OPTIMIZATION IN ZAKAT MANAGEMENT THROUGH THE DEVELOPMENT OF A CHATBOT-BASED MOBILE APPLICATION

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Abstract— *The growing awareness of zakat, infaq, and sadaqah (ZIS) in Indonesia calls for intelligent and transparent management systems. This study proposes a chatbot-based mobile application integrated with the SECI knowledge management model to optimize ZIS management and distribution. Using the waterfall software development model, the research includes requirement analysis, system design, chatbot implementation, and validation. The decision-tree-based chatbot enables interactive and personalized guidance for muzakki, while the SECI framework ensures structured knowledge sharing among zakat institutions. Functional and compatibility testing show that the system operates reliably on Android version 10 and above, with intent classification accuracy reaching 92 percent. The findings demonstrate that combining intelligent interaction and structured knowledge management improves transparency, operational efficiency, and institutional learning in digital zakat systems. The proposed framework provides both theoretical and practical contributions to advancing socio-economic management through mobile technology.*

Keywords: *Chatbot, Infaq, Mobile Application, Sadaqah (ZIS), SECI Model*

Intisari— *Peningkatan kesadaran terhadap zakat, infaq, dan sadaqah (ZIS) di Indonesia menuntut sistem pengelolaan yang cerdas dan transparan. Penelitian ini mengusulkan aplikasi mobile berbasis chatbot yang terintegrasi dengan model manajemen pengetahuan SECI untuk mengoptimalkan pengelolaan dan distribusi ZIS. Dengan menerapkan model pengembangan perangkat lunak waterfall, penelitian meliputi analisis kebutuhan, perancangan sistem, implementasi chatbot, serta validasi fungsional. Chatbot berbasis decision tree memberikan panduan interaktif dan personal bagi muzakki, sedangkan kerangka SECI memastikan pertukaran pengetahuan yang terstruktur di lembaga zakat. Hasil uji menunjukkan sistem beroperasi andal pada Android versi 10 ke atas dengan akurasi klasifikasi intent mencapai 92 persen. Integrasi interaksi cerdas dan manajemen pengetahuan terstruktur terbukti meningkatkan transparansi, efisiensi operasional, serta pembelajaran kelembagaan dalam sistem zakat digital. Kerangka ini memberikan kontribusi teoretis dan praktis bagi penguatan tata kelola sosial ekonomi berbasis teknologi mobile.*

Kata Kunci: *Chatbot, Infak, Aplikasi Mobile, Sedekah (ZIS), Model SECI.*

INTRODUCTION

Zakat has a vital role in reducing poverty and social inequality through the fair redistribution of wealth. In Indonesia, its management is entrusted to the Badan Amil Zakat (BAZ) and Lembaga Amil Zakat (LAZ), which are responsible for collecting, managing, and distributing zakat funds [1]. Zakat, infaq and sadaqah (ZIS) are essential Islamic financial instruments that aim to strengthen social welfare and economic equity. The conceptual distinction among these three instruments is presented in Table 1.

Table 1 explains the distinctive roles of zakat, infaq, and sadaqah. Zakat is a mandatory act of worship with clear rules, including minimum

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thresholds and categories of recipients, serving as a structured instrument to reduce poverty and enhance social equity. Infaq is voluntary and highly flexible, enabling contributions to be directed to anyone in need and strengthening society's generosity. Sadaqah covers tangible and intangible actions, extending beyond financial assistance to acts of kindness and sadaqah jariyah that provide continuous benefits. Together, these three concepts establish the foundation for developing a digital system that manages charitable contributions in a comprehensive and structured way.

Table 1. Concepts of ZIS

Concept	Definition	Characteristics	Purpose
Zakat [2]	A mandatory form of almsgiving in Islam, where a specific portion of wealth is distributed to eligible recipients.	Obligatory for eligible Muslims, it has a minimum threshold (nisab) and specific categories of recipients (asnaf).	Purifies wealth, reduces poverty, and supports social welfare.
Infaq [3]	Voluntary spending or giving of wealth for charitable purposes, without specific limitations on the amount or recipients.	Not obligatory, flexible in amount and recipients, can be given to anyone in need.	Encourages generosity and financial support for various causes, including family and the needy.
Sadaqah [4]	A broader form of charity that includes both material and non-material contributions, such as good deeds and helping others.	Encompasses material and non-material acts, including ongoing charity (sadaqah jariyah) that provides continuous rewards.	Promotes kindness and community welfare beyond financial aid.

Source: (Research Results, 2025)

Over the past three years, zakat management has encountered several challenges that hinder its optimal implementation. The main issues include low public awareness, limited transparency, uneven distribution, and insufficient utilization of modern technology [5], [6].

Public awareness regarding the obligation to pay zakat remains relatively low, preventing the full realization of the potential of zakat. Limited accountability in zakat management institutions has led to skepticism about distributing zakat through official organizations [7]. In terms of distribution, disparities occur due to inaccurate mustahik data and suboptimal mechanisms. In today's digital era, information technology should serve as a solution

for modernizing zakat management, yet its implementation remains incomplete.

