Analysis of Smart Tourism in Disaster-Affected Tourism Recovery from the Perspective of the UTAUT Model: A Case Study of Hualien

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DOI: https://doi.org/10.30211/JIC.202402.007

ABSTRACT

Based on the UTAUT3 model, this study analyzes smart tourism in disaster-affected tourism recovery, using Hualien as a case study. The Hualien area suffered significant damage from an earthquake, severely impacting its infrastructure and tourism industry. Through information and communication technology (ICT), innovative tourism technology improves tourism management and customer service in the post-disaster uncertain environment, enhancing visitor experience and safety.

The study comprehensively considers five variables of the UTAUT3 model: performance expectancy, effort expectancy, social influence, facilitating conditions, and trust, to explore the application of smart tourism in disaster recovery. Performance expectancy includes post-disaster real-time information updates, emergency management, interaction and engagement, resource optimization, and enriched tourism experiences. Effort expectancy involves the ease of use, compatibility, functional integration, and technical support of applications. Social influence encompasses peer influence, opinion leader attitudes, media impact, and local government support. Facilitating conditions include technological infrastructure, partnership relationships, government policies, and environmental convenience. Trust factors cover privacy protection, data security, reliability, and information authenticity.

This study uses the Analytical Hierarchy Process (AHP) to gather opinions from experts and scholars. It examines the model of smart tourism in disaster recovery and assesses the role of each factor in the UTAUT3 model in accelerating the tourism industry's recovery. The study results will extend to effective strategies for integrating smart tourism technology into post-disaster reconstruction, supporting the sustainable development of the tourism industry in disaster-affected areas.

Keywords: Smart Tourism, UTAUT3 Model, AHP Method, Post-Disaster Reconstruction

1. Introduction

Hualien is a significant tourist destination in Taiwan. However, the 7.2 magnitude earthquake on April 3, 2024, and thousands of aftershocks severely damaged the local infrastructure and tourism industry [1]. The earthquake caused damage to attractions, landslides, trail collapses, and road closures, impacting tourism revenue and visitor confidence. In this context, it is particularly important to explore the role of smart tourism technology in post-disaster recovery.

Smart tourism uses information and communication technology (ICT) to improve tourism management and customer service, particularly in uncertain post-disaster environments, enhancing visitor experience and safety [2], [3]. For example, after the Kumamoto earthquake in Japan, smart recommendation systems increased tourist satisfaction and revisit rates [4], [5]. Smart tourism is closely related to sustainable development, where regenerative tourism interventions improve tourist destinations' ecological and social environment[6], [7].

Smart tourism holds great potential in disaster recovery. Artificial intelligence and smart tourism platforms can optimize resource utilization, monitor and protect ecosystems, and increase community engagement and resilience [8], [9]. Research has confirmed that Internet of Things (IoT) technology can monitor and manage the environmental impact of attractions, improve resource use efficiency, and reduce negative environmental impacts[10]. Smartphones and applications improve visitor experiences by facilitating real-time data collection and analysis, enabling precise environmental measures and policies [11]. Big data and AI technologies can predict peak tourist periods, implement flow control, reduce environmental pressure, and achieve sustainable management [12].

This study focuses on the model of smart tourism in the specific context of disaster recovery. Previous research has primarily focused on general smart tourism or post-disaster technology applications, needing a comprehensive exploration of integrated strategies and models of smart tourism in disaster recovery[2], [13], [14], [15], [16]. This study aims to fill this gap through the UTAUT3 model, providing new perspectives and actionable recommendations.

The UTAUT model integrates key variables from multiple technology acceptance theories to explain user acceptance and usage behavior of new technologies[17]. UTAUT3 extends UTAUT and UTAUT2 by adding variables such as trust, making it particularly suitable for tourism recovery in disaster-affected areas[18]. The trust variable helps understand tourist trust in smart tourism technology, increasing the model's predictive and explanatory power and designing effective technology promotion strategies. Therefore, this study systematically explores the model of smart tourism in disaster recovery through the UTAUT3 model, providing theoretical and strategic directions for the tourism industry in disaster-affected areas.

2. Literature Review

2.1 Definition of Smart Tourism

Smart tourism encompasses Smart Destinations, Smart Services, and Smart Experiences, utilizing ICT to improve tourism experiences and management efficiency [2], [13], [19]. In practice, smart tourism applications in places like Barcelona, Spain, and Jeju Island, South Korea, have significantly improved urban management and tourist satisfaction [11], [13].

Smart tourism's core lies in data collection, analysis, and application. This data, through cloud computing, the Internet of Things (IoT), and big data technologies, provides real-time tourism information and services, allowing tourists to adjust their itineraries flexibly[2]. Mobile technology is crucial in smart tourism because it offers real-time information, online booking, smart navigation, and payment services through mobile apps, often integrated with GPS and AR technology[20]. IoT technology, through smart sensing devices, monitors visitor flows and environmental conditions at attractions in real-time. Tourists can receive personalized services through wearable devices, such as health monitoring and safety alerts[11].

Analyzing large volumes of data tourists generate helps identify patterns and trends, enhancing service delivery, marketing strategies, and destination management [21], [22]. AI technology, applied in voice recognition, image processing, and intelligent customer service, improves service quality and efficiency, bolstering personalized marketing and tourism operations [23]. AR and VR technologies provide immersive experiences by overlaying digital information in the real world or creating virtual environments, enhancing interaction and learning [24]. Cloud computing offers efficient data storage and processing capabilities, supporting the operation of smart tourism applications and data sharing, thereby improving resource management efficiency and scientific decision-making[25].

Smart tourism technologies improve tourist experiences and promote sustainable development in the tourism industry. For instance, smart transportation systems reduce traffic congestion and pollution, while big data analysis optimizes resource allocation and supports environmental protection. Smart tourism also encourages tourists to participate in community activities, fostering a better understanding and protection of local culture and heritage[19].

