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DRIVING SUSTAINABLE HOMESTAY PERFORMANCE THROUGH DRONE TECHNOLOGY AND TAKAFUL INTEGRATION

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Abstract:

The increasing frequency of natural disasters and the growing importance of ethical risk-sharing mechanisms have led to the emergence of innovative solutions in the tourism and insurance sectors. This study examines the integration of drone technology and takaful (Islamic insurance) in enhancing the performance and sustainability of homestay businesses in Malaysia. Drawing on qualitative data, including expert interviews and a disaster simulation exercise, this paper explores the potential of drones to improve post-disaster response, property inspections and marketing efficiency. Concurrently, it investigates how takaful supports homestay operators by offering Shariah-compliant risk mitigation. Findings highlight that the use of drones enhances claim accuracy and speeds up the compensation process, aligning with the *maqasid al-shariah* principle of community welfare. The research also identifies operational, financial and regulatory challenges that need to be addressed. In addition, the study applies the Technology Acceptance Model (TAM) and Technological, Organizational and Environmental (TOE) framework to examine the adoption of drone technology among homestay and takaful stakeholders. Therefore, this paper proposes strategic pathways for takaful operators and homestay businesses to collaborate, advancing ethical, technology-driven solutions for a resilient tourism sector.

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Technology, Islamic Finance, Disaster Management, Homestay

Introduction

Malaysia's Homestay Programme, introduced in 1995, is a government-endorsed initiative that promotes community-based tourism (CBT) by involving rural households in hosting domestic and international tourists. It allows visitors to live with host families, experience the local lifestyle, and participate in cultural activities (Azhar et al., 2021; Zulkefli et al., 2021). According to the Ministry of Tourism, Arts and Culture (MOTAC, 2023), this program is designed to empower rural communities through economic participation and cultural preservation. Homestays contribute to poverty alleviation, local job creation, the revival of traditional handicrafts and environmental awareness campaigns (Balasingam & Bojei, 2019; Janjua et al., 2021).

Despite its success, the homestay sector faces several threats, including exposure to natural disasters such as floods and landslides. These risks can significantly impact operations, safety and financial security. While takaful provides *Shariah*-compliant insurance coverage, the industry struggles with efficiency in claim processing, especially during disasters (Muhamat et al., 2018). The integration of drone technology presents an innovative opportunity to address these challenges. Drones offer aerial surveillance, real-time data capture and remote property assessment that are essential for timely and accurate claim evaluation.

While drone technology has been extensively studied in sectors such as logistics, agriculture, and disaster response, its integration with Islamic insurance (takaful) within the tourism industry remains largely underexplored. Existing literature often treats drone technology and takaful as separate domains, overlooking their potential synergy in enhancing disaster resilience. Rural homestay businesses, which are particularly vulnerable to natural disasters, have received limited attention in terms of how they can adopt innovative, Shariah-compliant tools for risk mitigation and recovery.

Furthermore, the role of takaful in supporting tourism-related small and medium enterprises (SMEs) is inadequately addressed in current research. Although technological, organizational, and environmental factors significantly influence drone adoption, few studies apply established models such as the Technology Acceptance Model (TAM) or the Technological, Organizational and Environmental (TOE) framework in this specific context. As a result, there is a limited understanding of the readiness and willingness of rural tourism stakeholders to adopt such technologies. Moreover, discussions on disaster risk management and post-disaster recovery tend to focus on logistical and economic dimensions, often neglecting the ethical considerations rooted in maqasid al-shariah (objectives of Islamic law). There is a lack of interdisciplinary frameworks and strategic policy recommendations to guide collaboration between takaful operators and tourism businesses in deploying technology-driven, ethical solutions for sustainable and resilient tourism development.

This study aims to explore the alignment of drone usage within takaful services with Islamic ethical principles, particularly Maqasid Al-Shariah. It also seeks to identify the operational and regulatory challenges faced by takaful operators in integrating drone technology, especially in the context of homestay protection. Furthermore, the research assesses the potential impact of

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combining drone applications with takaful schemes on the performance, resilience, and recovery of homestay businesses.

In addressing these aims, the study investigates three key questions: (1) In what ways does the use of drones support the objectives of takaful and Maqasid Al-Shariah? (2) What are the primary operational and regulatory challenges encountered by takaful providers in adopting drone technology? and (3) How does the integration of drones and takaful mechanisms influence the performance and sustainability of homestay businesses? Therefore, this study investigates how the synergy between drone technology and takaful can enhance homestay performance, promote business continuity and support Islamic ethical principles.

