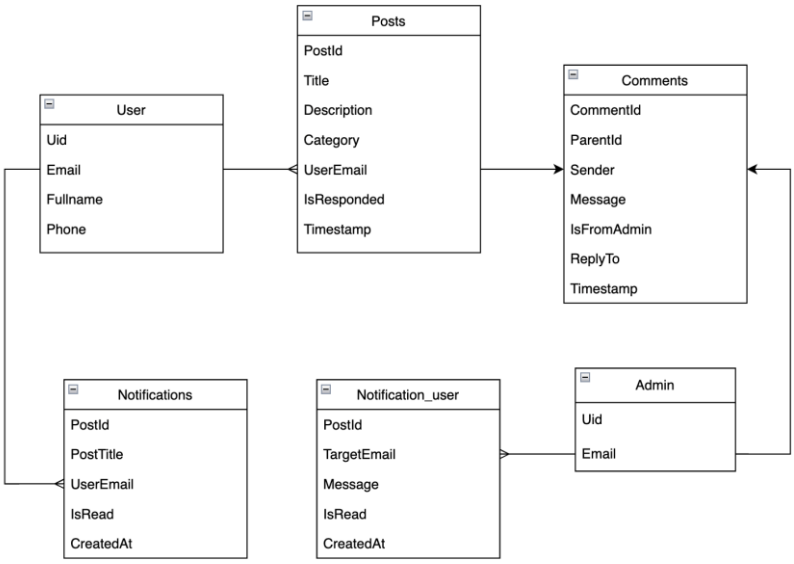


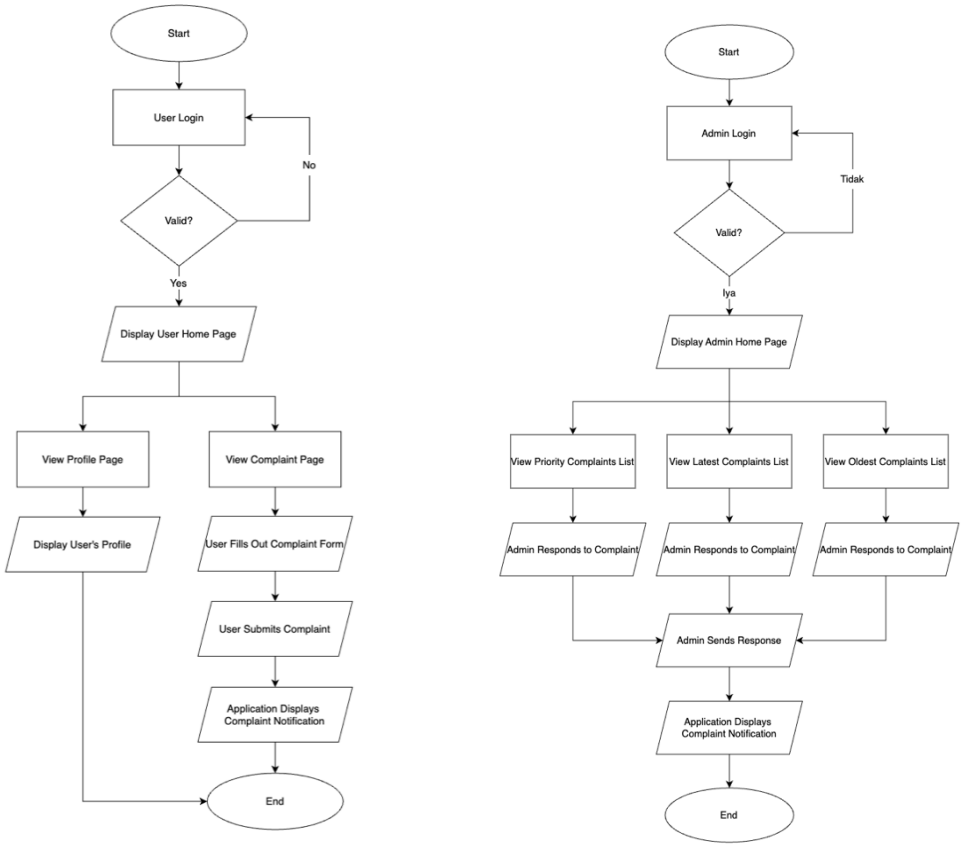
Figure 2. Class diagram of BankCare application

The User class managed identity data such as UID, email, full name, and phone number, with authentication handled through Firebase Authentication. Complaint reports were recorded in the Posts class, which stored attributes including title, description, category, and timestamp. Responses from both users and administrators were stored in the Comments class, while the Admin class maintained administrator data, distinguished by assigned roles. In addition, two notification collections,

Notifications for administrators and Notification_user for end-users, enabled real-time updates regarding status changes, replies, or new inputs. Overall, this architecture supported scalability, ensured structured data organization, and facilitated efficient prioritization logic.

2.2.2. Flowchart

The flowchart provided a sequential view of processes from both user and administrator perspectives (Figure 3). From the user side, the process began with login, after which users could access their profile or submit a complaint through a digital form. Once a complaint was submitted, the system automatically confirmed the report and issued a notification to the user. From the administrator side, the flow also began with login and proceeded to reviewing complaints, which could be sorted either by date or by priority. Administrators then responded, and the system automatically dispatched notifications to the respective users.