In summary, smart tourism leverages advanced ICT to provide efficient, personalized, and sustainable tourism services and management systems to improve tourist satisfaction and urban management effectiveness.

2.2 Research on Smart Tourism and UTAUT

The UTAUT model comprises four main components: Performance Expectancy, which refers to the degree to which users believe that using the technology will improve their work or life performance; Effort Expectancy, which refers to the ease of learning and using the technology; Social Influence, which refers to the degree to which users perceive that important others expect them to use the technology; and Facilitating Conditions, which refers to the infrastructure and support available to help users use the technology. These four variables influence users' Behavioral Intention, affecting their actual Use Behavior.

Research shows that tourists place a high value on the practicality and convenience of smart tourism applications[26], [27], and they believe that using smart tourism applications can help them achieve their travel goals [27]. Tourists prefer user-friendly applications that do not require significant effort to navigate[28]. Additionally, tourists' usage habits significantly affect their intention to use smart tourism applications [29]. The more habitual the Use, the more likely tourists will continue using the application. Trust factors, particularly data privacy and security, are also crucial; tourists are more likely to use applications they perceive as safe and trustworthy [30], [31]. Trust includes the transparency and protective measures of the application in handling personal data, directly influencing users' intention to use and satisfaction.

2.3 Exploring UTAUT3 Variables in Smart Tourism for Disaster Recovery

2.3.1. Performance Expectancy

Performance Expectancy is a significant factor influencing the intention to use smart tourism applications[32], [33]. In the context of post-disaster tourism recovery, travelers expect these applications to improve their travel experience and increase the attractiveness of the tourist areas. The main sub-dimensions of Performance Expectancy include Post-Disaster Information Updates, Emergency Management, Interaction and Engagement, Resource Optimization, and Enhanced Tourism Experience.

Post-Disaster Information Updates, a basic need for travelers, are met by smart tourism applications. These applications are expected to provide the latest updates on post-disaster reconstruction, the status of tourist attractions, and safety information, such as road conditions, accommodation availability, and safety tips. This comprehensive information allows travelers to make safe and informed decisions, adjust their itineraries on time, and avoid unexpected disruptions [34]. Emergency management is also a key factor. Travelers expect smart tourism applications to offer effective responses and support during emergencies, including emergency contact information, shelter locations, and medical resources, along with real-time rescue information and guidance when necessary to ensure they receive the required help and information [35].

Additionally, Interaction and Engagement are important aspects of Performance Expectancy. Smart tourism applications should facilitate interaction and engagement between tourists, local communities, and resources. Research on smart agricultural technology applications has shown a significant positive impact of Performance Expectancy on user behavior [36]. Travelers expect smart tourism to promote interaction with local communities, providing multimedia content about local culture, history, and reconstruction stories and encouraging participation in volunteer activities or community support programs.

As smart tourism applications continue to develop, Resource Optimization becomes an important expectation for travelers. They want these applications to help optimize the use of tourism resources, improving the overall efficiency and effectiveness of their travel[33]. Studies have shown that Performance Expectancy is a key factor influencing the continued use of food delivery applications [37]. Smart tourism applications can provide the best travel routes, booking suggestions, and transportation arrangements based on real-time data, avoiding resource wastage and improving the quality of the travel experience.

Lastly, travelers expect an Enhanced Tourism Experience from smart tourism applications. They want these applications to enrich their travel experience by providing various tourism activities and service options. Research indicates that Performance Expectancy significantly impacts the enhancement of the tourist experience [35], [38], [39]. Smart tourism applications should recommend local activities, cultural experiences, and attractions, helping travelers discover and experience new highlights and features of the post-disaster reconstruction process.

By meeting these performance expectations, smart tourism applications can effectively increase user satisfaction and intention to use them.

2.3.2. Effort Expectancy

In the UTAUT3 model, the Effort Expectancy variable for smart tourism applications refers to the degree of ease and effort individuals expect when using these applications. During the disaster recovery process, these variables influence the level of engagement and convenience for travelers using smart tourism applications. Specifically, Effort Expectancy includes four sub-dimensions: Ease of Use, Compatibility, Integration of Functions, and Technical Support.

Ease of Use is a key factor for smart tourism applications. The interface design of smart tourism applications should be simple and intuitive, allowing travelers to operate and use them easily [32]. Applications should provide clear navigation and guidance, ensuring travelers can quickly find the necessary information and features. For example, interface design should consider user habits, reduce operational steps, and improve the overall user experience. Compatibility is equally important. Travelers expect smart tourism applications to run smoothly on various devices and platforms without requiring additional hardware or software[11], [20], [40]. For instance, applications should be compatible with multiple operating systems (such as iOS and Android) and different types of devices (such as smartphones and tablets) to meet the diverse needs of users.

Furthermore, the Integration of Functions is another expectation travelers have for smart tourism applications. These applications should be able to integrate multiple functions, reducing the need for travelers to switch between different applications [41]. Applications should centralize various tourism services on a single platform, increasing convenience and providing a one-stop service, including accommodation booking, transportation information, attraction introductions, and safety tips, allowing travelers to manage their itinerary more efficiently. At the same time, Technical Support is crucial for users of smart tourism applications. These applications should offer effective technical support and customer service to help travelers resolve issues encountered during use. 24-hour online customer service, FAQs, and troubleshooting guides ensure that travelers can quickly get assistance when needed[34]. For example, offer comprehensive support services through live chat, dedicated phone lines, and detailed online help Q&A.

In conclusion, smart tourism applications' performance in terms of Effort Expectancy is critical for increasing travelers' intention to use and satisfaction. By improving ease of use, ensuring compatibility, integrating multiple functions, and providing comprehensive technical support, smart tourism applications can significantly enhance travelers' user experience.