Previous studies confirm the importance of digital technology in strengthening zakat management. Research on optimizations in zakat and waqf management [8] indicates that mobile applications improve efficiency, transparency, and accuracy. Another study [9] developed an Android-based application that simplified zakat collection and distribution, while [10] highlighted the role of digital platforms in enhancing transparency and efficiency. Next, [11] proposed blockchain-based zakat management to ensure data security. Although valuable, these studies remain limited in scope. Study [9] did not integrate chatbot-based interaction to guide and assist muzakki. Study [10] did not offer personalized systems tailored to financial profiles. Study [11] improved data security but lacked features for interactive consultation or automated zakat recommendations. These limitations highlight the need for a more integrated approach to intelligent and transparent zakat management.

This research introduces a holistic optimization that unites three core contributions. Mobile-based systems have been widely recognized as essential tools in modernizing zakat management, particularly in improving efficiency, transparency, and accessibility [12], [13], [8], [14]The first contribution of this study is the integration of a decision tree–based chatbot that enables interactive communication and personalized recommendations for zakat calculation. The second is the incorporation of a SECI-based knowledge management system to ensure systematic documentation and institutional knowledge sharing. The third is the development of a cross-platform design using Flutter and Dart to enhance accessibility for a wider range of users. These contributions demonstrate that this study advances knowledge in digital zakat management by offering a unified framework that integrates intelligent interaction, transparency, and organizational learning.

From these limitations, the State of the Art in this research emerges. This study combines three elements not addressed simultaneously in prior works: intelligent interaction through a decision-tree-based chatbot, personalized zakat calculation aligned with income data, and structured knowledge management using the SECI Model. This integrated approach positions the research beyond previous developments and justifies the proposed system. Artificial intelligence (AI) has significant potential to address various challenges in zakat management [15], [16]. This technology can analyze

mustahik data more accurately, predict zakat payment trends, and automate services such as payment reminders and zakat consultations. As a result, AI can enhance operational efficiency, strengthen transparency, and expand service accessibility for the public. Given these challenges, this study aims to develop an AI-powered mobile application as a chatbot as an innovative solution for zakat management within the Badan Amil Zakat [15], [17].

This study presents a practical, reliable digital solution for managing, calculating and distributing zakat, infaq and sadaqah for both zakat institutions and the public. By enhancing transparency and inclusive financial management, the system aims to strengthen public trust, support sustainable socio-economic development and serve as a reference model for the international digital transformation of zakat services.

MATERIALS AND METHODS

The development workflow comprises five integrated stages: user-interface design, zakat calculation analysis, charity and infaq management, implementation of chatbot learning for personalized muzakki interactions and generation of management reports for stakeholders. These sequential stages (see Figure 1) ensure that the system delivers usable interfaces, accurate zakat computations, effective donation handling, adaptive conversational support and actionable reporting for both administrators and users.
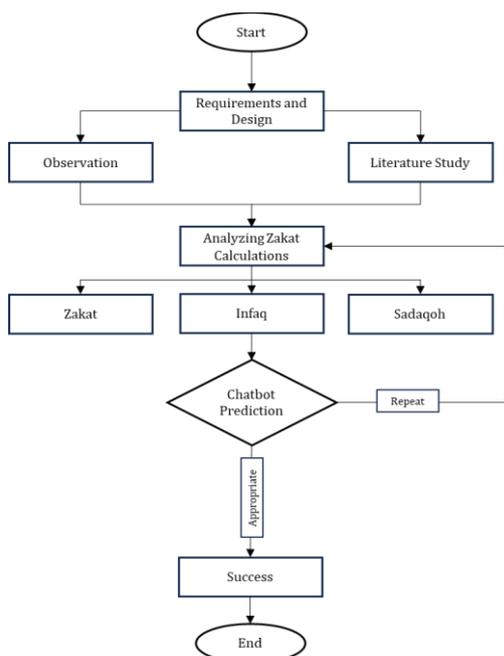
Source: (Research Results, 2025)
Figure 1. Research Waterfall Method

Figure 1 presents the research workflow following a five-stage Waterfall model: requirements analysis, design, implementation (zakat calculation, infaq management and chatbot integration), testing (functionality and compatibility) and maintenance (refinement and updates). This linear approach supports thorough documentation and stable delivery for a proof-of-concept and functional validation.

However, the Waterfall model limits responsiveness to changing requirements; for subsequent development we recommend migrating to adaptive frameworks such as Agile or Scrum to enable iterative delivery, frequent user feedback and continuous improvement [18], [19]. Scrum emphasizes short iterative sprints, continuous testing and regular review cycles to keep development aligned with evolving user requirements [20]. For digital zakat systems where transaction features, security protocols, and data governance frequently change Agileor Scrum enable faster updates, greater sustainability and more user-centered, institutionally aligned development.