(a) (b)

Figure 3. Application flowchart: (a) User flow, (b) Admin flow

2.2.3. Use Case Diagram

The use case diagram defined system scope and actor interactions (Figure 4). Users could submit, edit, or delete complaints, view administrator responses, and receive notifications. Administrators could view all complaints, prioritize them using TOPSIS, respond, and archive resolved cases.

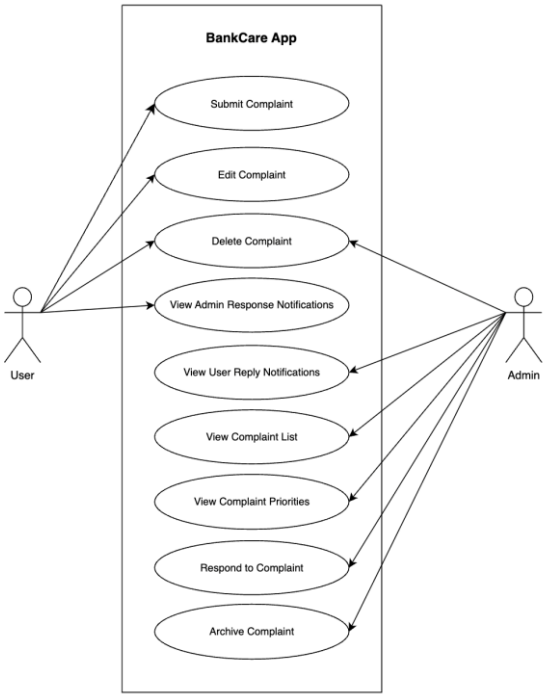
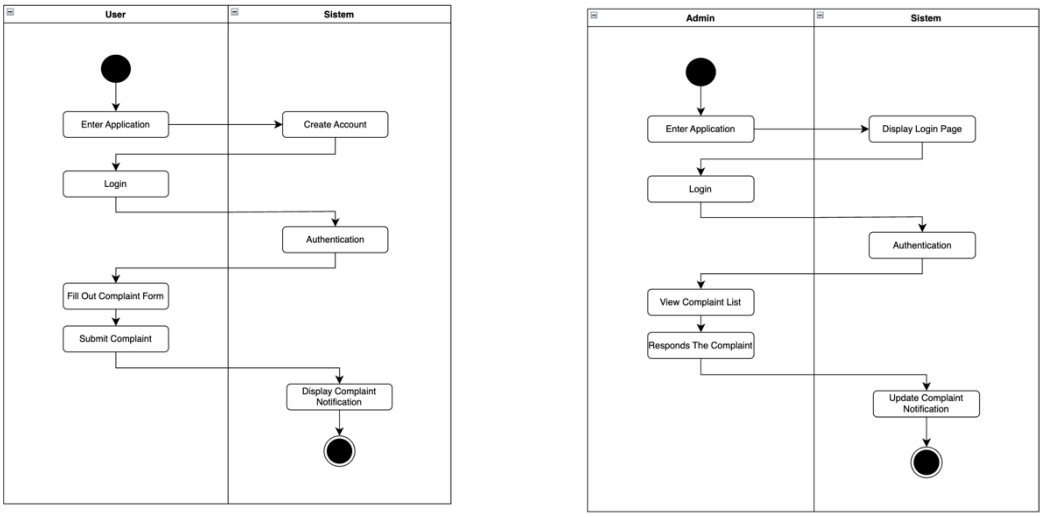


Figure 4. Use case diagram of BankCare application

2.2.4. Activity diagram

The activity diagram illustrated the dynamic interaction between system actors (Figure 5). On the user side, activities began with launching the application, logging in, filling out the complaint form, and submitting the report. The system then authenticated the user and provided feedback through automated notifications. On the administrator side, activities started with login, followed by accessing the complaint dashboard, where reports could be sorted either by recency or by TOPSIS-based priority. Once a complaint was addressed, the administrator's response was delivered to the user via notifications, ensuring a structured and timely communication flow.



(a) (b)

Figure 5. Activity diagram: (a) User activities, (b) Admin activities

2.2.5. TOPSIS Method

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was integrated as the complaint prioritization algorithm [11]. This MCDM technique identified alternatives closest to the ideal solution while farthest from the worst-case solution. In BankCare, complaints were ranked based on urgency level and submission timestamp, ensuring systematic and objective prioritization.

The TOPSIS procedure began with the construction of the normalized decision matrix. Normalization was applied to ensure that all criteria values were dimensionless and comparable across different scales. This process was performed using Equation (1), where r_{ij} represents the normalized value of the i-th alternative with respect to the j-th criterion, x_{ij} is the original score, and the denominator represents the square root of the sum of squared values across all alternatives for criterion j.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \tag{1}$$

The second step involved constructing the weighted normalized decision matrix. In this stage, each normalized value was multiplied by its corresponding criterion weight to reflect its relative importance in the decision-making process. As shown in Equation (2), y_{ij} is the weighted normalized value, w_i is the weight assigned to the criterion, and r_{ij} is the normalized score.

$$y_{ij} = w_i . \ r_{ij} \tag{2}$$

Subsequently, the positive ideal solution A^+ and the negative ideal solution A^- were determined. The positive ideal solution represented the optimal value for each criterion, while the negative ideal solution represented the least desirable value. These sets were expressed in Equations (3) and (4), where y_j^+ and y_j^- denote the maximum and minimum weighted normalized values for criterion j, respectively.