2.3.3. Social Influence

Social influence primarily affects individual behavioral intentions [42], [43]. When individuals perceive positive expectations from significant others regarding their use of technology, their attitudes, and willingness to use the technology increase significantly. It becomes particularly crucial in the early stages of technology adoption, as individuals may not fully understand the functions and benefits of the technology and thus rely on the opinions and recommendations of others[44], [45], [46]. In the context of disaster recovery, analyze the social influence of smart tourism applications through the social influence aspect of the UTAUT model. Research shows that social influence factors significantly affect residents' acceptance of smart transportation systems in smart city development[42]. Similarly, peer and opinion leader attitudes drive the promotion of medical information systems [3], [47], [48], [49].

Peer influence significantly impacts tourists' adoption of smart tourism applications. When tourists see friends, family, or colleagues actively using and recommending a particular smart tourism technology, they become more likely to show interest and willingness to try it [50]. In disaster recovery, positive experiences shared by friends on social media about using smart tourism applications can effectively increase tourists' acceptance. Similarly, the attitudes of opinion leaders play an important role. Opinion leaders, such as well-known travel bloggers, experts, or local celebrities, use their influence to promote new technologies and services, guiding public attitudes and behaviors[51]. When these opinion leaders publicly support and use smart tourism applications, they attract more followers, promoting the adoption of the technology. For example, travel bloggers showcasing the convenience and benefits of smart tourism applications through blogs, videos, and social media can increase public awareness and acceptance of the technology.

Media influence also plays a significant role, as media channels like social media, advertisements, and news reports greatly impact individual acceptance and use of technology or services [52]. Media reporting and promotion significantly affect tourists' acceptance of smart tourism technologies. Additionally, local government support plays a crucial role in promoting the application of smart tourism technologies. Government policy support and resource investment create an environment conducive to the widespread adoption of smart tourism applications. For example, local governments can promote the broad application of smart tourism technologies and enhance public trust and reliance by providing technological infrastructure, financial subsidies, and promotional activities, increasing acceptance and usage intentions [53].

Although social influence significantly affects technology acceptance, promoting smart tourism in disaster recovery faces challenges. Local governments may need more technical support due to resource constraints, and the influence of opinion leaders might weaken as the public prioritizes post-disaster reconstruction. Additionally, peer influence may diminish in high-risk environments due to safety concerns. Understanding the mechanisms and moderating factors of social influence in disaster recovery helps design more effective promotion strategies and interventions, facilitating the widespread application and adoption of new technologies.

2.3.4. Facilitating Conditions

Facilitating conditions involve external environmental factors that support and enable the successful implementation and use of smart tourism applications. One crucial facilitating condition is technical infrastructure, which includes whether the local technical environment can support the operation of smart tourism applications. High-speed internet coverage, stable mobile networks, and adequate data center resources are essential for improving user experience [50]. Adequate infrastructure ensures that smart tourism applications remain efficient and stable during use, enhancing the overall experience for travelers.

Partnerships and collaborations are crucial for the success of smart tourism applications. Cooperation between developers of these applications and local tourism operators, community groups, and technology suppliers plays a vital role. In the context of post-disaster tourism recovery, these partnerships strengthen the tourism sector's resilience in affected areas. For instance, working with local hotels, transport companies, and tourist attractions allows for integrating service resources, resulting in comprehensive and tailored travel solutions, thereby enhancing user satisfaction [54]. Such collaborations ensure optimal resource allocation and elevate overall quality and consistency of services, offering travelers a seamless and enjoyable experience.

Government policy support, including financial subsidies, tax incentives, and regulations to ensure safe application usage and data security, is indispensable. These policies promote the development and widespread use of smart tourism applications, driving the recovery of local tourism industries [55]. Active government intervention and support measures provide a solid foundation for promoting smart tourism and attracting more resources for innovation and expansion of application technologies.

Environmental convenience significantly influences the success of smart tourism applications. The application's user interface design, localized services (such as language support and local information), and developing features specific to disaster-affected areas are essential. Ensuring that travelers enjoy a convenient operational experience, receive services tailored to local needs, and better handle various challenges during their journeyis crucial[28]. By providing user-friendly interfaces and localized features, smart tourism applications can better meet the needs of travelers, increasing their willingness to use and satisfaction with the applications.

These facilitating conditions highlight the critical role of smart tourism applications in enhancing traveler convenience and promoting tourism recovery and development in disaster-affected areas. Strengthening technical infrastructure, fostering partnerships, obtaining government policy support, and improving environmental convenience enables smart tourism applications to more effectively help travelers navigate post-disaster tourism challenges and provide a richer and more diverse travel experience.

2.3.5. Trust

Within the UTAUT3 model, the trust dimensions for smart tourism applications are paramount, particularly during disaster recovery. These dimensions, which refer to the degree of travelers' trust in the reliability and security of the application, are not just theoretical constructs but real-world factors that can significantly impact the adoption and use of these applications. First, privacy protection, a key sub-dimension of trust, must be robust. Smart tourism applications should provide strong privacy protection measures, clearly informing users about the purpose and scope of data collection and employing data encryption and anonymization techniques to protect user privacy from misuse[27], [56]. These measures can strengthen user trust in the application and reduce concerns about privacy breaches.

Data security is equally important. Applications must effectively protect user data from unauthorized access and attacks by using the latest security technologies and measures, such as firewalls, virus protection, and multi-factor authentication, to ensure data integrity and security [32], [57]. These technical measures guard against potential security threats and enhance user trust in the application, further promoting the adoption and use of smart tourism applications.

Reliability is another crucial sub-dimension of trust. Applications should operate stably and maintain high accuracy and consistency when providing information and services, ensuring that services are not interrupted due to system failures or technical issues[58], [59]. Stable and reliable services can increase user trust, making them more willing to rely on the application for necessary travel information and services.

Information accuracy is also indispensable for building user trust. Travelers must be able to trust the accuracy of the information provided by the application, ensuring that content such as attraction descriptions, transportation information, and safety tips are updated and accurate[60], [61]. Accurate and timely information helps travelers make informed decisions, enhancing their overall travel experience and increasing trust in the application.