System Design

The system design phase focused on defining the application architecture, component interaction, and technology stack. The application was developed using Flutter and Dart, selected for their cross-platform capability, high performance, and efficient "hot reload" development process [21], [22], [23], [24], [25]. The system employs a three-layer architecture to ensure modularity and scalability. The Presentation Layer (Flutter) manages the user interface and chatbot interaction. The Logic Layer processes zakat and infaq calculations and implements rule-based decision mechanisms. The Data Layer, using Firebase Realtime Database, stores user data, transactions and chatbot knowledge. Communication between layers is conducted via RESTful services to maintain consistency and extensibility. The workflow begins with user input, which is processed in the logic layer to generate personalized outputs. Core activities include registration, data entry, zakat calculation, payment, chatbot interaction and transaction review.

Knowledge Management System

This chatbot-based mobile application aims to provide explicit knowledge to the Indonesian people, particularly for muzakki who wish to distribute zakat, infaq and sadaqah. This objective requires support from a well-structured knowledge management system, which becomes the foundation of the optimization developed in this

research. The framework of this knowledge management process is explained using the SECI Model proposed by Ikujiro Nonaka [26], as seen in Figure 2.
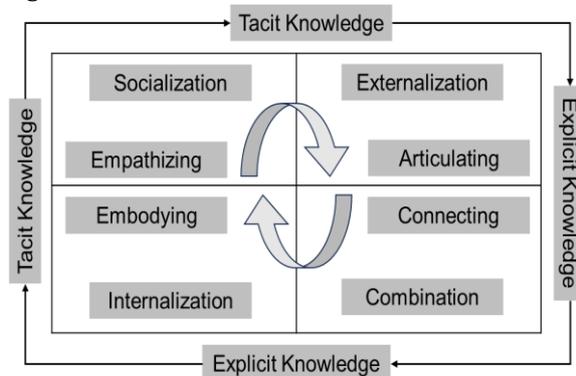
Source: (Research Results, 2025)
Figure 2. SECI's Model by Ikujiro Nonaka

Figure 3 illustrates the SECI Model, which describes the dynamic knowledge transformation process between tacit and explicit forms [27]. Socialization refers to the transfer of tacit knowledge through shared experiences, whereas externalization transforms tacit insights into explicit forms such as digital documentation. Combination integrates diverse explicit sources such as transaction records and zakat regulations into structured knowledge repositories. Internalization converts explicit knowledge into tacit understanding, enhancing users' and administrators' competencies through system interaction. By adopting this knowledge conversion model, the chatbot-based application facilitates continuous learning, structured decision-making, and systematic knowledge sharing, thereby strengthening transparency and accountability in zakat management.

Chatbot Implementation

The developed chatbot functions as an intelligent conversational interface to assist muzakki in zakat calculation and in accessing information on infaq and sadaqah. It applies a hybrid architecture that combines rule-based decision trees with intent classification to ensure accuracy and contextual relevance. The rule-based component maps key intents such as zakat calculation, nisab inquiry, distribution rules, and transaction history into structured decision paths with parameterized calculation rules based on users' income and assets. The intent-classification module employs keyword-matching techniques trained on 350 synthetic Bahasa Indonesia queries grouped into 10 intent classes, covering both formal and colloquial expressions.

The chatbot supports session-based context retention and adaptive keyword expansion to recognize linguistic variations (e.g., synonymous zakat terms), thereby improving interaction continuity and usability. Multi-turn dialogue management enables step-by-step guidance for calculation, donation selection, and payment confirmation. Implemented in Flutter and integrated with Firebase Realtime Database, the system achieved 92% accuracy in intent classification testing, demonstrating reliable performance in identifying user queries and generating appropriate responses [28], [29], [30].

Testing and Validation

Testing and validation were conducted to ensure compliance with system specifications and user requirements through three stages: functional, validation and compatibility testing. Functional testing employed a black-box approach to assess 14 core features, including registration, zakat and infaq calculation, chatbot interaction, transaction management, reporting and authentication. All test cases met predefined input–output criteria. Validation testing examined:
1) The accuracy of zakat computations across income thresholds.
2) Chatbot intent recognition using 350 labeled queries.
3) Data integrity between the interface and Firebase Realtime Database.

Results confirmed accurate calculations, 92% intent recognition accuracy, and stable data transmission without loss.
Compatibility testing across Android versions 9 to 14 indicated stable performance from Android 10 onward, with minor rendering delays on earlier versions. An initial usability evaluation involving ten participants reported positive perceptions regarding navigation, clarity and chatbot responsiveness, although this assessment was informal. Future research will incorporate standardized usability instruments such as the System Usability Scale (SUS) or the User Experience Questionnaire (UEQ).

Overall, the findings demonstrate that the system satisfies functional, logical and preliminary usability requirements, indicating readiness for broader implementation as a digital zakat management platform.

RESULTS AND DISCUSSION

The implementation and analysis are organized into three sequential stages. First,

observation and literature review were conducted to compile authoritative sources on Zakat, Infaq and Sadaqah (ZIS) programs. Second, ZIS calculation rules were formulated and analyzed with respect to muzakki income and financial profiles. Third, a chatbot-based mobile application was developed and evaluated as the study's primary output, providing a digital knowledge-management platform to help the Indonesia community optimize the calculation, management and distribution of charitable funds.

