



Development of Pilgrimage Tourism as an Application for Supporting Local Religious People

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Abstract: Hajj and Umrah are both Islamic pilgrimages in Mecca, Saudi Arabia, which are the main activities for Muslims. These are also required by Muslims in Thailand, and the trend is increasing every year. Typically, the number of pilgrims who can perform Hajj is limited by Saudi Arabia. In 2022, Thailand received a quota of 13,000 people, and the Committee for the Promotion of Hajj Affairs in Thailand will distribute the quota to entrepreneurs and religious leaders who have licenses to lead pilgrimage tourism. However, there are some difficulties in a pilgrimage tour, such as visa applications, accommodation bookings, flights, and so on. These processes need a lot of paperwork, so entrepreneurs and religious leaders will present to support pilgrims. There have been reports of pilgrimage tourism, including high service charges, poor management, and fraud by scammers. To the best of our knowledge, there is no digital platform to help local religious leaders organize the tour and provide online services for pilgrims. Therefore, we design and develop a novel application for pilgrimage tourism to facilitate religious leaders in handling paperwork for the Committee for the Promotion of Hajj Affairs in Thailand and support pilgrims in booking pilgrimage tours through a mobile web application, namely <https://www.hajestic.com>. The key development of the application is a user-centric, e-marketplace-based structure integrated to secure online payments and ensure compliance for users. In addition, we also designed 3 qualitative questionnaires based on the technology acceptance model (TAM) to guarantee the application meets users' requirements and satisfaction.

Keywords: Pilgrimage tourism; mobile web application; design and development; qualitative questionnaire

In Thailand, there are more than 7.4 million people who are Muslims. Most of them are living in Songkhla, Satun, Pattani, Yala, and Narathiwat [1]. Every year, some of them plan to perform Hajj and Umrah in Mecca, Saudi Arabia. Due to the high demand for pilgrimage tourism, Saudi Arabia limits the number of pilgrims annually. In 2022, the Committee for the Promotion of Hajj Affairs in Thailand received a quota of 13,000 people [2]. Thus, they distribute the quota to entrepreneurs and religious leaders who have licenses to lead pilgrimage tourism. However, most pilgrims living in Thailand struggle with many problems, such as visa applications, accommodation bookings, flights, and so on. Hence, local entrepreneurs or religious leaders provide package tours to support them and hand over the necessary documents to the Committee for the Promotion of Hajj Affairs. Recently, there have been reports of some issues

with pilgrimage tourism. For instance, religious leaders are not well managed in some local areas. Additional assistance charges are more expensive than the pilgrims expected, and they are not allowed to know the itinerary plan until the departure date. Some pilgrims got scammed and lost a lot of money. There is a report that the cost is approximately 100,000 baht per person [3], which mostly happens when a scammer promises to book a flight ticket or accommodation. Another main issue is that some local pilgrims learn about local religious leaders and pilgrimage tours through word of mouth. This may lead to insufficient detail and uneven data distribution.

In addition, research on the differences between general and religious tourism reveals several gaps in how they are studied and managed. While many studies focus on either "secular" tourists or "religious" pilgrims, they often ignore the growing number of people who fall into both categories. There is also a disconnection between the technologies being developed and the actual needs of the travelers. For example, while new applications and digital platforms are being developed, they often fail to align with the spiritual values of the journey. Furthermore, most research uses simple surveys administered at a single point in time, which fail to show whether the tour had a lasting impact on the person. Addressing these gaps is essential for developing a holistic understanding of how modern religious tours can satisfy both the logistical and transcendental needs of religious followers. To summarize, the key research gaps include:

(1) Theoretical Hybridity: The failure of existing frameworks to account for the difference in motivations between the traditional tourists and the pilgrims.

(2) Spiritual-Managerial Alignment: A lack of integrated models where tourism agencies operate as religious leaders rather than mere general tour guides.

(3) Digital Ecosystem Fragmentation: The absence of comprehensive customer relationship management (CRM) and digital ecosystems capable of synchronizing the needs of entrepreneurs, religious leaders, and pilgrims.

(4) Entrepreneurial Software Development: A deficit in novel software development approaches that prioritize "value-platform alignment" specifically for religious contexts.

(5) Methodological Snapshot Bias: An over-reliance on post-tour surveys that ignore the longitudinal, transformative impact of the travel experience on the individual.

To tackle the aforementioned problems, we decided to develop a solution that would help both local religious leaders and pilgrims streamline the preparation for pilgrimage tours. To the best of our knowledge, there is no digital platform to help local religious leaders organize the tours. Given the widespread availability of online platforms for booking general tours, e.g., Agoda, Airbnb, Booking.com, Trip.com, and Expedia [4-6], it would be helpful to have an online platform for religious tours. Therefore, we design and develop a novel application for pilgrimage tourism to facilitate religious leaders, namely <https://www.hajestic.com>. The first page of the website is shown in Fig. 1. The key development of the application is a user-centric, e-marketplace-based structure integrated to secure online payments and ensure compliance for users. This research consists of the following purposes:

(1) To study features of an online platform for managing pilgrimage tourism by local religious leaders and fulfill the pilgrims' requirements.

(2) To investigate the platform's impact on the hybrid motivations of modern pilgrims: This addresses the "Theoretical Hybridity" gap by examining if the application meets both the ritualistic needs and the expectations of the users.

(3) To design and develop an online platform as a mobile web application for pilgrimage tourism, and evaluate the integration of spiritual guidance into the digital marketplace. This explores the "Spiritual-Managerial Alignment" gap by examining how a platform can help religious leaders provide guidance rather than serve as a booking tool.

(4) To study online platform acceptance through quantitative questionnaires, which are designed based on the TAM [7], and assess the perceived value and behavioral change after using the application. This targets the "Methodological Snapshot" gap by moving beyond immediate "acceptance" (TAM) to assess whether the platform actually improved the overall quality and spiritual outcomes of the pilgrimage experience.

The development of the application aims to serve as a prototype for systematic management for local religious leaders and to enhance the Hajj and Umrah experience for local pilgrims, especially in Thailand. The remaining sections are organized as follows: Section 2 presents the related work. The design and development methods for both the mobile web application and the questionnaire are described in Section 3. The questionnaire results are shown in Section 4. A discussion of the procedure for validating the application and questionnaire for future work is presented in Section 5, and the conclusion is presented in Section 6.



Figure 1. The first page of the proposed mobile web application.

2. Related work

2.1 Online platform for business

The online business platform can be divided into many types based on value creation and facilitated interaction characteristics [8], as follows:

2.1.1 Marketplace Platform can provide connections between buyers and sellers in specific markets, such as Airbnb, which connects local hosts and travelers. These platforms focus on online transactions or specific missions [9].