These trust sub-dimensions help understand the factors influencing user trust when using smart tourism applications. They improve the application's design and operational strategies, improve user trust and willingness to use, and promote the application and adoption of smart tourism in disaster recovery. By strengthening privacy protection, improving data security, ensuring reliability, and maintaining information accuracy, smart tourism applications can more effectively meet user needs, driving the recovery and development of post-disaster tourism.

2.4 Aspects of Smart Tourism Models in Disaster Recovery

This study explores the basic concepts of smart tourism and the UTAUT3 model, suggesting that discussions on the application of smart tourism in disaster recovery should consider all aspects of the model. To systematically evaluate and optimize these aspects, this study uses the Analytic Hierarchy Process (AHP) to determine each aspect's relative importance and weight.

This study employs an AHP hierarchy diagram to provide operational definitions for each variable in the application of smart tourism in disaster recovery. This ensures respondents can answer effectively and enhances the validity and reliability of the research. Table 1 shows the operational definitions of the factors for smart tourism applications in disaster recovery.

Table 1. Operational Definition of Variables for Factors in Smart Tourism Models for Disaster Recovery

First-Level Dimension	Second-Level Key Factors	Operational Definition	References
(A) Performance Expectancy	1. Post-Disaster Information Updates	Provides real-time updates on post-disaster reconstruction, attraction openings, and safety information to help travelers make informed decisions.	[34]
	2. Emergency Management	Provides effective response measures during emergencies, including emergency contacts, shelter locations, medical resources, and real-time rescue information.	[35]
	3. Interaction and Engagement	Promotes interaction between travelers and local communities, offering multimedia content and encouraging participation in community activities.	[36]

	4. Resource Optimization	Uses real-time data to provide optimal travel routes, booking recommendations, and transportation arrangements, improving travel efficiency and effectiveness.	[33]
	5. Enhanced Tourism Experience	Recommends local activities, cultural experiences, and attractions to enrich the travel experience.	[35], [38], [39]
(B)Effort Expectancy	1. Ease of Use	Smart tourism applications should have a simple and intuitive interface, providing clear navigation and guidance. This should allow travelers to operate them easily and find necessary information.	[32]
	2. Compatibility	Refers to the application's ability to run smoothly on various devices and platforms without additional hardware or software requirements.	[11], [20], [40]
	3. Integration of Functions	Smart tourism applications should integrate multiple functions, such as accommodation booking, transportation information, and attraction introductions, providing a one-stop service and reducing the need to switch between different applications.	[41]
	4. Technical Support	Smart tourism applications should offer 24-hour online customer service, FAQs, and troubleshooting guides to help travelers resolve issues quickly.	[34]
(C)Social Influence	1. Peer Influence	Recommendations and usage experiences from friends, family, or colleagues significantly impact tourists' adoption of smart tourism applications.	[50]
	2. Opinion Leaders' Attitude	Influential figures such as well-known travel bloggers, experts, or local celebrities can guide public behavior and attitudes towards smart tourism by promoting and using it.	[51]
	3. Media Influence	Media, through social media, advertising, and news reports, significantly affects individuals' acceptance and use of smart tourism applications.	[52]
	4. Local Government Support	Government support through policies, financial subsidies, and the construction of technical infrastructure promotes the widespread use and public acceptance of smart tourism.	[53]
(D) Facilitating Conditions	1. Technical Infrastructure	Refers to whether local high-speed internet, stable mobile networks, and sufficient data center resources can support the operation of smart tourism.	[50]
	2. Partnerships and Collaborations	Refers to the cooperation between smart tourism application developers and local tourism operators, community organizations, and technology providers, integrating resources to offer comprehensive tourism services.	[54]
	3. Government Policies	Government support through financial subsidies, tax incentives, and regulations ensuring application use and data security promotes the recovery and development of local tourism.	[55]
	4. Environmental Convenience	Refers to providing a user-friendly interface, localized services (such as language support and local information), and disaster-specific features to ensure travelers have a convenient operational experience that meets local needs.	[28]
(E) Trust	1. Privacy Protection	Smart tourism applications should safeguard user privacy through data encryption and anonymization when collecting and using personal information.	[27], [56]

	2. Data Security	Smart tourism applications should employ the latest security technologies and measures, such as firewalls, antivirus protection, and multi-factor authentication, to protect user data integrity and security.	[32], [57]
	3. Reliability	Refers to the application's ability to operate stably and maintain high accuracy in providing real-time information and services.	[58], [59]
	4. Information Accuracy	Travelers should trust the accuracy of the information provided by smart tourism applications, ensuring that information on attractions, transportation, and safety tips is accurate and up-to-date.	[60], [61]

Source: this study

3. Methodology

This study uses the Analytic Hierarchy Process (AHP) to clarify the opinions of experts and scholars on various aspects of smart tourism models in disaster-affected tourism recovery. It analyzes and addresses the challenges faced by smart tourism in this context, clearly defining the main goals and decision-making objectives and breaking down the influencing factors and their independent relationships.

The study targets industry experts and scholars. Using an AHP questionnaire, it gathers their views on the weight and order of various dimensions and analyzes the factors of smart tourism models in disaster recovery. Thirteen experts from industry, government, and academia (six industry experts, three government experts, and four academic experts) participated in the survey, distributed either in paper form or via email.

The AHP method, a systematic and rigorous approach based on multi-criteria decision analysis, is the cornerstone of this study. It breaks down complex decision problems into several levels and determines the importance weights of each factor through pairwise comparisons. The AHP method includes the following steps [62]:

First, construct a hierarchical structure model that breaks down the decision problem into three levels: goals, criteria, and alternatives. In this study, the top level represents the research goal, the middle level the evaluation criteria, and the bottom level the alternatives. Next, construct pairwise comparison judgment matrices. Experts score each level's elements in pairs, creating judgment matrices that reflect the relative importance of the elements. Experts use the Saaty scale (1–9) to score the importance of elements. Then, calculate weights and perform consistency checks. Use the judgment matrices to calculate the weights of the criteria and alternatives and check the consistency of the judgment matrices using the consistency ratio (CR). A CR value of less than 0.1 indicates acceptable consistency. Finally, calculate the overall weights by combining the weights of each level to determine the overall weight of each alternative relative to the overall goal, which then serves as the basis for ranking.