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \tag{3}$$

$$A^- = (y_1^-, y_2^-, \dots, y_n^-) \tag{4}$$

The fourth step calculated the separation measures to quantify the distance of each alternative from both the ideal and negative-ideal solutions. Equation (5) defined the distance D_i^+ of the i-th alternative from the positive ideal solution, while Equation (6) defined the distance D_i^- from the negative ideal solution. Here, y_{ij} is the weighted normalized value of the i-th alternative under criterion j.

$$D_i^+ = \sqrt{\sum_{i=1}^{n} (y_i^+ - y_{ij})^2} \tag{5}$$

$$D_i^- = \sqrt{\sum_{i=1}^{n} (y_{ij} - y_i^-)^2} \tag{6}$$

Finally, the preference value V_i was computed to determine the relative closeness of each alternative to the ideal solution. As defined in Equation (7), this coefficient was calculated as the ratio between the distance of the alternative from the negative-ideal solution and the sum of its distances from both the positive and negative ideal solutions. A higher value of V_i indicated that the alternative was closer to the ideal solution and, therefore, had a higher priority.

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \tag{7}$$

2.3. Customer Test Drives Mock-up

The final phase involved usability testing of the developed prototype. Selected users assessed core functionalities, including complaint submission, administrative responses, notification delivery, and TOPSIS-based prioritization.

The evaluation aimed to verify whether the application met user expectations in terms of usability, clarity of workflows, and accessibility of features. Feedback collected from this phase was used to refine the interface, improve navigation, and ensure that the system effectively supported both customers and administrators before full deployment.

3. RESULTS

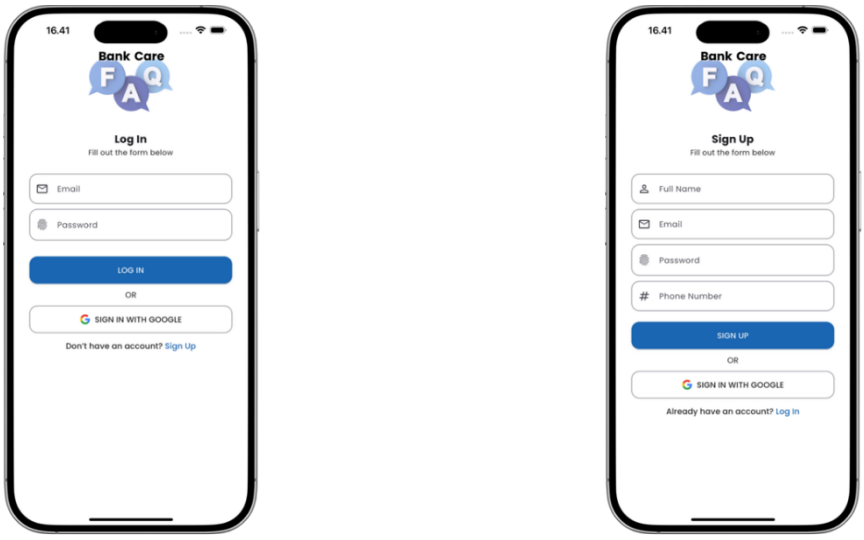
The results are presented following each stage of the development process, as outlined in the methods section. This approach explains how the application's features were implemented, tested, and refined based on user feedback.

3.1. Application Development Results

This section presents the results of developing the BankCare mobile application, which is designed to handle user complaints and support prioritization using the TOPSIS method. The development process was conducted using Flutter as the front-end framework and Firebase for backend services such as authentication and data storage. The system was developed with two main user roles: user and admin. Key features implemented in this application include complaint submission, feedback notifications, and complaint prioritization based on urgency and timestamp.

3.1.1. Login Page Display

The login and signup pages serve as the entry point for both users and administrators to access the BankCare application. These interfaces are designed with simplicity and usability in mind, allowing users to register new accounts or log in with their existing credentials. The authentication system is integrated with Firebase Authentication, ensuring secure and efficient user verification. Additionally, users have the option to log in using their Google accounts, providing a more convenient and faster access method. After successful authentication, users are redirected to their respective dashboards, either the user homepage or the admin interface, based on their assigned roles. This role-based navigation ensures proper access control and enhances the overall user experience, as illustrated in Figure 6.



(a) (b)

Figure 6. (a) Login page display; (b) Signup page display

3.1.2. User Home Page

After a successful login, users are directed to the home page, which functions as the main dashboard of the application. The User Home Page serves as the primary interface for users to monitor and manage their submitted complaints. It displays a list of posts made by the user, each containing the complaint title, the user's email, a short message description, and a timestamp indicating when the complaint was submitted.

A search bar is provided at the top of the page, allowing users to quickly find specific complaints using keywords. Additionally, a notification icon at the top-right corner informs users of any new updates or responses from the admin. This centralized layout enhances usability by enabling users to view, track, and manage their complaint history efficiently, as shown in Figure 7.