2.1.2 Social media platforms can facilitate online social networks and share users' experiences, e.g., LinkedIn [12], which connects professional employees and experts.

2.1.3 Transaction Platform can provide transaction services between users, like Uber [10], which connects drivers and passengers.

The proposed application for pilgrimage tourism is classified as a marketplace and transaction platform because the application supports connections between pilgrims and local religious leaders to manage religious tours for Hajj and Umrah. The goal of the proposed platform is to support local religious leaders in planning itineraries, managing paperwork, and allowing pilgrims to select and compare travel plans. Also, the platform provides a communication channel for users and local religious leaders to address the uneven distribution of data. The proposed application assumes that the significance of the design, which focuses on search, comparison, booking, and seamless payment features, including the development of efficient communication channels, will reduce problems in pilgrimage tourism.

2.2 The development of digital tourism platforms between general tourism and religious tourism

Digital tourism platforms have improved how travelers plan and experience their trips. The effectiveness of a digital platform is often measured by how well it meets user needs, such as search and

booking functions. Hu [11] explains that a website's technical features act as a "stimulus" that can influence a user to revisit a destination. Essentially, a well-built web application helps a destination stay competitive by easily making information accessible [12]. In general, web applications are designed primarily for commercial efficiency and speed [13]. The main goal is to help users book hotels, flights, and tours rapidly. Developers focus on high-performance features like real-time inventory updates and secure payment gateways [14]. Because general tourism covers a wide range of activities, these platforms use "smart" technology to offer personalized suggestions based on what the user has clicked on before. The focus is usually on the convenience of the transaction and the interface's usability [15]. In contrast, developing web applications for religious tourism requires a different approach. While general tourism is about leisure, religious tourism is often about heritage, rituals, and spiritual needs [16]. Furthermore, the study by Kluver and Cheong [17] suggests that these websites should be designed to respect the community's religious values. For example, a religious tourism site might prioritize information on prayer times and ritual protocols over commercial advertisements to meet pilgrims' needs [18].

2.2 Tools for development of a web application

Tools for web application development can help developers create, test, and refine applications to make them more efficient and better meet users' needs. The tools include diverse programs such as UI/UX design tools, database-integrated development environments (database IDEs), backend IDEs, and debugging and testing tools.

2.2.1 The PHP programming language is also known as Personal Home Page, which is a server-side scripting language and popular in development on websites. Due to its flexibility and options, this can be a crucial tool for software developers to build dynamic websites that respond to users' requirements. The key features of PHP are not limited to process time; they also include database management, frontend control, and handling user data. These are the essential features for the present web application system.

2.2.2 MySQL DBMS is a system to store, manage, and query data as a database. MySQL is a popular database system because it is open source and well-organized. Especially, applications that need fast processing and the ability to access complex data. MySQL uses the Structured Query Language (SQL) to connect to and access data, allowing users to create, update, delete, and query data. Moreover, MySQL supports concurrent access, supports table formats and indexes, and provides backups to secure data. Besides, MySQL DBMS is developed and maintained by developers and communities worldwide, ensuring stability and continuous development. This is suitable for a system that needs high performance and scalability.

2.3 Usability testing

Usability testing is a method for assessing users' satisfaction and verifying whether the proposed application meets users' requirements, as defined by the TAM.

2.3.1 Satisfaction assessment Oliver [19] describes the meaning of satisfaction as a response that shows a customer's opinion of products or services, and these depend on their perspective. Also, Hornby [19] defines satisfaction as a positive feeling when someone achieves or receives something. Satisfaction can be assessed using many methods; for example, a questionnaire can reflect satisfaction. A well-designed questionnaire can be an advantage for developers in analyzing and improving their products and services. A direct interview can also show users' satisfaction, but this requires more tasks for collection, such as recording or writing an interview. Another method is to assess the target person or group through observation. This method takes time and effort to understand their behavior or expression to analyze satisfaction.

2.3.2 The technology acceptance model (TAM) is the model proposed by Venkatesh and Davis [20], which is developed from the theory of reasoned action (TRA) and theory of planned behavior (TPB). Venkatesh et al. [21] studied TAM and showed its purpose. That is to analyze when a user decides to deploy technology and how they intend to use it. The components of TAM are:

(1) Perceived usefulness is a state in which a user believes that such technology can increase work performance, which directly relates to user attitudes towards usage and behavior.

(2) Perceived ease of use is a state in which a user believes that the technology is easy to use without high effort. This is directly related to perceived usefulness and attitude towards its use.

(3) Attitude toward using means a user's opinion of the technology. This is caused by the perceived usefulness and perceived ease of use, and has a direct impact on the intention to use it.

(4) Behavioral intention means behavioral intention to use technology, which is influenced by perceived benefits of use and attitude towards use.

(5) Actual Use means technology acceptance through practical application, where attitude towards use affects the actual use of the user.

2.4 Related existing studies

There has been extensive research to improve religious tourism. For example, Kawashima [22] studied the role of tourism agencies and tour leaders as spiritual leaders in organizing and transforming pilgrimages in Slovenia. It emphasizes the cooperation between tourism agencies and monks, known as "spiritual guides", who are popular for leading pilgrim groups because they can communicate and build relationships with pilgrims in a friendly manner. The research shows that cooperation between the Catholic Church and tourism agencies not only helps pilgrims receive spiritual care but also provides recreational opportunities, which have significantly influenced the revitalization of religious practice in Slovenia. Lubis et al. [23] studied the development of a digital ecosystem in the context of CRM for a Hajj portal website, highlighting its importance for preparing for the Hajj, a pillar of Islam that requires efficient management of pilgrims' information and needs. The research suggests that technology can facilitate faster, more accurate learning about the Hajj, and that CRM implementation can prevent conflicts between startups and Hajj service providers (PPIUs) by ensuring sustainability and fairness in the management process. However, this research may be limited in providing insights into the application of CRM in specific contexts, thereby providing a clearer picture of the successes and challenges of implementing a digital ecosystem.

Majid et al. [24] presented the HAJJRAH application, developed to address common issues faced by pilgrims performing Hajj and Umrah. It begins with a basic explanation of pilgrimage to holy sites and the issues various agencies face in managing pilgrims. The study also conducted a market analysis to support the market demand and the robustness of the application's business idea. The analysis revealed that the features available in HAJJRAH can effectively address the issues faced by pilgrims and their respective agencies, confirming the app's necessity and robustness in the market. Marinković [25] presented a new business model designed to meet the needs of the Serbian tourism sector, focusing on the creation of a digital platform for tourism agencies. The project involved a joint effort by IT and software engineers and tourism experts from several Serbian agencies. The research used case studies to gather relevant data and identify the benefits and challenges of implementing the new business model. In the second phase of the research, data were collected from tourism agency employees using the new digital platform through a questionnaire to assess their opinions on relevant factors. The results showed that the new digital platform offers both benefits and challenges, and its successful implementation requires collaboration between technology and tourism experts.