This study collects data through questionnaires and expert interviews. Using the AHP method to process and analyze the data, it calculates weights and checks consistency, improving the accuracy and reliability of the results. Through these methods, the study systematically addresses multi-criteria decision problems and quantitatively analyzes the relative importance of each criterion, providing a scientific basis for the final decision.

4. Analysis and Results

4.1 AHP Analytical Framework

The study focuses on smart tourism models in disaster recovery, using the Analytic Hierarchy Process (AHP) to evaluate and optimize various aspects of smart tourism applications in disaster-affected tourism recovery. Figure 1 below illustrates the AHP analytical framework for this study.

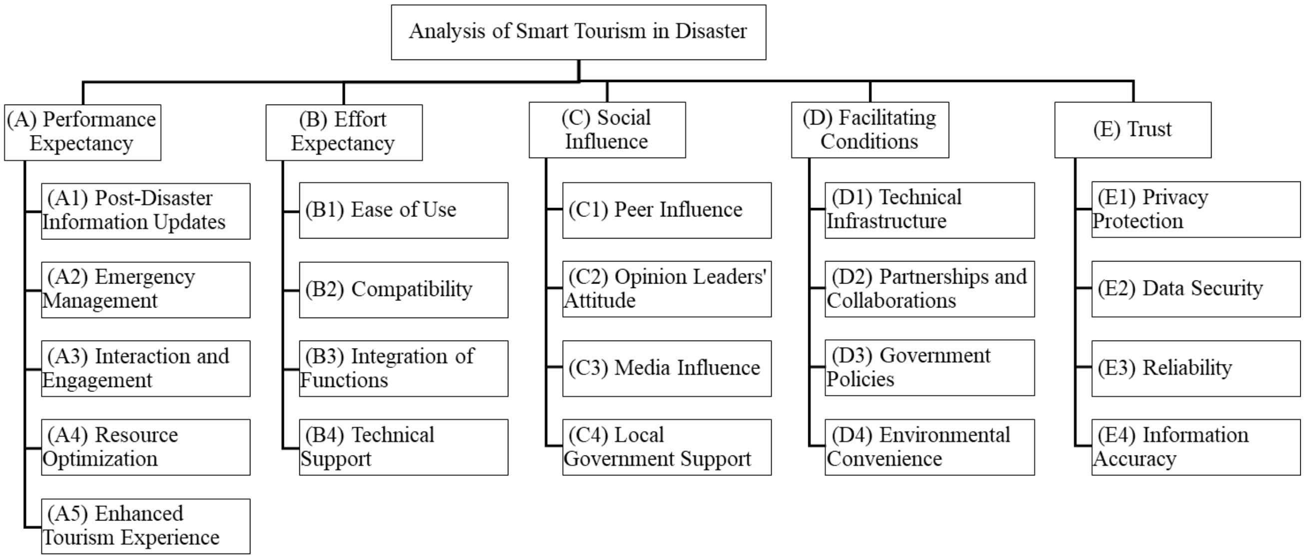

Figure 1 : AHP Framework for Smart Tourism Models in Disaster Recovery

4.2 Analysis Results

This study references domestic and international literature to explore the "Models of Smart Tourism in Disaster Recovery." Using five dimensions—performance expectancy, effort expectancy, social influence, facilitating conditions, and trust—researchers initially selected 21 important evaluation indicators and developed them into a formal questionnaire. Thirteen experts and scholars received and completed the questionnaire.

The study includes the following parts: the first level analyzes the importance of the "Models of Smart Tourism in Disaster Recovery." The second level analyzes the importance of the components within each dimension, detailed as follows:

1. Analysis Results of the First-Level Evaluation Indicators

Table 2. Pairwise Comparison Matrix of First-Level Evaluation Indicators

	A	B	C	D	E
A Performance Expectancy		1	1 2/5	1	1/2
B Effort Expectancy			1 3/4	1 1/4	1/2
C Social Influence				2/3	3/7

D Facilitating Conditions					3/7
E Trust					
Incon:0.04					

Source: this study

The individual relative weight values for the five key factors are as follows: the relative weight value for Performance Expectancy (A) is 0.181, for Effort Expectancy (B) is 0.191, for Social Influence (C) is 0.124, for Facilitating Conditions (D) is 0.162, and for Trust (E) is 0.342. The consistency ratio (CR) is 0.04, less than 0.1, indicating that the overall evaluation process has achieved consistency. The weight rankings are shown in Table 3.

Table 3. Weight Analysis of Smart Tourism Models in Disaster Recovery

Dimension	A Performance Expectancy	B Effort Expectancy	C Social Influence	D Facilitating Conditions	E Trust
The relative weight value	0.181	0.191	0.124	0.162	0.342
The weight rankings	3	2	5	4	1
Inconsistency(C.R.)：0.04					

Source: this study

From the results in the table, it is clear that in the hierarchical evaluation of the "Models of Smart Tourism in Disaster Recovery," experts and scholars consider "Trust" the most important factor. This indicates that "Trust" is a critical key factor in the reference for "Models of Smart Tourism in Disaster Recovery." The subsequent importance in order is Effort Expectancy, Performance Expectancy, Facilitating Conditions, and lastly, Social Influence.

2. Analysis Results of the Second-Level - Performance Expectancy Indicators

The pairwise comparison matrix for secondary evaluation indicators in the "Performance Expectancy" dimension of the "Models of Smart Tourism in Disaster Recovery" hierarchy is shown in Table 4. The relative weight values for the five secondary factors are: Post-Disaster Information Updates (0.241), Emergency Management (0.244), Interaction and Engagement (0.101), Resource Optimization (0.255), and Enhanced Tourism Experience (0.159). The consistency ratio (C.R.) is 0.04, indicating that the evaluation process has achieved consistency. The weight rankings are shown in Table 5.