Decision Tree Chatbot

Optimization centered on a chatbot that leverages machine learning to deliver personalized recommendations based on each muzakki's data. User inputs are routed through a decision-tree logic that guides response selection and recommendation generation (see Figure 4), improving personalization, decision-making efficiency and relevance of assistance.
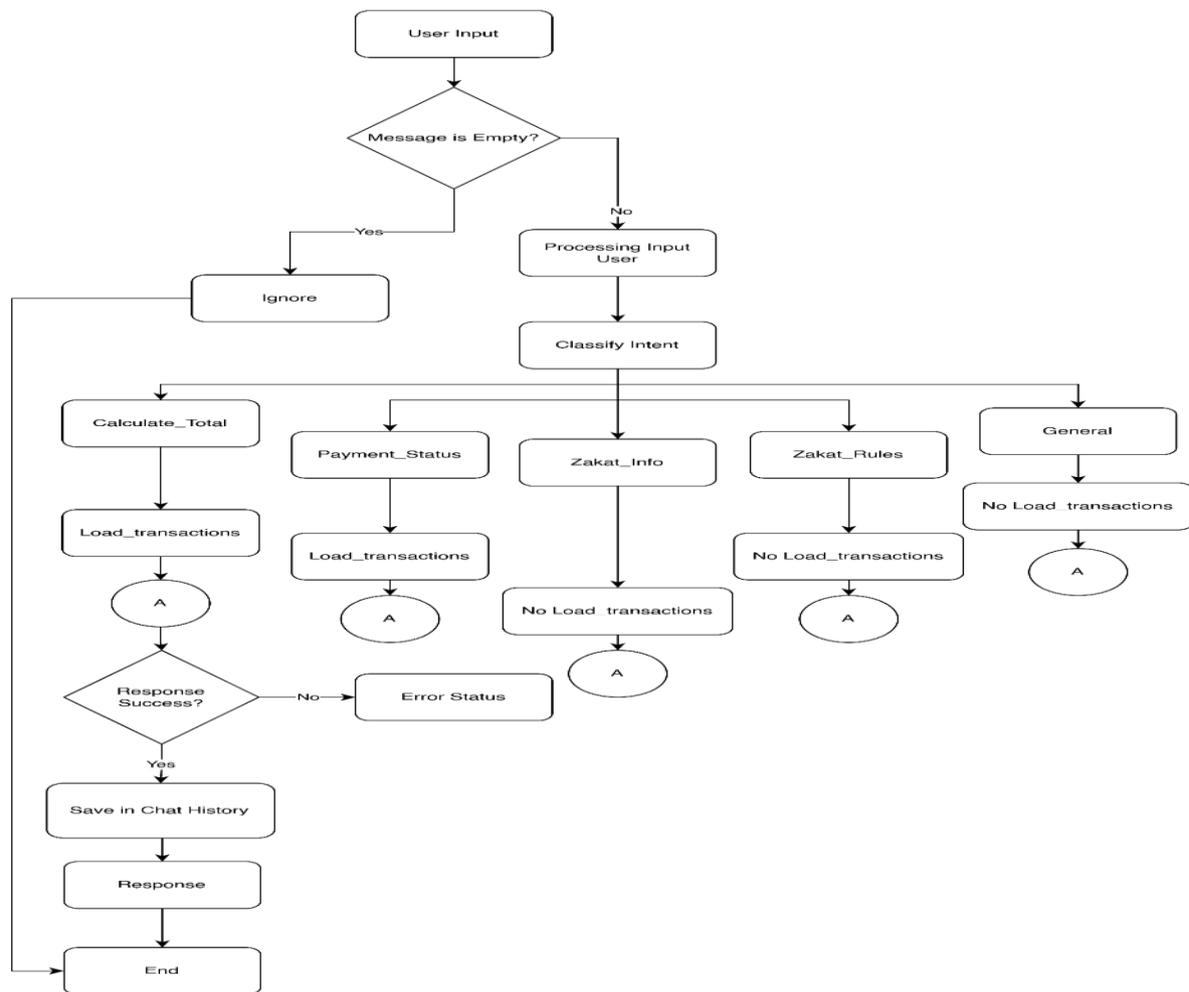
Source: (Research Results, 2025)
Figure 3. Decision Tree Chatbot in This Research

Figure 3 illustrates the decision tree that governed how the chatbot identified and classified user inputs. Each tree branch corresponded to a specific intent, such as zakat calculation, payment status or general inquiries. This systematic arrangement ensured that the chatbot processed user messages step by step, mapping them to the appropriate function.

The structure improved accuracy and efficiency by minimizing misclassification and allowing the chatbot to provide relevant information or services in line with user requirements. Through this mechanism, the chatbot supported personalized guidance for zakat calculation and enhanced the overall interaction experience.

The classification process determined the purpose of each user message and directed the chatbot to respond accordingly. For instance, user inputs could request zakat calculation, payment

status, or general information. The system automatically retrieved the relevant data from the user database if the intent was related to a transaction, such as CALCULATE_TOTAL or PAYMENT_STATUS. The mapping of these intents is shown in Table 2.