Hevner and Malgonde [26] propose a novel approach to software development on digital platforms that differs significantly from traditional approaches. They point out that software managers and development teams face unique challenges in platform environments and require novel development approaches to succeed. This research proposes that digital application development must achieve alignment with the application platform and create new value beyond the core platform values. Furthermore, the research suggests that software development teams act like entrepreneurs. Also, the study explores existing software development environments (e.g., Apache Cordova) to determine whether the principles of effective development hold. Preliminary findings support effective development approaches and call for the development of innovative, effective software solutions for digital platforms.

In Thailand, some studies focus on developing applications for local tourism. For instance, Puttitaweesri et al. [27] developed smartphone-based navigation systems for tourism in Ratchaburi, where attractions are diverse but information is fragmented, thereby facilitating efficient travel and promoting lesser-known destinations. The features of this study can be applied to religious tourism, such as real-time navigation, route optimization, and more. A similar study can be found in Sooknit and Sakda [28], which

provides local tourism routes using geolocation data and the Google Maps Platform, highlighting the application of location-based technologies in enhancing tourism planning. To the best of our knowledge, there is a lack of studies on religious tourism towards technological use. Based on the aforementioned studies, we applied these documents and research to develop a platform for managing pilgrims by local religious leaders. We saw an opportunity to integrate the management strategies of Thai Hajj and Umrah companies with e-commerce systems to develop a platform model that would help local religious leaders manage pilgrims. This would also enhance the Hajj and Umrah service and booking systems to the next level, benefiting users and helping pilgrims manage their services and bookings more efficiently. This also leverages the growing trend of using technology to improve and develop services to a higher level.

3. Design and development methodology

This section describes how to design and develop the proposed mobile web application and provides the concept design of 3 questionnaires to assess user satisfaction and technology acceptance.

3.1 Development of mobile web application

The key development of the proposed application is to assist users in easily and quickly searching for, comparing, and booking Hajj and Umrah package tours with trustworthiness. The main idea for that design is that “the technology comes along with faith.” This can refer to the website's sanctity, credibility, and accessibility. The procedure for the development of the proposed application is described as follows:

3.1.1 User study The preliminary questionnaire and interview showed that most users prefer the user-friendly application, like flight or hotel booking websites, which has important information such as price, itinerary date, and user reviews on one page. Also, the website should include photos from previous trips to build trust.

3.1.2 Website architecture The prototype of the proposed mobile web application contains four pages. The first page is the home page, featuring a photo of pilgrims to motivate and encourage users to continue using it. The search bar is designed for large-scale use and is located in the middle of the page for easy access. The following functions are the promotions under the search bar and the menu bar at the top of the page. The second page is the package tour page. This page uses the card design to show price, travel duration, and review score. The other main functions on the page are booking buttons, price tags, and promotion tags. The third page is the blog/article page. The page covers many topics related to preparing for a pilgrimage. These articles can increase the web application's credibility and search engine optimization (SEO). The last page is the contact page, which clearly shows the contact channels, i.e., a phone number, LINE contact, and also allows contact through a form on the website. This page is designed to ensure users' trust and accessibility.

3.1.3 User interface design (UI design) The design of the user interface (UI) and user experience (UX) for the Hajestic platform is grounded in a user-centered design approach, emphasizing simplicity, efficiency, and trustworthiness. The platform integrates technological functionality with the spiritual context of pilgrimage tourism, aiming to provide a meaningful and reliable digital experience for users.

(1) User Experience (UX) Design Philosophy: The UX design is guided by the concept of “technology along with faith,” which reflects the integration of digital services with religious values. This approach seeks to enhance users' trust, credibility, and spiritual connection while they interact with the platform. Trustworthiness is established through the use of authentic visual elements, such as real images from pilgrimage journeys, which help build user confidence. In addition, efficiency is enhanced by consolidating essential information—such as prices, travel dates, and user reviews—into a single interface. This design approach is inspired by established flight and hotel booking systems, enabling users to make decisions quickly and effectively.

(2) User Interface (UI) Strategy: The UI design focuses on creating a culturally appropriate and visually coherent identity. The platform employs a color palette of green, white, and gold, representing cleanliness, purity, and Islamic faith. These colors contribute to both aesthetic appeal and symbolic meaning. Typography is implemented using LINE Seed Sans TH [29], selected for its clarity and readability across mobile devices. The overall interface follows a clean, minimal design, ensuring key elements are easily identifiable and accessible.

(3) Information Architecture and User Journey: The platform is structured to support a continuous and goal-oriented user journey, guiding users through a logical sequence of interactions:

- Step 1: Discovery (Home Page): The entry point emphasizes visual engagement and accessibility, with a large, centrally positioned search bar that lets users access relevant information immediately.
- Step 2: Comparison (Package Page): Search results are displayed using a card-based layout, presenting key details such as price, duration, and review scores. This enables users to compare pilgrimage packages efficiently.
- Step 3: Credibility and Knowledge (Blog/Articles Page): Informational content is provided to support users in preparing for pilgrimage, enhance platform credibility, and improve search engine optimization (SEO).
- Step 4: Conversion and Trust (Contact Page): Clear communication channels, including phone, messaging applications (e.g., LINE), and contact forms, are presented to reinforce transparency and build user confidence, particularly in financial transactions.

This structured design ensures that users can navigate the platform intuitively from initial exploration to final decision-making.

(4) Accessibility and Platform Design Considerations: The platform is developed as a mobile web application, allowing users to access the system directly through web browsers without requiring additional software installation. This approach reduces barriers to entry and enhances accessibility, particularly for users in local or resource-limited environments. Furthermore, the design supports multiple user roles, including pilgrims, religious leaders, and entrepreneurs, while maintaining consistency and usability across the system. This ensures the platform remains inclusive and adaptable to diverse user needs.

3.1.4 Use Case Functions and Interactions The use case diagram, as shown in Figure 2, demonstrates that system interactions are structured with three major functional layers:

(1) Actors in the System: the system consists of four primary actors: the pilgrim is the main end-user who searches for, compares, and books pilgrimage packages. The religious leader is responsible for managing pilgrimage activities, guiding pilgrims, and coordinating communication. Hajj Entrepreneur operates at the organizational level by offering travel packages and managing documentation. The administrator oversees the backend system, ensuring data integrity, transaction monitoring, and system security.