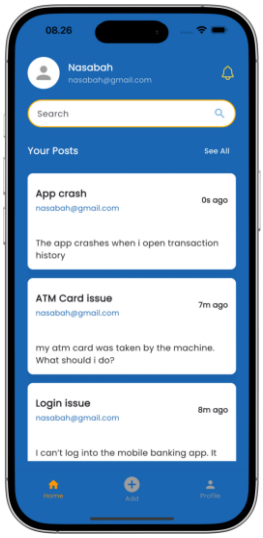
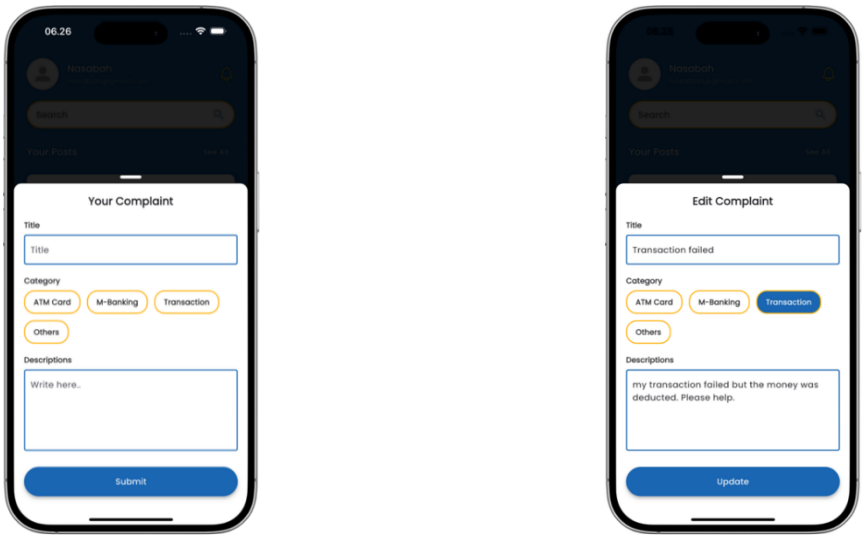


Figure 7. User home page display

3.1.3. User Upload and Edit Complaint Page

The complaint form in the BankCare application allows users to submit reports related to banking issues by filling in the title, selecting a complaint category (e.g., ATM Card, M-Banking, Transaction, Others), and writing a description of the issue. This feature ensures users can convey their concerns clearly and categorically, improving the efficiency of complaint handling.



(a) (b)

Figure 8. (a) Upload complaint display; (b) Edit complaint display

Additionally, the application provides an Edit Complaint feature, as shown in Figure 8. Users can easily update previously submitted complaints by modifying the title, adjusting the selected category, and revising the description. This ensures flexibility and accuracy in the reporting process, especially when users need to clarify or correct information.

3.1.4. User Profile Page

Figure 9 illustrates the User Profile page in the BankCare application, which displays essential user information, including the user's name, email, and phone number. It features an "Edit Profile" button that allows users to update their personal details to ensure data accuracy. Additionally, a "Logout" button is provided to enable users to securely exit the application. This page emphasizes personalization and control over user data while maintaining a clean and intuitive layout.

Beyond its basic functionality, the User Profile page also enhances the overall user experience by integrating role-based access and data security principles. By centralizing account management, users can conveniently maintain up-to-date contact information, which supports effective communication and notification delivery within the system. The inclusion of logout functionality reflects attention to privacy and security, ensuring that sensitive account data remains protected when the application is accessed on shared or public devices. Collectively, these elements contribute to a balance between usability, personalization, and system integrity.

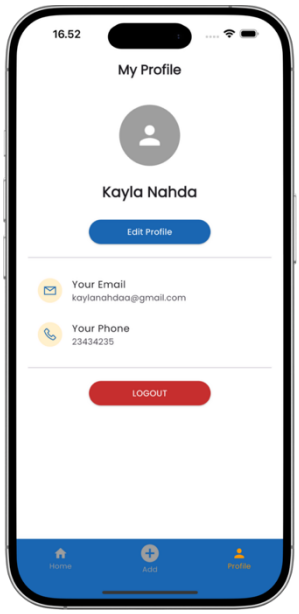


Figure 9. User profile page display

3.1.5. Admin Home Page

The Admin Home Page in the BankCare application serves as the central dashboard for managing user complaints. It displays a list of submitted complaints, along with key details such as the user's email, complaint title, category, and timestamp. When accessing this page, shown in Figure 10, admins can respond to complaints, delete irrelevant or inappropriate posts, and archive resolved issues. The interface is designed to streamline the complaint management process, allowing admins to efficiently maintain the flow of user reports.

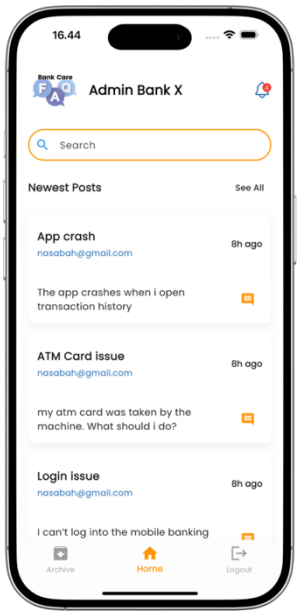


Figure 10. Admin home page display

3.1.5. Admin Response Page

The Admin Response Page allows administrators to provide direct responses to user complaints. As shown in Figure 11, when an admin selects a specific complaint, a modal view appears showing the full content of the complaint along with a text field to input a response. After submitting the response, the system updates the related post and sends a notification to the user. This feature ensures that each complaint receives timely and targeted feedback, enhancing communication between users and the admin team.