Table 2. Function and Status of Classify Intent

No	Function	Status
1	CALCULATE_TOTAL	Loads transaction data (_loadTransactions())
2	PAYMENT_STATUS	Loads transaction data (_loadTransactions())
3	ZAKAT_INFO	No transaction data required
4	ZAKAT_RULES	No transaction data required
5	GENERAL	No transaction data required

Source: (Research Results, 2025)

Table 2 classifies intents into transactional (e.g., CALCULATE_TOTAL, PAYMENT_STATUS) which require user-data retrieval and non-transactional (e.g., ZAKAT_INFO, ZAKAT_RULES, GENERAL) which return predefined knowledge. This separation improves efficiency and preserves accuracy by routing data-dependent queries to the appropriate retrieval and computation modules while handling informational requests with static responses.

The intent classifier was trained and evaluated on a synthetic dataset of 350 queries distributed across seven classes (CALCULATE_TOTAL, PAYMENT_STATUS, ZAKAT_INFO, ZAKAT_RULES, USER_SALARY, USER_PROFILE, and GENERAL). Preprocessing included tokenization, normalization, and keyword extraction. A hybrid architecture combined supervised intent classification with pattern-matching rules and a rule-based decision tree to resolve ambiguity. Evaluation yielded 92% intent-recognition accuracy; however, because the dataset is synthetic and limited in size, this figure should be treated as a preliminary indicator rather than a fully generalizable result.

Technically, the decision tree governs follow-up logic and disambiguation, while the supervised model adapts to interaction patterns over time. This hybrid approach balances interpretability and adaptability, reduces misclassification and supports incremental improvement making it suitable for transparent, production-oriented digital zakat consultation systems.

Dataset Limitation and Future Improvement

Although the prototype achieved promising accuracy, future studies should incorporate real-world user data and larger sample diversity to improve model generalization and reduce linguistic bias in intent recognition. Future enhancement will also explore data augmentation techniques and integration with open-source conversational datasets to enrich linguistic variability and strengthen the model's adaptability in real-world contexts.

Flutter and Dart

The mobile application was developed using Flutter as the cross-platform framework and Dart as the programming language. These technologies were chosen for their ability to manage dynamic user interactions through the chatbot interface while maintaining responsiveness and seamless integration with backend services. When a message is sent, it is first recorded and stored in the conversation history before being forwarded to the backend for analysis. The _preprocessMessage() function enhances the user prompt, which is then processed by the chatbot system to produce an appropriate reply. If the response is valid, it is displayed to the user and stored in the database for traceability. In case of an error, the system automatically delivers a clear and user-friendly notification. This implementation ensured consistent communication flow, reliable performance and meaningful outputs aligned with the objectives of digital zakat management.

In addition to the chatbot interaction module, the developed application integrated several supporting features to improve user experience and strengthen zakat management performance:

1) a zakat calculator that automatically determined user obligations based on income and *nisab* thresholds;
2) a real-time transaction management system using Firebase for secure data storage and synchronization;
3) a user profile and authentication module for managing *muzakki* information; and
4) an institutional information dashboard providing real-time updates from zakat organizations.

These components ensure that the application not only facilitates interactive consultation but also supports end-to-end management of zakat, infaq and sadaqah through a structured and user-friendly digital platform.

The integration of Flutter and Dart not only enhanced performance and portability but also demonstrated how lightweight frameworks could support intelligent financial applications without compromising responsiveness or security. This finding reinforces the suitability of modern cross-

platform technologies for developing scalable digital zakat systems.

Calculator Zakat

The application implements zakat maal calculation via a fixed algorithm: it compares a user's annual assets or income against the nisab (equivalent to 85 g of gold) and, if the threshold is met, computes payable zakat as 2.5% of the annual total. This automated routine performed client and server-side provides real-time obligation status, automated validation and reporting, thereby reducing human error. Integration with e-wallets and partner banks supports seamless payments and auditable transaction records. Overall, the approach preserves Sharia compliance while improving convenience, accuracy and transparency and offers a replicable model for fintech systems handling religious financial rules.

Application Programming Interface (API)

The application integrates with Firebase to enable real-time management of zakat, infaq and sadaqah transactions, supporting user-specific retrievals (eligibility, financial summaries, transaction histories) and automated status updates and notifications. Eligibility is evaluated against stored financial records (income, assets), and confirmed cases trigger transparent updates to user status. Security and data governance measures include Firebase Authentication (OAuth 2.0), Firestore security rules for role-based access, TLS encryption and anonymization of sensitive fields, together with a user consent mechanism for data processing. These controls ensure synchronized, secure and auditable data flows, offering a replicable model for transparent, Sharia-compliant fintech solutions.

Mobile Application Interface-Based Chatbot

The mobile interface was developed iteratively, beginning with low-fidelity (Lo-Fi) prototypes to establish layout, navigation and core interactions and progressing to high-fidelity (Hi-Fi) designs to refine visual consistency and interactive behavior. Chatbot functionality and backend integration were implemented during the Hi-Fi stage to enable predictive ZIS (zakat, infaq sadaqah) features tailored to users' financial profiles. The resulting screens (Figures 4–6) including dashboard, zakat calculator, transaction history and chatbot demonstrate that this staged approach improved usability, functional fidelity and alignment between interface design and backend intelligence, thereby supporting transparency and user adoption.