Table 4. Pairwise Comparison Matrix of Secondary Evaluation Indicators in the "Performance Expectancy" Dimension

	(A1)	(A2)	(A3)	(A4)	(A5)
(A1) Post-Disaster Information Updates		1	2 2/9	8/9	1 7/9
(A2) Emergency			2 2/3	5/6	1 4/7

Management					
(A3) Interaction and Engagement				4/9	3/5
(A4) Resource Optimization					1 3/7
(A5) Enhanced Tourism Experience					
Incon:0.04					

Source: this study

Table 5. Weight Analysis of the Performance Expectancy Dimension

Dimension	(A1) Post-Disaster Information Updates	(A2) Emergency Management	(A3) Interaction and Engagement	(A4) Resource Optimization	(A5) Enhanced Tourism Experience
The relative weight value	0.241	0.244	0.101	0.255	0.159
The weight rankings	3	2	5	1	4
Inconsistency(C.R.)：0.04					

Source: this study

From the results in the table, it is clear that among the five secondary factors in the Performance Expectancy dimension, experts and scholars consider "Resource Optimization" the most important. Following in order of importance are Emergency Management, Post-Disaster Information Updates, Enhanced Tourism Experience, and finally, Interaction and Engagement.

3. Analysis Results of the Second-Level - Effort Expectancy Indicators

In the "Models of Smart Tourism in Disaster Recovery" hierarchy, the second main key factor is "Effort Expectancy." The pairwise comparison matrix for the secondary evaluation indicators in this dimension is shown in Table 6. The relative weight values for the four secondary factors are: Ease of Use (0.362), Compatibility (0.19), Integration of Functions (0.239), and Technical Support (0.209). The consistency ratio (CR) is 0.03, indicating that the evaluation process has achieved consistency. The weight rankings are shown in Table 7.

Table 6. Pairwise Comparison Matrix of Secondary Evaluation Indicators in the "Effort Expectancy" Dimension

	(B1)	(B2)	(B3)	(B4)
(B1) Ease of Use		2	1 5/9	1 1/2
(B2) Compatibility			4/5	1
(B3) Integration of Functions				1 1/5
(B4) Technical Support				
Incons:0.03				

Source: this study

Table 7. Weight Analysis of the Effort Expectancy Dimension

Dimension	(B1) Ease of Use	(B2) Compatibility	(B3) Integration of Functions	(B4) Technical Support
The relative weight value	0.362	0.19	0.239	0.209
The weight rankings	1	4	2	3
Inconsistency(C.R.)：0.03				

Source: this study

The results in the table show that experts and scholars consider "Ease of Use" to be the most important of the four secondary factors in the Effort Expectancy dimension. Following in order of importance are Integration of Functions, Technical Support, and Compatibility.

4. Analysis Results of the Second-Level - Social Influence Indicators

In the "Models of Smart Tourism in Disaster Recovery" hierarchy, the third main key factor is "Social Influence." The pairwise comparison matrix for the secondary evaluation indicators in this dimension is shown in Table 8. The relative weight values for the four secondary factors are: Peer Influence (0.364), Opinion Leaders' Attitude (0.213), Media Influence (0.183), and Local Government Support (0.24). The consistency ratio (C.R.) is 0.02, indicating that the evaluation process has achieved consistency. The weight rankings are shown in Table 9.

Table 8. Pairwise Comparison Matrix of Secondary Evaluation Indicators in the "Social Influence" Dimension

	(C1)	(C2)	(C3)	(C4)
(C1) Peer Influence		1 7/8	2	1 2/5
(C2) Opinion Leaders' Attitude			1 1/6	1
(C3) Media Influence				3/4
(C4) Local Government Support				
Incon:0.02				

Source: this study

Table 9. Weight Analysis of the Social Influence Dimension

Dimension	(C1) Peer Influence	(C2) Opinion Leaders' Attitude	(C3) Media Influence	(C4) Local Government Support
The relative weight value	0.364	0.213	0.183	0.24

The weight rankings	1	3	4	2

Inconsistency(C.R.)：0.02

Source: this study

The results in the table show that among the four secondary factors in the Social Influence dimension, experts and scholars consider "Peer Influence" to be the most important. Following in order of importance are Local Government Support, Opinion Leaders' Attitude, and Media Influence.

5. Analysis Results of the Second-Level - Facilitating Conditions Indicators

In the "Models of Smart Tourism in Disaster Recovery" hierarchy, the fourth key factor is "Facilitating Conditions." The pairwise comparison matrix for the secondary evaluation indicators in this dimension is shown in Table 10. The relative weight values for the four secondary factors are: Technical Infrastructure (0.21), Partnerships and Collaborations (0.204), Government Policies (0.245), and Environmental Convenience (0.341). The consistency ratio (C.R.) is 0.03, indicating that the evaluation process has achieved consistency. The weight rankings are shown in Table 11.

Table 10. Pairwise Comparison Matrix of Secondary Evaluation Indicators in the "Facilitating Conditions" Dimension

	(D1)	(D2)	(D3)	(D4)
(D1) Technical Infrastructure		1 1/8	7/9	3/5
(D2) Partnerships and Collaborations			5/6	2/3
(D3) Government Policies				2/3
(D4) Environmental Convenience				
Incons:0.03				

Source: this study

Table 11. Weight Analysis of the Facilitating Conditions Dimension

Dimension	(D1) Technical Infrastructure	(D2) Partnerships and Collaborations	(D3) Government Policies	(D4) Environmental Convenience
The relative weight value	0.21	0.204	0.245	0.341
The weight rankings	3	4	2	1

Inconsistency (C.R.)：0.03

Source: this study

The table results clearly show that among the four secondary factors in the Facilitating

Conditions dimension, experts and scholars consider "Environmental Convenience" to be the most important. Following in order of importance are Government Policies, Technical Infrastructure, and Partnerships and Collaborations.