(2) Use Case Functions and Interactions: The use case diagram demonstrates that system interactions are structured around three major functional layers. First, the pilgrim interaction layer interacts with the platform primarily through service-oriented functions. These include search and compare trips; enabling users to explore available packages based on preferences, book a package; allowing users to reserve selected pilgrimage tours, secure payment; supporting transaction processing and confirmation, track booking status; providing real-time updates on booking and documentation, view itinerary; allowing users to monitor travel schedules and receive notifications.

(3) Religious Leader and Entrepreneur Interaction Layer: Religious leaders and entrepreneurs engage with the platform through management and coordination functions, i.e., manage itinerary plan; including planning and updating travel schedules, accommodation, and costs, manage pilgrim list; allowing monitoring of participant status and group organization, digital paperwork management; supporting document handling for official submission processes, broadcast notification; enabling communication of updates, reminders, and guidance to pilgrims.

(4) Backend and Administrative Layer: Administrators interact with the system through control and monitoring functions, including: data aggregation; collecting and organizing user and transaction data, transaction monitoring; ensuring secure payment processing, and handling refunds, system integrity control; maintaining data security, access control, and system stability.

The overall system interaction, as illustrated in Figure 2, follows a multi-directional and interconnected workflow. Pilgrims initiate the process by searching and booking services, while religious leaders and entrepreneurs respond by managing itineraries and providing guidance. Simultaneously, backend systems continuously support these interactions by maintaining data consistency, monitoring transactions,

and enforcing security protocols. This integrated interaction model demonstrates that the platform operates as a digital ecosystem, where front-end user activities, service management, and backend processes are closely interconnected. Compared to traditional pilgrimage management systems, which often rely on fragmented communication and manual processes, the proposed system enables centralized coordination, real-time communication, and improved transparency.

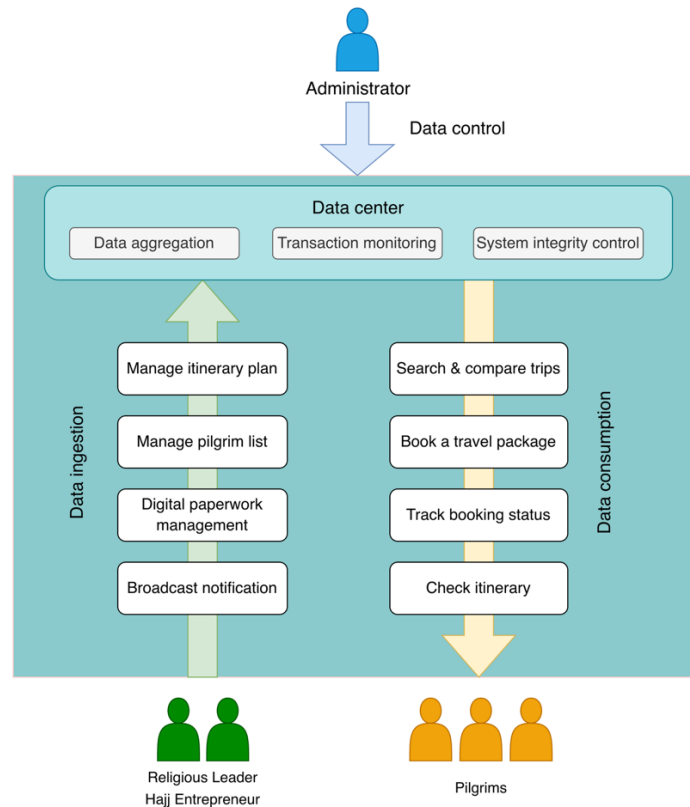


Figure 2. A diagram of the system interaction.

3.1.5 Security Architecture: The platform's security architecture is designed using a multi-layered defense-in-depth approach, ensuring comprehensive protection across network, transport, application, data, and authentication layers as shown in Figure 3. Secure communication is enforced via HTTPS with modern TLS protocols, supported by advanced cryptographic standards such as Perfect Forward Secrecy, to maintain data confidentiality even in the event of a key compromise [30,31]. The system adopts a Zero Trust Architecture, integrating JSON Web Token (JWT)-based authentication, multi-factor authentication (MFA), and strict session management to enhance identity verification and reduce unauthorized access risks [32-34]. At the application level, multiple safeguards are implemented, including Web Application Firewall (WAF), input validation, and protection mechanisms against common attacks such as SQL injection, cross-site scripting (XSS), and cross-site request forgery (CSRF), following OWASP best practices [35,36]. Additionally, role-based access control (RBAC) ensures least-privilege access, while sensitive data is secured using AES-256 encryption and protected through encrypted backups and database-level security mechanisms [37,38].

The platform further integrates a secure payment infrastructure using Stripe Payment Gateway, which is designed to comply with PCI DSS standards to minimize direct handling of sensitive financial data [39]. Payment processing is conducted through tokenization and encrypted APIs, ensuring that credit card information is never stored within the platform. Advanced mechanisms such as webhook signature verification, idempotency keys, and 3D Secure authentication are employed to maintain transaction integrity and prevent fraud or duplicate processing [40-42]. Moreover, centralized logging, anomaly detection, and incident response systems enable continuous monitoring and rapid threat mitigation, aligning with established intrusion detection and digital forensics practices [43]. Overall, the system demonstrates a robust,

standards-compliant security framework that ensures the confidentiality, integrity, and reliability of data in managing pilgrimage tourism services.