Figure 4 highlights the main dashboard, home page and profile section. These features allow users to manage personal and financial data, calculate zakat and access the chatbot.
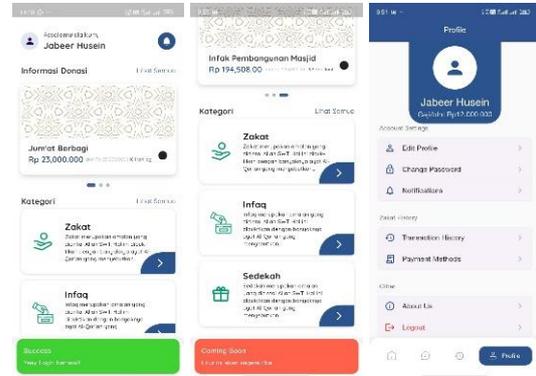
Source: (Research Results, 2025)
Figure 4. Dashboard, Home, and Profile

Figure 5 illustrates the zakat calculator and transaction history interface. It enables users to calculate zakat obligations accurately and monitor previous payments.
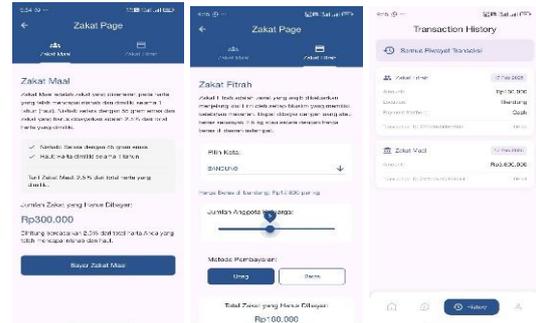
Source: (Research Results, 2025)
Figure 5. Zakat Page and Transaction History

Figure 6 presents the chatbot interface, ZISmart, which provides personalized recommendations, interactive consultation and guidance for zakat-related inquiries.
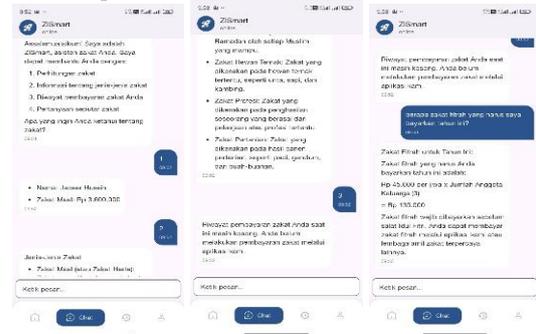
Source: (Research Results, 2025)
Figure 6. ChatBot ZISmart

By combining Lo-Fi and Hi-Fi stages, the application development process ensures both functional precision and an engaging user experience. The backend database integration supports intelligent predictions, enabling zakat management to be conducted more efficiently and transparently.

Functional and Compatibility Results

After the system was fully implemented, a series of functional, validation, and compatibility tests were conducted to evaluate its performance, stability and usability. These assessments ensured that the application operated effectively across devices and provided reliable benchmarks prior to deployment. The testing procedures were designed to confirm compliance with predefined requirements while identifying potential areas for optimization.

The results of the functional and validation testing are summarized in Table 3. The evaluation demonstrated that the application met the primary functional specifications. Nevertheless, several modules still required refinement, particularly in input validation, zakat data entry, income management, tokenization and form validation during authentication. These issues did not significantly affect the overall performance but indicated potential areas for improvement in future versions.

Table 3. Functional and Validation System

ID	Function	Description	Status
001	Registration	Users can register as muzakki (zakat givers) using email, cellphone numbers, or social media accounts.	Works Well
002	Member Management	Admins can manage member data.	Works Well
003	Login	Users can log in to the app using an email and password, or a social login method like Google.	Need Validation Improvement
004	Add User Data	Admins can add new user data into the system.	Works Well
005	Add Data Zakat	Muzakki can distribute zakat (zakat fitrah, mall, infaq, sadaqah) and record payment transactions.	Need Validation Improvement
006	Chatbot Validation	AI chatbots can answer common questions about zakat, the amount of payment, and the mustahik who is entitled to receive.	Works Well
007	Data Validation	The system can verify user data.	Need Validation Improvement

ID	Function	Description	Status
008	Transaction History	Users can see the history of payments and zakat distributions that have been made.	Works Well
009	Manage Income or Basic Salary Data	Manage revenue data for AI calculations in learning predictions.	Need Validation Improvement
010	Transaction Management	Can do zakat, infaq, sodaqah and transactions etc.	Works Well
011	Edit Profile	Can change user data in the form of basic salary and username.	Works Well
012	Tokenization	Find the core words of the user input to later be grouped by type.	Need Validation Improvement
013	Get and Push Firebase	Retrieving and Saving User Documents to the Firestore.	Works Well
014	Validation Form Login and Register	Each input field has been completed with validation so that the data is as expected by the system.	Need Validation Improvement

Source: (Research Results, 2025)

The outcomes in Table 3 indicated that critical modules such as registration, transaction history, and chatbot responses performed consistently and reliably. The functions requiring improvement were primarily related to input and authentication validation, which are common in early-stage prototypes. These findings confirmed that the application was operationally usable and technically sound, though additional refinement could further enhance data consistency and system robustness.