6. Analysis Results of the Second-Level - Trust Indicators

Experts and scholars evaluated the fifth main key factor, "Trust," in the "Models of Smart Tourism in Disaster Recovery" hierarchy. The pairwise comparison matrix for the secondary evaluation indicators in this dimension is shown in Table 12. The relative weight values for the four secondary factors are: Privacy Protection (0.2196), Data Security (0.1595), Reliability (0.2618), and Information Accuracy (0.3591). The consistency ratio (C.R.) is 0.03, indicating that the evaluation process has achieved consistency. The weight rankings are shown in Table 13.

Table 12. Pairwise Comparison Matrix of Secondary Evaluation Indicators in the "Trust" Dimension

	(E1)	(E2)	(E3)	(E4)
(E1) Privacy Protection		1 1/2	8/9	1/2
(E2) Data Security			3/5	1/2
(E3) Reliability				3/4
(E4) Information Accuracy				
Incons:0.03				

Source: this study

Table 13. Weight Analysis of the Trust Dimension

Dimension	(E1) Privacy Protection	(E2) Data Security	(E3) Reliability	(E4) Information Accuracy
The relative weight value	0.2196	0.1595	0.2618	0.3591
The weight rankings	3	4	2	1
Inconsistency (C.R.)：0.03				

Source: this study

From the results in the table, it is clear that among the four secondary factors in the Trust dimension, experts and scholars consider "Information Accuracy" to be the most important. Following in order of importance are Reliability, Privacy Protection, and finally, Data Security.

4.3 Analysis of the Importance of Overall Bottom-Level Components

This section refers to multiplying the priority ratios of each bottom-level component by the priority ratios of their corresponding criteria to obtain the overall weight of each evaluation factor, as shown in Table 14.

Table 14. Overall Weight of Evaluation Factors

Dimension	The relative weight value	Evaluation Factors	The relative weight value	Importance ranking
A Performance Expectancy	0.181	(A1) Post-Disaster Information Updates	0.2410	9
		(A2) Emergency Management	0.2440	8
		(A3) Interaction and Engagement	0.1010	21
		(A4) Resource Optimization	0.2550	6
		(A5) Enhanced Tourism Experience	0.1590	20
B Effort Expectancy	0.191	(B1) Ease of Use	0.3620	2
		(B2) Compatibility	0.1900	17
		(B3) Integration of Functions	0.2390	11
		(B4) Technical Support	0.2090	15
C Social Influence	0.124	(C1) Peer Influence	0.3640	1
		(C2) Opinion Leaders' Attitude	0.2130	13
		(C3) Media Influence	0.1830	18
		(C4) Local Government Support	0.2400	10
D Facilitating Conditions	0.162	(D1) Technical Infrastructure	0.2100	14
		(D2) Partnerships and Collaborations	0.2040	16
		(D3) Government Policies	0.2450	7
		(D4) Environmental Convenience	0.3410	4
E Trust	0.342	(E1) Privacy Protection	0.2196	12
		(E2) Data Security	0.1595	19
		(E3) Reliability	0.2618	5
		(E4) Information Accuracy	0.3591	3

Source: this study

Since the number of factors evaluated in the "Models of Smart Tourism in Disaster Recovery" varies, standardizing and adjusting the weight ratios gives us the rankings shown in Table 15.

The top six factors comprise nearly 47% of the total weight, categorizing them as highly valued. Four belong to the trust dimension, accounting for about 34.2% of the weight, indicating the trust dimension as the most critical. Within the trust dimension, experts consider information accuracy the most important indicator, followed by reliability, while also considering privacy protection and data security.

In the moderately valued category, factors ranked 7th to 15th account for about 37.5% of the weight. Most experts believe resource optimization, integration of functions, peer influence, emergency management, post-disaster information updates, technical support, government policies, compatibility, and technical infrastructure have a positive impact.

The bottom six ranked factors for the less valued category include three from the social influence dimension, indicating less emphasis on local government support, opinion leaders' attitudes, and media influence. Most experts and scholars consider partnerships and collaborations, local government support, enhanced tourism experience, opinion leaders' attitudes, media influence, and interaction and engagement less important.

Table 15. Rankings of Evaluation Factors in the "Models of Smart Tourism in Disaster Recovery"

Level of Importance	Weighted Ranking	Evaluation Factors	Weighted Weight (Rounded)	Dimensions
Highly Valued	1	(E4) Information Accuracy	0.12281	E.Trust
	2	(E3) Reliability	0.08954	E.Trust
	3	(E1) Privacy Protection	0.07510	E.Trust
	4	(B1) Ease of Use	0.06914	B.Effort Expectancy
	5	(D4) Environmental Convenience	0.05524	D.Facilitating Conditions
	6	(E2) Data Security	0.05455	E.Trust
Moderately Valued	7	(A4) Resource Optimization	0.04616	A.Performance Expectancy
	8	(B3) Integration of Functions	0.04565	B.Effort Expectancy
	9	(C1) Peer Influence	0.04514	C.Social Influence
	10	(A2) Emergency Management	0.04416	A.Performance Expectancy
	11	(A1) Post-Disaster Information Updates	0.04362	A.Performance Expectancy
	12	(B4) Technical Support	0.03992	B.Effort Expectancy
	13	(D3) Government Policies	0.03969	D.Facilitating Conditions
	14	(B2) Compatibility	0.03629	B.Effort Expectancy
	15	(D1) Technical Infrastructure	0.03402	D.Facilitating Conditions
less valued	16	(D2) Partnerships and Collaborations	0.03305	D.Facilitating Conditions
	17	(C4) Local Government Support	0.02976	C.Social Influence
	18	(A5) Enhanced Tourism Experience	0.02878	A.Performance Expectancy
	19	(C2) Opinion Leaders' Attitude	0.02641	C.Social Influence
	20	(C3) Media Influence	0.02269	C.Social Influence
	21	(A3) Interaction and Engagement	0.01828	A.Performance Expectancy

Source: this study

5. Conclusion and Recommendations

Based on the analysis in Chapter 4, this section presents the findings and conclusions of the study. This study explores models of smart tourism in disaster recovery by analyzing AHP questionnaires filled out by industry experts. The conclusions and insights drawn from the research are outlined as follows:

5.1 Conclusions

This study's analysis results highlight the importance of trust in applying smart tourism for disaster recovery. Trust is a key factor that demands significant emphasis in the "Models of Smart Tourism in Disaster Recovery."