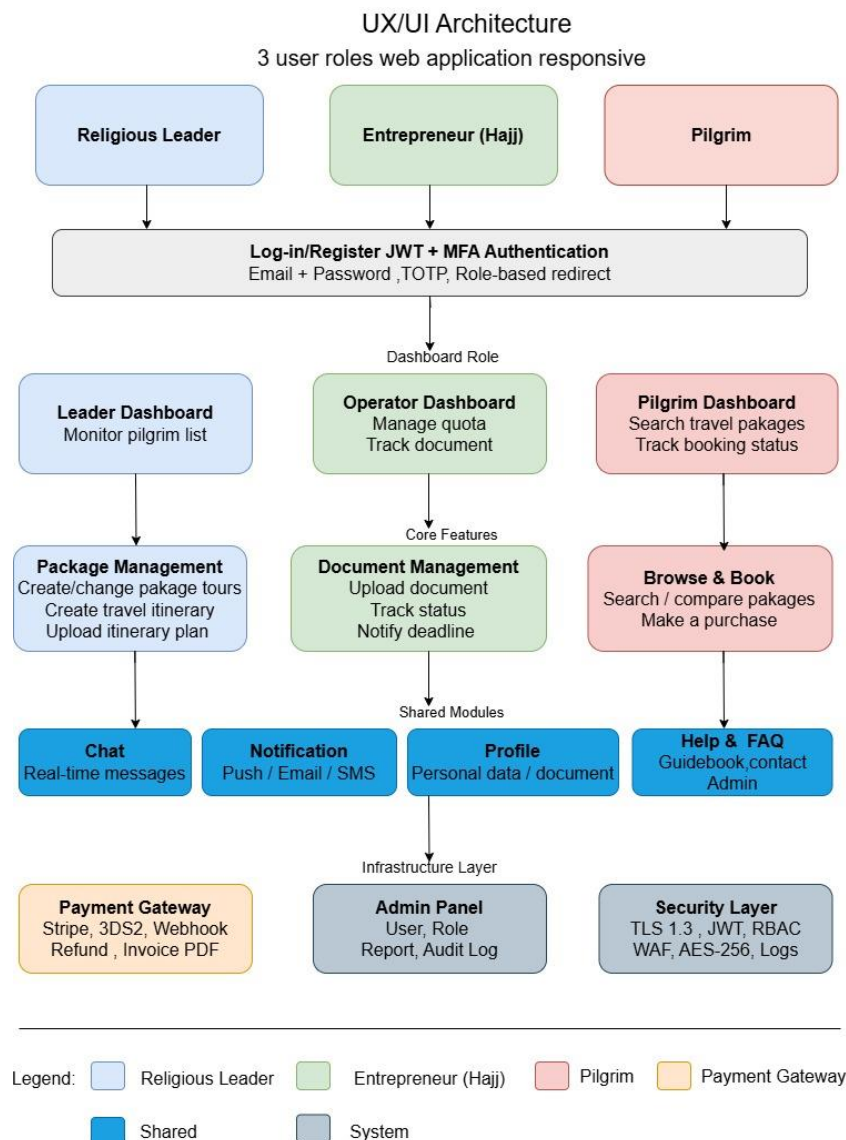


Figure 3. A diagram of the platform architecture.

3.2 Design of questionnaires

To understand user satisfaction and assess user technology acceptance, we designed three questionnaires: the platform suitability assessment form, used to evaluate and improve the web application. The platform performance assessment form is designed to receive opinions on the platform's performance. The purpose of the platform acceptance assessment form is to understand users' TAM-related thoughts. This model was employed to evaluate user acceptance due to its strong theoretical foundation and widespread application in information system research. TAM focuses on perceived usefulness and perceived ease of use, which are directly relevant to assessing whether the proposed platform improves efficiency and reduces complexity in pilgrimage tourism management. Furthermore, TAM is suitable for evaluating prototype systems, as it captures users' perceptions and behavioral intentions in the absence of long-term usage data. Its structured framework also enables analysis of the adoption process across multiple stages, providing deeper insight into user acceptance behavior in the context of digital religious tourism.

Furthermore, these three surveys are designed based on a 5-point Likert scale [44], where “1” means strong disagreement with the context, “2” means disagreement with the context, “3” means neutral or uncertain with the context, “4” means agreement with the context, and “5” means strong agreement with the context. The questionnaires employed a non-probability sampling approach, i.e., a combination of purposive and convenience sampling methods [45,46]. Purposive sampling was appropriate because the study required respondents directly relevant to pilgrimage tourism, such as pilgrims, religious leaders, or users interested in Hajj and Umrah services. Convenience sampling was also reflected in the data collection process, as the questionnaires were distributed online and participation depended on respondents’ availability and willingness to answer. This approach was suitable for prototype evaluation because the objective was not to generalize to the entire population of Thai Muslim pilgrims, but to obtain preliminary user feedback on platform suitability, performance, and acceptance. The procedure after aggregating surveys is to perform statistical analysis, i.e., mean, standard deviation (SD), and Cronbach’s alpha, to assess validity and reliability.

3.2.1 The platform suitability assessment form is designed based on the satisfaction assessment method. It is divided into three main sections. The first section requires a user to enter their personal data, including sex, user type (religious leader, Hajj entrepreneur, or pilgrim), address, marital status, education, career type, average monthly salary, and technology experience. The second section asks about user satisfaction with the web application’s features. The third section allows a user to provide further suggestions.

3.2.2 The platform performance assessment form aims to study platform performance through users’ opinions. It is divided into 3 parts. The first part requires a user to fill in their personal data, which is the same as the platform suitability assessment form. The second part is the performance context, and the third part is the suggestion part.

3.2.3 The platform acceptance assessment form is designed based on TAM. The purpose is to study platform acceptance through users’ opinions. It is divided into 3 parts. The first part requires a user to fill in their personal data, which is the same as the platform suitability assessment form and the platform performance assessment form. The second part is the acceptance context, as shown in Table 3, and the third part is the suggestion part.

4. Survey results

We conducted the online questionnaires with 64 participants. The analysis of participants’ backgrounds shows that most are pilgrims (98.4%). The gender distribution is heavily skewed toward Female participants (81.2%), while the core age group falls within the 25–34-year-old bracket (44.4%). Geographically, the sample is highly concentrated, with nearly four-fifths of participants residing in Narathiwat (79.4%). Crucially for technology adoption, a majority reported having high levels of technology experience (64.1%). However, financially, the group is dominated by those with salaries below 10,000 Baht (60.9%).

Based on the analysis of the 5-point Likert scale results, the three assessment models, i.e., platform suitability, platform performance, and platform acceptance, were further analyzed using grouped-item summaries to provide a higher-level interpretation of the system evaluation. The grouped results, including average mean scores, standard deviations (SD), and Cronbach’s alpha coefficients (α), demonstrate consistent patterns across all dimensions.

The grouped analysis of platform suitability (Table 4) indicates that all functional components achieved a moderate level of suitability, with mean scores ranging from 3.22 to 3.42. The highest-rated dimension was Religious Leader Engagement (Mean = 3.42, SD = 1.05), highlighting the importance of administrative control and operational features for religious leaders. Similarly, Profile Setting (Mean = 3.40, SD = 1.05) and Notification System (Mean = 3.37, SD = 0.95) were positively evaluated, reflecting the necessity of user account management and real-time communication. Conversely, the Backend System and Payment System both received moderate but relatively lower scores (Mean = 3.32), suggesting that while core infrastructure is acceptable, improvements are required in data handling and financial processes. The lowest-rated dimension, Pilgrim and General Engagement (Mean = 3.22, SD = 1.02), indicates that user interaction and engagement features remain the platform’s weakest aspect. All dimensions demonstrated excellent internal

consistency ($\alpha = 0.97$), indicating that the measurement items within each group are highly reliable. The grouped performance assessment result, as shown in Table 5, reveals a similarly moderate level of effectiveness, with mean values ranging from 3.42 to 3.49. The highest-rated dimension was Usage Result (Mean = 3.49, SD = 1.01), indicating that users perceive clear benefits and value from using the platform. This is followed by Platform Capability (Mean = 3.44, SD = 1.05), suggesting that the system's functional features are generally adequate. The lowest-rated dimension, User Experience (Mean = 3.42, SD = 1.08), reflects concerns regarding usability and interface design. Notably, the relatively higher SD in this category indicates greater variability in user opinions, suggesting inconsistent user experiences. Despite these differences, all dimensions exhibited high reliability ($\alpha = 0.94$), confirming the robustness of the performance measurement model.