To ensure the system's reliability across various devices, compatibility testing was carried out using multiple Android versions. The results are shown in Table 4.

Table 4. Compatibility Test Results

No	Android Version	Kompatibilitas Firebase	Firebase compatibility	UI & Animation Compatibility	Potential Issues
1	Android 8 (Oreo)	Incompatible	Potential crash	Running with limitations	Firebase does not support this version
2	Android 9 (Pie)	Unstable	Slower response compared to newer versions	Works well	Cloud Firestore may experience errors in certain conditions

No	Android Version	Kompatibilitas Firebase	Firebase compatibility	UI & Animation Compatibility	Potential Issues
3	Android 10 (Q)	Compatible	Works well	No Issues	No significant issues found
4	Android 11 (R)	Compatible	Works well	No Issues	No significant issues found
5	Android 12 (S)	Compatible	Optimal	No Issues	No significant issues found
6	Android 13 (T)	Compatible	Optimal	No Issues	No significant issues found
7	Android 14 (U)	Compatible	Optimal	No Issues	No significant issues found
8	Android 15 (V, Beta)	Need further testing	Optimal	No Issues	Firebase SDK may undergo changes
9	Emulator API 33	Compatible	Works well	No Issues	Performance may vary compared to physical devices
10	Emulator API 34	Compatible	Optimal	No Issues	Performance may vary compared to physical devices

Source: (Research Results, 2025)

The results confirmed that the system functioned optimally on Android version 10 and above, ensuring smooth operation for most users. Earlier versions such as Android 8 (Oreo) and Android 9 (Pie) showed limited support and potential instability, consistent with Firebase's deprecation policy. Emulator tests verified that the system maintained consistent performance across virtual environments, confirming scalability and cross-device reliability.

Quantitative performance evaluation further indicated that the chatbot achieved an average response time of 1.8 seconds across 200 user queries, with an intent classification accuracy of 92% and an overall functional success rate of 95%. Modules requiring further validation produced a minor error rate of 7%, which remained acceptable for an early-stage intelligent prototype. The testing achieved a mean task completion rate of 95% and an error variance below 0.08 across repeated trials,

indicating stable functional performance. A limited user experience (UX) test was also conducted involving five lecturers and five students to evaluate usability, interaction quality, and clarity of zakat computation. Participants reported positive feedback on interface simplicity, accuracy of chatbot responses, and transparency of the *zakat* calculation module. These results demonstrated that the application was intuitive, user-friendly, and suitable for broader institutional and community adoption. This user testing represented informal feedback sessions rather than a formal usability evaluation such as the System Usability Scale (SUS) or User Experience Questionnaire (UEQ), and was intended primarily for early-stage prototype validation.

The combination of functional, validation, and compatibility tests provided empirical evidence of the system's reliability and usability. The integration of AI-driven interaction and SECI-based knowledge management was successfully validated through structured testing, establishing a foundation for scalable deployment. The findings demonstrated that intelligent *zakat* management systems could achieve both operational efficiency and user trust through systematic engineering validation and continuous improvement.

Knowledge Management System

The knowledge management system embedded in the developed mobile application was designed to guide both individual users and *zakat* management institutions in adopting and utilizing the platform effectively. The framework followed the SECI (Socialization, Externalization, Combination and Internalization) Model, which emphasizes the dynamic transformation of knowledge between tacit and explicit forms. Within this framework, administrators played a crucial role as knowledge mediators, ensuring that institutional and user-generated information was accurately captured, shared, and reused for informed decision-making. The knowledge mapping of this transformation process is summarized in Table 5.

Table 5. SECI Model Implementation in the Chatbot-Based Zakat System

Tacit to Tacit Knowledge		Tacit to Explicit Knowledge	
Socialization	**Empathizing**	**Externalization**	**Articulating**
This application can be directly introduced to Zakat Management	Users can interact directly with the admin, who will monitor the application.	Zakat, Infaq, and Sadaqah have become well known concepts and experiences within Indonesian	There is a news and information feature that provides updates on Infaq and Sadaqah for the public or

Tacit to Tacit Knowledge	Tacit to Explicit Knowledge	
Organizations (Badan Amil Zakat), Zakat Institution, and the general public as users.	society. This knowledge is valuable for the future development of chatbot learning and documentation.	programs from Zakat Management Organizations (Badan Amil Zakat).

Explicit to Explicit Knowledge		Explicit to Tacit Knowledge	
Connecting	**Combination**	**Embodying**	**Internalization**
The data and history recorded by the system based on user experiences can serve as new insights for future development and improvement.	New insights and user interaction history can generate new predictions and programs to expand Infaq and Sadaqah trends that attract public attention in Indonesia.	This AI based mobile application utilizes a chatbot designed to align with users personal data based on their financial information and history of zakat, infaq and sadaqah contribution. It is equipped with a process that assists in decision making for better financial management.	The updated features on the dashboard related to news and the latest information make it easier for users to read, stay informed, and learn about upcoming programs for distribution.