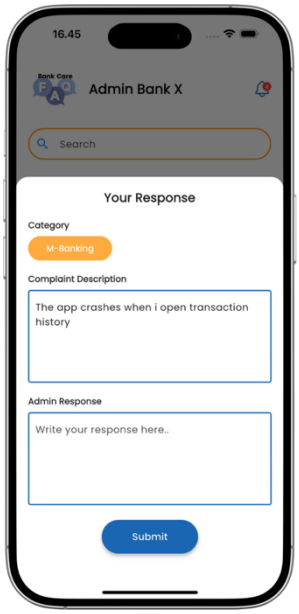
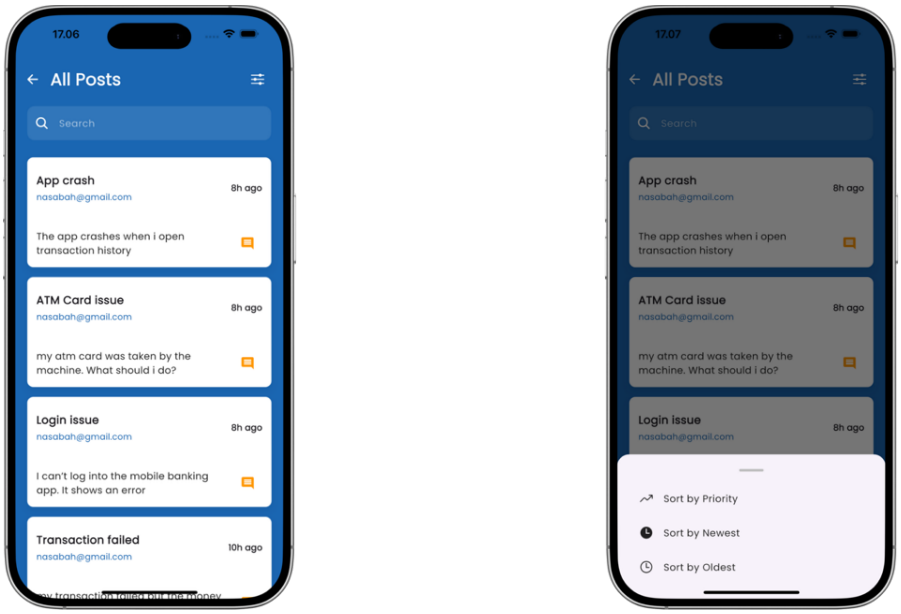


Figure 11. Admin response display

3.1.7. Complaint Sorting Feature

As depicted in Figures 12 (a) and (b), The Complaint Sorting feature in the BankCare application allows administrators to organize complaint lists based on three main criteria: *Sort by Newest*, *Sort by Oldest*, and *Sort by Priority*. The *Newest* and *Oldest* options arrange complaints chronologically, either from the most recent to the oldest or vice versa. Meanwhile, the *Sort by Priority* option utilizes the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method to rank complaints based on specific criteria, such as submission time and urgency level. This feature enables administrators to efficiently identify and address high-priority complaints, thereby improving the overall responsiveness and effectiveness of the service.

The Complaint Sorting feature not only enhances administrative efficiency but also ensures fairness and consistency in complaint handling. By integrating both chronological and algorithmic approaches, the system provides flexibility for administrators to adapt sorting to situational demands. For example, while the chronological view supports routine monitoring of incoming cases, the priority-based sorting ensures that urgent complaints, such as transaction failures or service disruptions, receive immediate attention. This dual approach reflects the balance between operational practicality and data-driven decision-making, ultimately contributing to improved customer satisfaction and trust in the banking service ecosystem.



(a) (b)

Figure 12. (a) All post page displays; (b) Complaint sorting features display

3.2. Application Testing Results

The core modules of the application underwent rigorous black-box testing to evaluate their functionality, reliability, and user experience. The results for each module are presented below.

3.2.1. Login Page Test

The login page was evaluated to ensure proper user authentication, including handling of incorrect credentials and support for password recovery. The results of this test are summarized in Table 2.

Table 2. Login page test result

No.	Scenario	Test Case	Expected Output	Result
1	Access login interface	Click on the login button	The login page is displayed with email and password fields.	Success
2	Login with valid data	Enter correct email and password	The system grants access and redirects to the main dashboard.	Success
3	Login with invalid data	Enter incorrect password	The system shows an error message: “Incorrect email or password.”	Success
4	Forgot password	Click on the “Forgot Password” option	The system redirects to the password recovery page.	Success

3.2.2. User Home Page Test

The user home page presents a list of submitted complaints and provides functionalities for viewing, searching, and navigating to complaint details. The test results for the homepage are summarized in Table 3.

Table 3. User home page test result

No	Scenario	Test Case	Test Output	Result
1	Access home screen	Tap "Home" icon in bottom navigation	The user homepage loads successfully.	Success
2	View complaint list	Scroll through the list of posts	Complaints are displayed in reverse chronological order.	Success
3	Use search bar	Input keywords in the search field	Displays posts matching the entered keywords.	Success
4	Tap on a complaint	Tap any post shown on the list	Navigates to the complaint detail screen.	Success

3.2.3. Complaint Form Page Test

The complaint form enables users to submit new complaints or edit existing ones by providing a title, category, and description. The testing outcomes are presented in Table 4.