The grouped analysis of platform acceptance (Table 6), structured by the stages of the technology acceptance model (TAM), shows a progressive trend in user perceptions. The mean scores range from 3.17 to 3.48, indicating an overall moderate level of acceptance. The Evaluation Stage achieved the highest score (Mean = 3.48, SD = 1.11), followed closely by the Trial Stage (Mean = 3.44, SD = 1.06), demonstrating that users develop stronger confidence and positive attitudes after interacting with the platform. The Adoption Stage (Mean = 3.38) and Interest Stage (Mean = 3.37) also show relatively positive perceptions. However, the Awareness Stage recorded the lowest mean score (Mean = 3.17, SD = 1.22), indicating a significant gap in user knowledge and initial platform exposure. The higher SD in this stage suggests divergent opinions and uncertainty among users. All stages demonstrated excellent reliability ($\alpha = 0.95$), reinforcing the TAM-based measurement's consistency. To summarize, the grouped analysis confirms that the proposed platform demonstrates strong reliability and moderate acceptance across all evaluation dimensions. While the system delivers functional value and user satisfaction, critical improvements are needed in user experience design, engagement mechanisms, and awareness strategies to enhance adoption and long-term sustainability.

Table 4. The platform suitability assessment result shows the grouping summary and statistics.

Context	No. Items	Mean (Avg)	SD (Avg)	Cronbach's α (if deleted)
Religious Leader Engagement	8	3.42	1.05	0.97
Profile Setting	6	3.40	1.05	0.97
Notification System	4	3.37	0.95	0.97
Backend System	6	3.32	1.08	0.97
Payment System	5	3.32	1.06	0.97
Pilgrim & General Engagement	4	3.22	1.02	0.97

Table 5. The platform performance assessment result shows the grouping summary and statistics.

Context	No. Items	Mean (Avg)	SD (Avg)	Cronbach's α (if deleted)
User Experience	4	3.42	1.08	0.94
Platform Capability	5	3.44	1.05	0.94
Usage Result	4	3.49	1.01	0.94

Table 6. The platform acceptance assessment result shows the grouping summary and statistics.

Stage	No. Items	Mean (Avg)	SD (Avg)	Cronbach's α (if deleted)
Awareness	5	3.17	1.22	0.95
Interest	5	3.37	1.16	0.95
Evaluation	5	3.48	1.11	0.95
Trial	5	3.44	1.06	0.95
Adoption	5	3.38	1.09	0.95

5. Discussion

This study evaluated a mobile web application designed to support pilgrimage tourism management through three complementary dimensions: platform suitability, performance, and technology acceptance. The findings consistently indicate a moderate level of user acceptance, but more importantly, they reveal insights into how functional value, usability, and trust interact in a religious digital platform context.

5.1 Interpretation of Platform Suitability

The platform suitability results (Mean $\approx$ 3.35) indicate that users place the highest value on administrative control and transparency features, particularly within the dimension of religious leader engagement (Mean = 3.42). This result aligns with Kawashima's work, which highlights that religious leaders play a dual role as both spiritual guides and operational coordinators. However, this study extends the existing literature by demonstrating that digital systems can structurally reinforce this dual role rather than merely support logistical tasks. Compared to prior studies on religious tourism, which often focus on organizational or social dynamics, the present findings provide empirical evidence that system design itself can enhance spiritual-managerial alignment, thereby offering a more integrated technological contribution. Despite this strength, the lowest scores in pilgrim engagement (Mean = 3.22) and overall user engagement (Mean = 3.06) highlight a critical limitation. This contrasts with general tourism platform studies, such as Hu, where user engagement and interface quality are primary drivers of satisfaction and revisit intention. The relatively weak engagement performance suggests that the proposed platform, while functionally sufficient, lacks interactive and user-centered features that are standard in contemporary digital tourism systems. Thus, the suitability results reveal a functional-experiential imbalance: the system is strong in administrative capabilities but underdeveloped in user interaction design.

5.2 Platform Performance

The platform performance results (Mean $\approx$ 3.45) show that the system performs well in technical efficiency, particularly in data quality (Mean = 3.77) and processing speed (Mean = 3.60). These findings are consistent with digital tourism research, such as Shariffuddin, which emphasizes that system reliability and information accuracy are fundamental to user satisfaction and trust formation. In comparison with existing pilgrimage applications, such as HAJJRAH (Majid et al.), this study provides stronger empirical validation by demonstrating not only the perceived usefulness of features but also their measured performance across multiple dimensions. This represents a methodological advancement, as previous studies often relied on conceptual validation or limited user feedback. However, the lowest-rated item, i.e., ease of use (Mean = 3.18, SD = 1.20), reveals a significant usability issue. The high standard deviation indicates inconsistent user experiences, suggesting that some users adapt successfully while others struggle. This finding aligns with Hevner's argument that successful digital platforms must achieve not only technical performance but also alignment with the application-user experience. This insight is particularly important because it shows that technical optimization alone does not guarantee user satisfaction, especially in contexts with diverse user groups and varying levels of digital literacy.

5.3 Technology Acceptance

The TAM-based analysis (Mean $\approx$ 3.37) reveals a clear progression across the five stages of adoption. The lowest score in the Awareness stage (Mean = 3.17) indicates a lack of prior exposure and limited trust in the platform, while the highest scores emerge in the Evaluation and Trial stages, particularly "usage meets expectations" (Mean = 3.68). This finding strongly supports Venkatesh's theoretical framework, confirming that perceived usefulness and user attitudes improve through direct interaction. However, this study extends TAM by demonstrating a distinct behavioral transition specific to religious digital platforms. In contrast to Lubis et al., who emphasize CRM systems as a mechanism for improving trust and coordination, the present findings suggest that trust cannot be effectively established through information systems alone. Instead, trust emerges after experiential validation, meaning that users must first interact with the platform before forming positive perceptions. This leads to a key contribution: the identification of an "awareness-experience gap," where initial adoption is hindered by low awareness and credibility concerns. But post-use evaluation leads to high satisfaction and a strong intention to recommend (Mean = 3.52). Compared to existing studies, this

insight offers a more dynamic understanding of adoption behavior, particularly in religious contexts where trust, credibility, and community influence are critical.