Source: (Research Results, 2025)

The SECI model implementation illustrated how knowledge in the system was continuously created, shared, and refined. Tacit user experiences were externalized into structured chatbot knowledge, while explicit institutional information was internalized by users through interactive features and financial feedback loops. This cyclical transformation ensured that knowledge did not remain static but evolved through repeated interaction between human and system agents.

This research provides new insights into the digital transformation of zakat management. Previous studies such as Imron et al. and Alfatah [10] primarily focused on improving efficiency and transparency of transactions, while Musana et al. [11] emphasized data security through blockchain. The findings of this study extend the literature by demonstrating that the integration of a decision-tree based chatbot and personalized zakat calculator enhances both usability and trust in digital zakat systems. In addition, the incorporation of the SECI-based Knowledge Management System ensures that institutional knowledge is systematically documented and shared, which has not been highlighted in earlier works [8], [14]. These contributions illustrate that digital optimization in zakat management can move beyond technical solutions toward a holistic framework that combines technology, knowledge management, and user-centered services.

Moreover, the integration of a decision-tree-based chatbot with a personalized *zakat* calculator operationalized SECI principles through real-time user interaction. The system not only improved usability and transparency but also established a mechanism for institutional learning and community-driven knowledge evolution. This demonstrated that digital *zakat* management can be conceptualized as an interdisciplinary academic framework that bridges technology, religious finance and organizational learning.

The SECI-based implementation validated that intelligent zakat systems could function as dynamic knowledge ecosystems. By transforming tacit religious practices into explicit digital knowledge, and vice versa, the system reinforced institutional capability and user trust, positioning AI-based zakat management as a sustainable and knowledge-oriented model for Islamic financial technology innovation.

Overall Discussion

Taken together, the results of this study not only demonstrated the successful development of a chatbot-based mobile *zakat* application but also provided broader scholarly insights into the intersection of artificial intelligence, financial technology, and knowledge management in Islamic contexts. The integration of a decision-tree classification mechanism, an automated *zakat* calculator, and a SECI-based knowledge management framework exemplified how intelligent systems can enhance both operational efficiency and institutional transparency in digital *zakat* governance.

Empirical evaluations validated that the system achieved stable performance, high functional accuracy, and strong usability across multiple devices and Android versions. These findings confirmed that the combination of AI-driven interaction and structured knowledge transformation could produce tangible improvements in user trust and institutional adaptability. The implementation also revealed key opportunities for refinement, particularly in input validation and real-world data integration, which would further strengthen the model's robustness for large-scale deployment.

From an academic standpoint, this research extended current literature by reframing digital *zakat* management as more than a technological tool positioning it as a dynamic *knowledge ecosystem* where social, institutional, and computational intelligence converge. By embedding SECI-based knowledge processes within an AI-enhanced framework, the study established a foundation for future interdisciplinary work linking *Islamic financial governance*, *human-computer interaction*, and *organizational learning*.

In summary, the study demonstrated that digital *zakat* management can evolve into an integrative research domain that unites algorithmic reasoning, social behavior, and institutional learning. This holistic approach not only advances the theoretical understanding of AI-based financial systems but also contributes to the broader discourse on sustainable and knowledge-oriented innovation within the Islamic fintech ecosystem. These insights are expected to contribute to the advancement of Indonesia's digital zakat ecosystem, aligning religious financial practices with modern technological and knowledge-based governance.

CONCLUSION

This study concludes that the integration of a decision-tree-based chatbot and the SECI (Socialization, Externalization, Combination, and Internalization) knowledge management framework provides a validated digital solution for managing zakat, infaq and sadaqah (ZIS) in Indonesia. The developed system successfully combines intelligent interaction, automated zakat calculation and institutional knowledge transformation into a cohesive mobile platform that enhances both user experience and managerial decision-making. Functional, validation, and compatibility testing demonstrated that the application operates reliably and efficiently, confirming the feasibility of AI-driven digital zakat systems for broader adoption.

Beyond technical implementation, the empirical findings validate the proposed framework as a foundation for digital zakat governance that is transparent, inclusive and knowledge-oriented. The integration of SECI-based knowledge management ensures that institutional learning and public engagement occur simultaneously, transforming tacit community practices into explicit, actionable insights. This approach bridges technological innovation and social responsibility, positioning the system as both a practical tool and a scholarly model for Islamic financial technology.

Future work should focus on expanding dataset diversity and conducting large-scale usability testing involving zakat institutions and real users to measure satisfaction, accessibility, and acceptance. In addition, cross-platform development including iOS and web-based versions will enhance inclusivity and scalability, ensuring that the system can be deployed nationally and adapted globally.

In conclusion, this research contributes not only to the technological advancement of digital zakat management but also to the theoretical understanding of how artificial intelligence and knowledge management can jointly support sustainable, equitable, and community-centered financial ecosystems.

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