Literature Review

Homestays and Community-Based Tourism in Malaysia

Homestay program is a form of community-based tourism (CBT), established in 1995 to empower rural communities through cultural and economic participation (Azman, 2020; Ramele & Yamazaki, 2020). According to the Ministry of Tourism, Arts and Culture (MOTAC, 2023), the program encourages visitors to live with host families, experience local customs and partake in traditional lifestyles. Moreover, the program also promotes sustainable tourism that strengthens social bonds, reduces poverty and supports cultural preservation (Kunjuraman et al., 2022). This is in line with Azhar et al., 2021 stated in their study that the visitors benefit from meaningful cultural exchanges, while host communities gain income opportunities and enhanced local pride from this homestay program .In addition, Zulkefli et al. (2021) emphasize that these authentic experiences attract global travelers seeking unique and affordable rural tourism. Additional benefits include the revitalization of handicrafts, increased environmental awareness and local infrastructure development (Balasingam & Bojei, 2019; Janjua et al., 2021).

Besides that, the other functions of this program are it act as a grassroots entrepreneurship model for women and elderly community members who may not otherwise have income-generating opportunities (Kunjuraman et al., 2022; Balasingam & Bojei, 2019). Furthermore, to ensure the quality service delivery, homestay operators are typically provided with training in areas such as hospitality, hygiene, cultural presentation and basic business management (Azhar et al., 2021; MOTAC 2023). These capacity-building efforts are essential for enhancing the operators' readiness to manage and sustain their homestay businesses effectively. However, beyond individual skill development, broader structural factors also play a critical role in determining performance. According to Ramlan (2024), homestay success is significantly influenced by access to technology, organizational capacity and external environmental conditions, all of which require supportive infrastructure and governance mechanisms. When these enabling conditions are met, operators are better equipped to deliver authentic experiences while maintaining operational resilience.

Furthermore, homestay initiatives promote community participation, democratic decision-making, and shared ownership, all of which enhance social capital and local resilience (Zulkefli et al., 2021). This localized approach to tourism ensures that economic benefits are reinvested within the community, creating a sustainable cycle of growth and empowerment (Ramele & Yamazaki, 2020). Nevertheless, the sector remains vulnerable to environmental shocks and market fluctuations, reinforcing the need for complementary support mechanisms such as

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takaful insurance and the adoption of enabling technologies like drones (Ahmad et al., 2022; Daud et al., 2022). Overall, Malaysia's homestay program remains a key driver of inclusive, sustainable rural development that aligns with both national objectives and global tourism trends (MOTAC, 2023; Janjua et al., 2021).

Challenges and Opportunities in Homestay Management

Although the homestay program has made significant contributions to rural tourism and community development, it faces several challenges that hinder its full potential (Azman, 2020; Ramlan, 2024). Among the most prominent issues are inconsistent quality standards, limited digital literacy and infrastructure deficiencies in rural areas (Zulkifli et al., 2022). Many homestay operators still rely on manual booking systems and lack formal training in hospitality management, reducing their competitiveness in the global tourism market (Kunjuraman et al., 2022; Azhar et al., 2021).

Furthermore, fluctuations in tourist arrivals due to economic or climatic factors leave homestay operators financially vulnerable (Balasingam & Bojei, 2019). According to Ramlan (2024), these operational gaps can be addressed through greater integration of technology, improved stakeholder coordination, and targeted government support. Opportunities lie in digital marketing, e-commerce for local products, and collaboration with platforms like Airbnb and Booking.com to enhance visibility (Zulkefli et al., 2021). Additionally, incorporating smart tourism technologies such as drones for marketing and inspection purposes can modernize homestay offerings and increase visitor confidence (Ahmad et al., 2022; Daud et al., 2022). Addressing these challenges holistically will elevate Malaysia's homestay program from a cultural initiative to a sustainable economic engine that enhances rural livelihoods and strengthens tourism resilience (MOTAC, 2023; Ramlan, 2024).

Takaful and Ethical Risk Management

Takaful is a Shariah-compliant form of insurance that embodies the principles of mutual cooperation, shared responsibility and ethical finance. Unlike conventional insurance, it prohibits *riba* (interest), *gharar* (uncertainty) and *maysir* (gambling), making it suitable for Muslim communities (Muhamat et al., 2018). Participants contribute to a common pool and claims are paid from this collective fund, adhering to Islamic jurisprudence.