5.4 Limitations and Future Work

Several limitations highlight important areas for improvement. Since the sampling method combines purposive and convenience sampling, it limits the generalizability of the findings. The sample was dominated by pilgrims, female respondents, and participants from Narathiwat, which may not fully represent religious leaders, Hajj entrepreneurs, or pilgrims from other regions. Future studies should apply stratified sampling or quota sampling to ensure a more balanced representation of key user groups. The most critical issue lies in user experience (UX/UI), where low ease-of-use scores and high variability indicate that the platform is not sufficiently intuitive for all users. This usability constraint undermines the system's otherwise strong technical performance. Additionally, user engagement features remain underdeveloped, limiting the platform's ability to match the interactive standards of modern tourism applications. The study also reveals a lack of effective awareness and trust-building mechanisms, which creates barriers during the early stages of adoption, as well as moderate confidence in financial features, particularly refund and payment reliability. These limitations suggest that future development should prioritize human-centered design, enhanced interaction capabilities, and strategic communication, ensuring the platform not only functions effectively but also delivers a seamless, trustworthy user experience.

6. Conclusion

This study developed and evaluated a mobile web application to improve pilgrimage tourism management by integrating administrative, transactional, and communication functions. The results indicate that the platform achieves a moderate level of acceptance across the suitability, performance, and technology adoption dimensions, while demonstrating strong measurement reliability. The platform's primary strength lies in its ability to support religious leaders in managing pilgrimage processes efficiently, particularly through centralized control, transparent data handling, and reliable system performance. These features confirm the platform's potential to address existing challenges in pilgrimage tourism, including fragmented information, a lack of transparency, and inefficient coordination. However, the study also identifies several critical limitations that constrain adoption. The platform shows weaknesses in user experience design, engagement functionality, and initial awareness, which collectively hinder usability and trust formation. The findings further reveal that user acceptance is significantly influenced by direct experience, suggesting that initial skepticism can be overcome only after users interact with the system. In conclusion, this research contributes a validated prototype and a deeper theoretical understanding of digital platform adoption in religious tourism, highlighting that successful implementation requires not only technical functionality but also alignment with user experience, trust dynamics, and the socio-religious context of pilgrimage practices.

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Appendix A: The list of contexts in assessment forms.

Table 1A. A list of context about user satisfaction with features in the proposed mobile web application

Component	Context
User engagement	Religious leader engagement - Main controller - Showing a list of pilgrims - Notification for payment or confirmation - Showing the status of an incoming trip - Planning a pilgrimage trip (accommodation, activity plan, expense) - Changing plan (changing itinerary, a booking) - Having a text notification or a personal suggestion - Having Q&A channels for pilgrims Pilgrim engagement - Searching and comparing a trip - Capable of using filters for price, departure time, and accommodation - Capable of comparing trips among companies or services Profile setting - Ability to view and change profile details - Capable of checking the history of bookings and payments - Capable of tracking the status of booking - Capable of notifying data in real-time, e.g., notifying departure time, meeting points, change of itinerary plan, etc. - The design of UX/UI is user-friendly, clean, and convenient to use. - Having a support system, such as a chatbot or live chat, for answering customers' questions
Backend system	- Aggregating user data, e.g., full name, email, phone number, and necessary documents - Collecting booking information, i.e., name, phone number, email, Thai ID/passport, package tour detail, booking status, payment detail - Collecting trip information, i.e., activity schedule, number of seats, accommodation information - Having communication logs, e.g., notes or notifications - Collecting payment transactions, i.e., amount of money, payment date, payment method
Payment system	- Having different payment methods, e.g., credit card, debit card, or other payment methods. - Having payment confirmation - Capable of checking payment status - Capable of making a refund
Notification	- Capable of notifying of booking confirmation for a trip - Capable of notifying payment - Capable of notifying of a trip status

Table 2A. A list of context about the performance of the proposed mobile web application

Topic	Context
User experience	- Easy to use - Convenient to search and compare trips - Fast processing - Stability of the platform
Platform capability	- Capable of making a payment through the platform - Variety of religious leaders - Comparison of trip details - Capable of reviewing - Having a refund after cancellation
Usage result	- The proposed platform can decrease burdens or problems in pilgrimage tourism. - You are satisfied with the data in the platform - Having all the information based on the required information - Credibility of the proposed platform

Table 3A. A list of context about the technology acceptance of the proposed mobile web application

Stage	Context
Awareness	- Have you ever received information about the platform for managing pilgrimage tourism? - You understand the purpose and characteristics of the platform. - You believe that this platform can increase the performance in terms of pilgrimage tourism. - You gain the information from reliable sources. - You are interested in learning more about the platform.
Interest	- You are interested in using this platform for pilgrimage. - You believe that this platform has the potential to decrease the complexity of pilgrimage tourism. - You are not worried about the usage of this platform. - You agree that this platform is different from usual management. - You believe that this platform has advantages for your community.
Evaluation	- Have you ever compared this platform to the usual management? - You agree that this platform has more advantages than the current method. - You do not need more information before deciding to use this platform. - You agree that it is easy to change using this platform. - You are confident that other users can use this platform efficiently.
Trial	- Have you ever had an experience using this platform? - Using this platform meets your expectations. - You do not have any troubles or struggles when using this platform. - You agree that this platform does not have to improve. - You do not have to learn more about using this platform.
Adoption	- You tend to use this platform continuously. - You would like to recommend this platform to other people. - You believe that this platform can help pilgrimage tourism in the long term. - You support using this platform broadly. - You are confident that this platform is reliable and capable of being used in the long term.

Appendix B: The results of surveys in full contexts.

Table 1B. The platform suitability assessment results show the number of participants who answered in each context, along with the mean, SD, and Cronbach's alpha.