Table 4. Complaint form page test results

No	Scenario	Test Case	Test Output	Result
1	Open new complaint form	Tap the "+" button	Complaint form is displayed with input fields and category tags.	Success
2	Submit a new complaint	Fill out the form and press "Submit"	Complaint is saved and displayed on homepage.	Success
3	Edit existing complaint	Tap on an existing post and swipe left to edit	Complaint form is populated with existing data.	Success
4	Save edited complaint	Modify fields and press "Update"	The updated complaint is saved and reflected on the homepage.	Success

3.2.4. User Profile Page Test

The profile page allows users to view and manage personal information such as email and phone number. Test results are shown in Table 5.

Table 5. User profile page test

No	Scenario	Test Case	Test Output	Result
1	Access profile page	Tap "Profile" icon in bottom navigation	Profile page is displayed with user info and edit/logout buttons.	Success
2	View profile details	Observe email and phone number	Displays the correct user data from the database.	Success
3	Tap "Edit Profile"	Press the edit button	Redirects to edit profile form.	Success
4	Logout	Tap the red "Logout" button	User is logged out and returned to login screen.	Success

3.2.5. Admin Home Page Test

The admin dashboard allows administrators to manage complaints by responding, archiving, or deleting posts. The test outcomes are summarized in Table 6.

Table 6. Budget projection test result

No	Scenario	Test Case	Test Output	Result
1	Access admin dashboard	Log in as admin	Admin homepage displays list of user complaints.	Success
2	Delete a complaint	Swipe right to delete a complaint	Complaint is removed from the list.	Success
3	Archive a complaint	Swipe left to archive a complaint	Complaint is moved to archive collection.	Success
4	Respond to a complaint	Tap comment icon and submit a response	Response is saved and shown on the user's post detail.	Success

3.2.6. Complaint Sorting Features Test

Sorting functionality enables administrators to organize complaints by priority, newest, or oldest. Results are presented in Table 7.

Table 7. Financial report test result

No	Scenario	Test Case	Test Output	Result
1	Sort by newest	Tap "Sort by Newest" option	Complaints are ordered by most recent date.	Success
2	Sort by oldest	Tap "Sort by Oldest" option	Complaints are ordered by oldest date first.	Success
3	Sort by priority (TOPSIS)	Tap "Sort by Priority" option	Complaints are sorted based on TOPSIS-calculated urgency values.	Success

3.2.7. Notification Test

The notification feature was tested to verify its functionality in delivering updates to both users and admins. Notifications are triggered by key events such as admin responses and user replies. Table 8 outlines the test results of the notification system.

Table 8. Notification test result

No	Scenario	Test Case	Test Output	Result
1	Admin sends a response	Admin replies to a complaint	A notification is sent to the respective user about the admin's response.	Success
2	User replies to admin's comment	User responds back to the admin comment	A notification is sent to the admin to inform about the new user reply.	Success
3	Open notification panel (admin)	Admin taps the bell icon on top right	A modal appears displaying a list of incoming notifications.	Success
4	Open notification panel (user)	User taps the bell icon	The user is shown recent updates or responses from admin.	Success
5	Read notification behavior	Tap on a specific notification	App navigates to the related complaint or response detail.	Success

4. Discussion

The development of the BankCare application responds to an increasing demand for efficient, user-oriented complaint management systems within the banking sector. Traditional complaint-handling mechanisms often suffer from delays, inconsistent prioritization, and limited transparency, which can negatively affect customer satisfaction and trust [14]. By enabling users to submit, edit, and monitor complaints through an intuitive interface, while simultaneously providing administrators with a structured platform to manage and respond to issues, BankCare addresses several systemic challenges inherent in conventional complaint management processes.

A key innovation integrated into BankCare is the implementation of the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method as a decision support mechanism for complaint prioritization. In the context of customer service, complaints vary significantly in urgency and potential impact; a delayed response to critical complaints, such as failed transactions, ATM malfunctions, or security incidents, can result in substantial operational and reputational costs [15], [16]. Traditional first-come, first-served approaches do not adequately account for these differences, often leading to inefficient resource allocation. BankCare mitigates this by providing administrators with multiple sorting options, by timestamp, urgency, or computed priority, thereby facilitating responsive and data-driven handling of critical cases [17].

The TOPSIS algorithm in BankCare operationalizes prioritization by evaluating complaints against two primary dimensions: the urgency level indicated at the time of submission and the timestamp reflecting when the complaint was filed. Each criterion is normalized to account for scale differences, and the relative distance of each complaint from the ideal and anti-ideal solutions is calculated. This yields a composite priority score, which allows complaints to be ranked in an order that reflects both immediacy and criticality. Such an approach not only ensures consistency and transparency but also reduces potential biases associated with subjective human judgment in prioritization, a known challenge in administrative decision-making [17], [18]. By formalizing the prioritization process, the system operationalizes fairness and accountability within complaint management workflows.

Empirical testing of the application indicates that both functional and decision-support components perform reliably. The sorting mechanisms, by newest, oldest, or priority, operate seamlessly, enabling

administrators to act promptly on high-priority complaints. Notably, the integration of TOPSIS does not compromise system usability; the interface remains clear and accessible for both users and administrators, suggesting that intelligent decision support can coexist with intuitive user experience design [17].

Furthermore, the implementation of TOPSIS within BankCare exemplifies how multi-criteria decision-making (MCDM) approaches can be effectively applied to operational workflows in service-oriented sectors. By providing a quantifiable, algorithmic basis for complaint prioritization, the system enhances administrative efficiency, reduces response latency, and potentially increases overall service quality. From a research perspective, this highlights the practical applicability of MCDM methods beyond traditional industrial or engineering contexts, extending into the domain of digital customer service platforms [18].