Specifically, experts consider information accuracy the most important indicator, underscoring the need to provide accurate and truthful information as the foundation for building trust during disaster recovery. Following closely, reliability is also crucial, ensuring the consistency and stability of tourism-related services and information. Privacy protection and data security further enhance tourists' and local residents' confidence in smart tourism applications.

Smart tourism technology faces data privacy and security challenges, which affect tourists' trust and acceptance of applications. Implementing and maintaining these technologies incurs significant costs, which pose challenges for resource-limited tourism destinations[2]. Addressing these challenges is crucial for the sustainable development of smart tourism.

Moderately valued factors include resource optimization, integration of functions, peer influence, emergency management, post-disaster information updates, technical support, government policies, compatibility, and technical infrastructure. These elements play an essential role in the smart tourism model for disaster recovery.

These findings show that smart tourism models need a foundation of trust and effective integration and optimization of technology and resources.

Less emphasized factors include local government support, opinion leaders' attitudes, and media influence, which experts and scholars consider less critical in the smart tourism model for disaster recovery. They generally view partnerships and collaborations, local government support, enhanced tourism experience, opinion leaders' attitudes, media influence, and interaction and engagement as having a lower impact on smart tourism models.

Thus, trust plays a crucial role in the smart tourism model for disaster recovery. Improving information accuracy, reliability, privacy protection, and data security is essential for the successful implementation of smart tourism applications. These findings provide valuable insights for policymakers and tourism managers, aiding in the effective use of smart tourism technology in post-disaster recovery.

This study shows that trust holds the most important position in applying smart tourism for disaster recovery, particularly regarding information accuracy and reliability. Building and maintaining trust among tourists and residents is essential during recovery. Additionally, the ease of use, integration of functions, and technical support in the effort expectancy and facilitating conditions dimensions further enhance the efficiency and effectiveness of disseminating smart tourism applications.

Resource optimization and emergency management in the performance expectancy dimension significantly improve recovery efficiency and handle emergencies in smart tourism models.

Moderately valued factors such as resource optimization and technical support also play an important role in positively influencing smart tourism models. In contrast, factors in the social influence dimension have a relatively smaller impact on smart tourism models.

Improving information accuracy, reliability, privacy protection, and data security is key to successfully implementing smart tourism applications. These findings provide important guidance for policymakers and tourism managers in post-disaster recovery, helping to use smart tourism technology more effectively to promote the recovery and development of disaster-affected areas.

5.2 Recommendations

Based on the conclusions of this study, to build and maintain trust among tourists and residents, tourism managers and policymakers should take measures to strengthen information accuracy and reliability. Establish transparent information dissemination systems to ensure all information is verified and up-to-date. Consider using blockchain technology to guarantee information immutability. Implement standardized data management processes to ensure strict adherence to standards during data collection, processing, and dissemination, preventing the spread of misinformation. These measures will increase the credibility of information, facilitating the effective implementation of smart tourism applications in disaster recovery.

To boost user trust in smart tourism applications and improve privacy protection and data security. Introduce advanced encryption technologies to protect user data from unauthorized access and leaks and enforce data encryption and secure storage measures. Develop detailed privacy policies, ensuring users understand how their data is collected, used, and protected, and provide easy data management options. These actions will increase user trust and willingness to use smart tourism applications.

Effective integration and optimization of technology and resources are crucial for the success of smart tourism models. Establish cross-departmental collaboration mechanisms to promote cooperation among tourism, technology, and emergency management departments, sharing resources and information to improve response speed and service quality. Promote intelligent management systems using big data, artificial intelligence, and Internet of Things technologies to improve the management efficiency of tourist attractions and infrastructure. These measures will optimize resource allocation and enhance the overall effectiveness of smart tourism.

Although this study's social influence dimension is relatively secondary, it requires appropriate attention. Collaborate with local governments and opinion leaders, leveraging their influence and media cooperation to increase the promotion and application of smart tourism models, raising public awareness and acceptance. Encourage social participation and interaction, designing more interactive smart tourism application features to enhance the engagement and satisfaction of tourists and residents. These actions will help fully utilize the potential of the social influence dimension, promoting the successful implementation of smart tourism models.

5.3 Future Research Directions

To further improve the application of smart tourism models in disaster recovery, future research can focus on the following four areas:

1. **Long-term Impact of Smart Tourism Technologies**: Investigate the long-term impact of smart tourism technologies on the disaster recovery process, particularly their sustained effects on the local economy and society.
2. **User Behavior and Needs Analysis**: Conduct in-depth studies on the needs and behavior patterns of different types of tourists and local residents regarding smart tourism technologies to develop more precise application strategies.
3. **Cross-regional Comparative Studies**: Compare the experiences and outcomes of smart tourism applications in different disaster-affected areas, summarizing successful models and best practices that can referenced.
4. **Application of Emerging Technologies**: Smart tourism embraces more innovative applications as technology advances. Explore the potential applications of emerging technologies such as blockchain, 5G, VR, and AR in smart tourism models to increase the depth and breadth of technology use. For example, blockchain technology can enhance the transparency and security of tourism transactions, 5G technology can significantly improve the responsiveness and stability of mobile applications, and AI and machine learning technologies can further improve the accuracy and efficiency of personalized services[63].

In summary, smart tourism improves the tourist experience and gives tourism managers more efficient management tools. These research recommendations can help policymakers and tourism managers in disaster recovery effectively utilize smart tourism technologies, promoting the recovery and development of disaster-affected areas and providing direction for future research.

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