Context	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	SD	α (If deleted)
Overall user engagement	4	17	19	19	5	3.06	1.07	0.97
Religious leader engagement: Main controller	2	3	23	25	11	3.63	0.93	0.97
Religious leader engagement: Showing a list of pilgrims	1	8	28	17	10	3.42	0.96	0.97
Religious leader engagement: Notification for payment or confirmation	2	5	26	22	9	3.48	0.94	0.97
Religious leader engagement: Showing the status of an incoming trip	4	8	20	24	8	3.38	1.06	0.97
Religious leader engagement: Planning a pilgrimage trip (accommodation, activity plan, expense)	3	8	17	26	10	3.50	1.05	0.97
Religious leader engagement: Changing plan (changing itinerary, a booking)	2	12	17	21	12	3.45	1.1	0.97
Religious leader engagement: Having a text notification or a personal suggestion	6	7	24	18	9	3.27	1.13	0.97
Religious leader engagement: Having Q&A channels for pilgrims	8	8	16	24	8	3.25	1.21	0.97
Pilgrim engagement: Searching and comparing a trip	4	13	25	16	6	3.11	1.04	0.97
Pilgrim engagement: Capable of using filters for price, departure time, and accommodation	2	12	17	24	9	3.41	1.05	0.97
Pilgrim engagement: Capable of comparing trips among companies or services	2	9	27	20	6	3.30	0.94	0.97
Profile setting: Ability to view and change profile details	1	4	28	20	11	3.56	0.91	0.97
Profile setting: Capable of checking the history of bookings and payments	5	6	23	23	7	3.33	1.05	0.97
Profile setting: Capable of tracking the status of booking	1	5	30	16	12	3.52	0.94	0.97
Profile setting: Capable of notifying data in real-time	3	9	22	20	10	3.39	1.06	0.97
Profile setting: The UX/UI design is user-friendly, clean, and convenient to use.	7	5	22	19	11	3.34	1.18	0.97
Profile setting: Having a support system	7	7	21	21	8	3.25	1.15	0.97
Overall backend system	2	8	27	17	10	3.39	1	0.97
Aggregating user data	4	8	26	18	8	3.28	1.05	0.97
Collecting booking information	1	14	23	17	9	3.30	1.02	0.97
Collecting trip information	3	10	21	18	12	3.41	1.11	0.97
Having communication logs	4	13	18	19	10	3.28	1.15	0.97
Collecting payment transaction	5	8	28	12	11	3.25	1.13	0.97
Overall payment system	1	15	16	22	10	3.39	1.06	0.97
Having different payment methods	3	14	27	12	8	3.13	1.05	0.97
Having payment confirmation	1	9	22	19	13	3.53	1.02	0.97
Capable of checking payment status	3	14	20	17	10	3.27	1.12	0.97
Capable of making a refund	3	12	21	20	8	3.28	1.06	0.97
Overall notification	2	13	21	18	10	3.33	1.07	0.97
Capable of notifying of booking confirmation for a trip	2	10	31	15	6	3.20	0.93	0.97
Capable of notifying payment	1	8	23	23	9	3.48	0.94	0.97
Capable of notifying of a trip status	1	5	29	21	8	3.47	0.87	0.97

Table 2B. The platform performance assessment results show the number of participants who answered in each context, along with the mean, SD, and Cronbach's alpha.

Context	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	SD	α (If deleted)
User experience: Easy to use	8	7	18	20	7	3.18	1.2	0.94
User experience: Convenient to search and compare trips	3	7	24	16	10	3.38	1.06	0.94
User experience: Fast processing	4	3	16	27	10	3.6	1.04	0.94
User experience: Stability of the platform	2	8	18	22	10	3.5	1.03	0.94
Platform capability: Capable of making a payment through the platform	3	4	28	14	11	3.43	1.03	0.94
Platform capability: Variety of religious leaders	2	7	15	25	11	3.6	1.03	0.94
Platform capability: Comparison of trip details	3	11	17	19	10	3.37	1.12	0.94
Platform capability: Having a refund after cancellation	3	11	17	21	8	3.33	1.08	0.94
Platform capability: The proposed platform can decrease burdens or problems in pilgrimage tourism.	2	7	19	24	8	3.48	0.98	0.94
Usage result: The proposed platform can decrease burdens or problems in pilgrimage tourism.	5	3	22	26	4	3.35	0.99	0.94
Usage result: You are satisfied with the data in the platform	2	4	13	28	13	3.77	0.98	0.94
Usage result: Having all the information based on the required information	3	6	26	19	6	3.32	0.97	0.94
Usage result: Credibility of the proposed platform	3	8	16	22	11	3.5	1.1	0.94

Table 3B. The platform acceptance assessment results show the number of participants who answered in each context, along with the mean and SD.

Context	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	SD	α (if deleted)
Awareness Stage: Have you ever received information about the platform for managing pilgrimage tourism?	6	12	23	14	7	3.06	1.13	0.95
Awareness Stage: You understand the platform's purpose and characteristics.	3	15	16	17	11	3.29	1.16	0.95
Awareness Stage: You believe that this platform can increase the performance in terms of pilgrimage tourism	8	11	16	17	10	3.16	1.27	0.95
Awareness Stage: You gain the information from reliable sources.	11	6	19	16	10	3.13	1.31	0.95
Awareness Stage: You are interested in learning more about the platform.	7	10	17	19	9	3.21	1.22	0.95
Interest Stage: You are interested in using this platform for pilgrimage.	1	6	19	19	10	3.56	0.98	0.95
Interest Stage: You believe that this platform has the potential to decrease the complexity of pilgrimage tourism.	5	5	26	19	7	3.29	1.05	0.95
Interest Stage: You are not worried about using this platform.	8	6	19	20	9	3.26	1.21	0.95
Interest Stage: You agree that this platform is different from usual management.	6	11	14	17	14	3.35	1.28	0.95
Interest Stage: You believe that this platform has advantages for your community.	7	8	17	15	15	3.37	1.3	0.95
Evaluation Stage: Have you ever compared this platform to the usual management?	5	3	23	20	11	3.47	1.1	0.95
Evaluation Stage: You agree that this platform has more advantages than the current method.	5	4	19	23	11	3.5	1.11	0.95
Evaluation Stage: You do not need more information before deciding to use this platform.	3	7	23	17	12	3.45	1.08	0.95

Table 3B. The platform acceptance assessment results show the number of participants who answered in each context, along with the mean and SD. (continue)

Context	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	SD	α (if deleted)
Evaluation Stage: You agree that it is easy to change using this platform.	5	3	25	17	12	3.45	1.11	0.95
Evaluation Stage: You are confident that other users can use this platform efficiently.	4	9	11	27	11	3.52	1.14	0.95
Trial Stage: Have you ever used this platform?	4	4	26	18	10	3.42	1.05	0.95
Trial Stage: Using this platform meets your expectations.	1	7	15	27	12	3.68	0.97	0.95
Trial Stage: You have no issues or struggles when using this platform.	4	6	25	17	10	3.37	1.07	0.95
Trial Stage: You agree that this platform does not have to improve.	5	7	28	13	9	3.23	1.09	0.95
Trial Stage: You do not have to learn more about using this platform.	6	2	21	22	11	3.48	1.13	0.95
Adoption Stage: You tend to use this platform continuously.	4	4	33	13	8	3.27	0.99	0.95
Adoption Stage: You would like to recommend this platform to other people.	2	9	17	23	11	3.52	1.05	0.95
Adoption Stage: You believe that this platform can help pilgrimage tourism in the long term.	5	4	19	22	12	3.52	1.13	0.95
Adoption Stage: You support using this platform broadly.	4	11	22	16	9	3.24	1.11	0.95
Adoption Stage: You are confident that this platform is reliable and can be used long-term.	5	8	20	18	11	3.35	1.16	0.95