Finally, the BankCare application demonstrates the potential for hybrid socio-technical systems where user-centered design principles are harmonized with algorithmic decision-making. By bridging usability with intelligent prioritization, the system contributes to enhanced stakeholder satisfaction, better operational outcomes, and the establishment of a replicable model for other service sectors [18]. While the current implementation relies on two primary criteria (urgency and timestamp), future extensions could incorporate additional factors, such as complaint type, customer profile, or historical resolution metrics, to further refine the prioritization logic and support predictive analytics for proactive service.

5. Conclusion

This study successfully developed BankCare, a cross-platform mobile application designed to streamline the management of customer complaints in the banking sector. Built using Flutter and integrated with Firebase for secure user authentication and efficient data management, the application provides a comprehensive suite of functionalities, including complaint submission, admin response management, real-time notification delivery, and complaint prioritization. A central contribution of BankCare is the integration of the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which enables administrators to prioritize complaints based on two primary criteria: urgency level and report submission time. By embedding these multi-criteria decision-making algorithm into the admin dashboard, the system allows for objective, data-driven prioritization, ensuring that high-impact issues, such as transaction failures or ATM malfunctions, are addressed promptly. This systematic approach minimizes human error and subjectivity in complaint handling, enhancing operational transparency and accountability. Evaluation through comprehensive application testing demonstrated that all core functionalities, including user registration, complaint submission, response management, and priority-based sorting, operate reliably. Additionally, user feedback highlighted the intuitive and user-friendly interface, confirming that advanced decision-support features can be effectively integrated without compromising usability. Beyond functional performance, BankCare exemplifies the potential of combining mobile technology with algorithmic decision support to optimize service delivery in the banking sector. The implementation of TOPSIS not only enhances the responsiveness and efficiency of complaint resolution but also establishes a framework for scalable and replicable digital service management, which could be extended to other sectors requiring structured issue prioritization. In summary, BankCare demonstrates that the convergence of mobile platforms and intelligent prioritization algorithms can substantially improve customer service quality, operational efficiency, and stakeholder satisfaction. Future developments could incorporate additional prioritization criteria, predictive analytics, or integration with broader enterprise systems, further strengthening the system's capacity to proactively manage complaints and enhance overall service excellence.

DECLARATIONS

Author Contributions

Kayla Nahda Muadzah: Conceptualization, Methodology, Software, Investigation, Data Curation, Visualization, Writing - Original Draft, Writing – Review & Editing. **Agariadne Dwinggo Samala:** Supervision, Validation, Formal Analysis, Visualization, Writing – Review & Editing. **Yeka Hendriyani:** Validation, Formal Analysis. **Titi Sriwahyuni:** Validation, Formal Analysis. All authors have read and approved the final version of this manuscript.

Acknowledgments

The authors sincerely thank all individuals, institutions, and external collaborators who provided invaluable guidance, technical support, and insights throughout the development and evaluation of the BankCare application. Their expertise significantly contributed to the rigor, quality, and practical relevance of this study.

Ethical Approval

This study did not involve human or animal subjects in experimental interventions. All user feedback was collected through voluntary, anonymized surveys and system usage data, ensuring no identifiable personal information was used. Therefore, formal ethical approval was not required.

Funding

The authors declare that this research was conducted independently and did not receive any external funding or financial support. All stages of the study, including system design, development, testing, and manuscript preparation, were carried out without external grants or sponsorships.

Competing Interests

The authors confirm that there are no conflicts of interest, financial or otherwise, that could have influenced the research or the outcomes reported in this study.

Generative AI and AI-Assisted Technologies Statement

During the final stages of manuscript preparation, the authors employed AI-assisted tools, including ChatGPT and Grammarly, to improve clarity, readability, and linguistic accuracy. These tools were used solely for language refinement and formatting suggestions. All substantive content, analyses, interpretations, and conclusions presented in this manuscript were independently developed, verified, and finalized by the authors. The authors retain full responsibility for the accuracy, integrity, and scholarly rigor of the work.

REFERENCES

[1] M. M. Hasan, S. A. Jalal Siam, and A. Haque, "he Significance of Customer Service in Establishing Trust and Enhancing The Reputation of The Banking Industry in Bangladesh," *Bus. Econ. Dev. Ctries.*, vol. 1, no. 2, pp. 71–75, May 2023, doi: 10.26480/bedc.02.2023.71.75.

[2] H. J. Seta, D. G. Suharto, and K. Setyowati, "Digitalization: Innovation in Public Services (Case Study Implementation of The Complaints Service Unit in Surakarta (ULAS) and Klaten Regency

Industry and Manpower Office)," *J. Gov. Civ. Soc.*, vol. 8, no. 2, p. 161, Nov. 2024, doi: 10.31000/jgcs.v8i2.10884.

[3] Osinachi Deborah Segun-Falade, Olajide Soji Osundare, Wagobera Edgar Kedi, Patrick Azuka Okeleke, Tochukwu Ignatius Ijomah, and Oluwatosin Yetunde Abdul-Azeez, "Developing Crossplatform Software Applications to Enhance Compatibility Across Devices and Systems," *Comput. Sci. IT Res. J.*, vol. 5, no. 8, pp. 2040–2061, Aug. 2024, doi: 10.51594/csitrj.v5i8.1491.

[4] Biju Patnaik University of Technology (BPUT), Rourkela, Odisha, India, S. K. Sahoo, S. S. Goswami, and Biju Patnaik University of Technology (BPUT), Rourkela, Odisha, India, "A Comprehensive Review of Multiple Criteria Decision-Making (MCDM) Methods: Advancements, Applications, and Future Directions," *Decis. Mak. Adv.*, vol. 1, no. 1, pp. 25–48, Dec. 2023, doi: 10.31181/dma1120237.

[5] T. Arsu and M. B. Aytaç, "Evaluating Turkish Banks' Complaint Management Performance Using Multi-Criteria Decision Analysis," in *Data Analytics for Management, Banking and Finance: Theories and Application*, F. Saâdaoui, Y. Zhao, and H. Rabbouch, Eds., Cham: Springer Nature Switzerland, 2023, pp. 197–220. doi: 10.1007/978-3-031-36570-6_9.

[6] E. R. Oliveira *et al.*, "An Iterative Process for the Evaluation of a Mobile Application Prototype," *SN Comput. Sci.*, vol. 3, no. 4, p. 262, Apr. 2022, doi: 10.1007/s42979-022-01153-6.

[7] Abdussalam Mustajib and L. Friska Narulita, "Solusi Manajemen Order Menggunakan Metode TOPSIS dan Kanban Board berbasis Android," *J. Rekayasa Sist. Inf. Dan Teknol.*, vol. 2, no. 1, pp. 400–413, Aug. 2024, doi: 10.59407/jrsit.v2i1.1005.

[8] Z. Sari, L. Y. Imam, D. R. Chandranegara, W. Suharso, and H. Wibowo, "Aplikasi Pendukung Keputusan Kontrasepsi Menggunakan Metode TOPSIS Berbasis Mobile," *CYBERNETICS*, vol. 5, no. 02, p. 98, Nov. 2021, doi: 10.29406/cbn.v5i02.2731.

[9] Adams Gbolahan Adeleke, Temitope Oluwafunmike Sanyaolu, Christianah Pelumi Efunniyi, Lucy Anthony Akwawa, and Chidimma Francisca Azubuko, "Leveraging UX Design and Prototyping in Agile Development: A Business Analyst's Perspective," *Eng. Sci. Technol. J.*, vol. 5, no. 8, pp. 2670–2693, Aug. 2024, doi: 10.51594/estj.v5i8.1518.

[10] S. Syafril, Z. Asril, E. Engkizar, A. Zafirah, F. A. Agusti, and I. Sugiharta, "Designing Prototype Model of Virtual Geometry in Mathematics Learning Using Augmented Reality," *J. Phys. Conf. Ser.*, vol. 1796, no. 1, p. 012035, Feb. 2021, doi: 10.1088/1742-6596./1796/1/012035

[11] F. Ciardiello and A. Genovese, "A Comparison Between TOPSIS and SAW Methods," *Ann. Oper. Res.*, vol. 325, no. 2, pp. 967–994, June 2023, doi: 10.1007/s10479-023-05339-w.

[12] V. Maduhu, "Effectiveness of Complaints Resolution Approaches on Customer Satisfaction in Local Government Authorities: A Case of Arusha City Council," vol. 2023

[13] H. Park, K. Kim, J. Hyung, T. Kim, and J. Koo, "Decision-Making for The Hazard Ranking of Water Distribution Networks Using The TOPSIS Method," *Water Supply*, vol. 23, no. 2, pp. 715–726, Feb. 2023, doi: 10.2166/ws.2023.013.

[14] R. D. Kurniasih, H. J. Astuti, H. Widhiandono, and E. Rachmawati, "The Effect Of Handling Complaints and Service Quality On Customer Loyalty Through Customer Satisfaction (Study On Clinic University of Muhammadiyah Purwokerto)," *Int. J. Econ. Bus. Innov. Res.*, vol. 4, no. 04, pp. 1514–1537, 2025. doi: 10.63922/ijebir.v4i04.2099.

[15] E. Susanti, "Complaints Handling Satisfaction mediates between Complaints Handling to Customer Loyalty for the Indonesian Banking Industry," *Int. J. Digit. Entrep. Bus.*, vol. 2, no. 2, pp. 86–, 2021. doi: 10.52238/ideb.v2i2.69.

[16] S. Varga, J. Brynielsson, and U. Franke, "Cyber-threat perception and risk management in the

Swedish financial sector," *Comput. Secur.*, vol. 105, p. 102239, Jun. 2021. doi: 10.1016/j.cose.2021.102239.

[17] A. Bashkirova and D. Krpan, "Confirmation bias in AI-assisted decision-making: AI triage recommendations congruent with expert judgments increase psychologist trust and recommendation acceptance," *Comput. Hum. Behav. Artif. Hum.*, vol. 2, no. 1, p. 100066, Jan.–Jul. 2024. doi: 10.1016/j.chbah.2024.100066.

[18] M. Soori, F. K. Ghaleh Jough, R. Dastres, and B. Arezoo, "AI-Based Decision Support Systems in Industry 4.0, A Review," *J. Econ. Technol.*, in press, 28 Aug. 2024. doi: 10.1016/j.ject.2024.08.005.

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