Despite its ethical and religious foundations, the takaful sector often faces criticism for delays in claims processing, especially during natural disasters (Gomez, 2018; Muhamat et al., 2017). These inefficiencies can erode public trust and discourage adoption among rural communities. Moreover, Takaful's operational processes need modernization to improve responsiveness, transparency, and scalability particularly when serving tourism-dependent businesses like homestays (NST, 2019).

Drone Technology in Disaster and Insurance Contexts

Drones or Unmanned Aerial Vehicles (UAVs) have revolutionized disaster management and insurance practices by providing rapid, high-resolution assessments of affected areas. Drones can access remote or hazardous regions, capture real-time imagery and support efficient data-driven decisions (Daud et al., 2022). In the insurance industry, drones have significantly shortened the time required to evaluate claims and verify property damage (Malaysia Insurance Online, 2018).

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In the U.S., insurers such as Allstate use drones to complete three property inspections per hour, compared to one per day using traditional methods (Shmat, 2018). In Malaysia, drones offer considerable advantages for rural homestays, which are often located in flood-prone or difficult-to-access areas. However, adoption is limited by regulatory constraints, lack of training, and affordability (Zulkifli et al., 2022). Furthermore, enhancing awareness and partnerships are needed to mainstream drone use in disaster prone in rural tourism settings.

The Impact of Digital Transformation towards Tourism and Insurance

The rise of digital transformation has impacted key industries such as tourism and insurance, necessitating rapid adaptation to technologies like drones, AI, and cloud computing to sustain competitive advantage (Haktanir et al., 2023). This growing trend underscores the potential value of integrating drone technology and takaful as innovative tools to improve the resilience and sustainability of Malaysia's homestay sector.

Integration of Drones with Takaful Operations

Integrating drones with takaful operations offers a modern and ethical solution to existing inefficiencies. Drones expedite the verification of claims, reduce fraud and ensure faster disbursement of funds (Ahmad et al., 2022). This not only improves operational efficiency but also aligns with *maqasid al-shariah*, particularly the protection of life and property (Al-Jayyousi et al., 2022). in addition, drone usage ensures assessors avoid risky on-site visits, preserving safety during disasters.

The visual evidence captured enhances trust between policyholders and providers, addressing skepticism surrounding takaful claim processes. When backed by clear Shariah guidelines and ethical frameworks, drone-assisted takaful claims can increase public confidence and participation. It reflects how modern technologies can complement Islamic finance to serve underserved rural populations.

Technology Acceptance Model (TAM) and the TOE Framework

The Technology Acceptance Model (TAM) posits that two primary beliefs which are perceived usefulness (PU) and perceived ease of use (PEU) influence the acceptance of new technology (Davis, 1989). In the case of drones in the homestay and takaful sectors, PU refers to operational benefits such as faster claim processing and better marketing, while PEU reflects how easily operators can use drones with minimal training.

Moreover, Ramlan (2024) further supports the application of the Technological, Organizational and Environmental (TOE) framework in understanding adoption decisions. TOE includes technological readiness, organizational capabilities and external pressures such as regulation and industry standards. Guillerme et al. (2020) argue that these frameworks offer a multi-dimensional lens to analyze drone adoption, particularly in small tourism enterprises. Together, TAM and TOE inform strategic policymaking and stakeholder training to accelerate technology diffusion in Islamic finance and rural tourism.

Methodology

This research employed a qualitative case study methodology to explore the integration of drone technology with takaful services and its impact on homestay performance. The study adopted a constructivist epistemology, focusing on stakeholder experiences and perceptions. Data collection was conducted through semi-structured interviews with 20 experts, including

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drone engineers, takaful managers, disaster response personnel, and Shariah scholars. Additionally, three homestay operators from Selangor and Negeri Sembilan were interviewed to gain grassroots perspectives.

A disaster simulation exercise was conducted over four days in Melaka, featuring drones for post-disaster inspections. In addition, organizations such as NADMA, Aerodyne, and forensic units participated. The simulation measured drone accuracy, efficiency, and adaptability under various disaster scenarios. Complementary document analysis included takaful policy manuals, regulatory documents and drone operation guidelines.

Next, the data from the simulations were transcribed and coded using ATLAS.ti. Then, thematic analysis was guided by the TAM and TOE frameworks and aligned with Shariah ethical considerations. The themes were triangulated across interviews, field observations and document reviews to ensure validity and consistency.

Findings

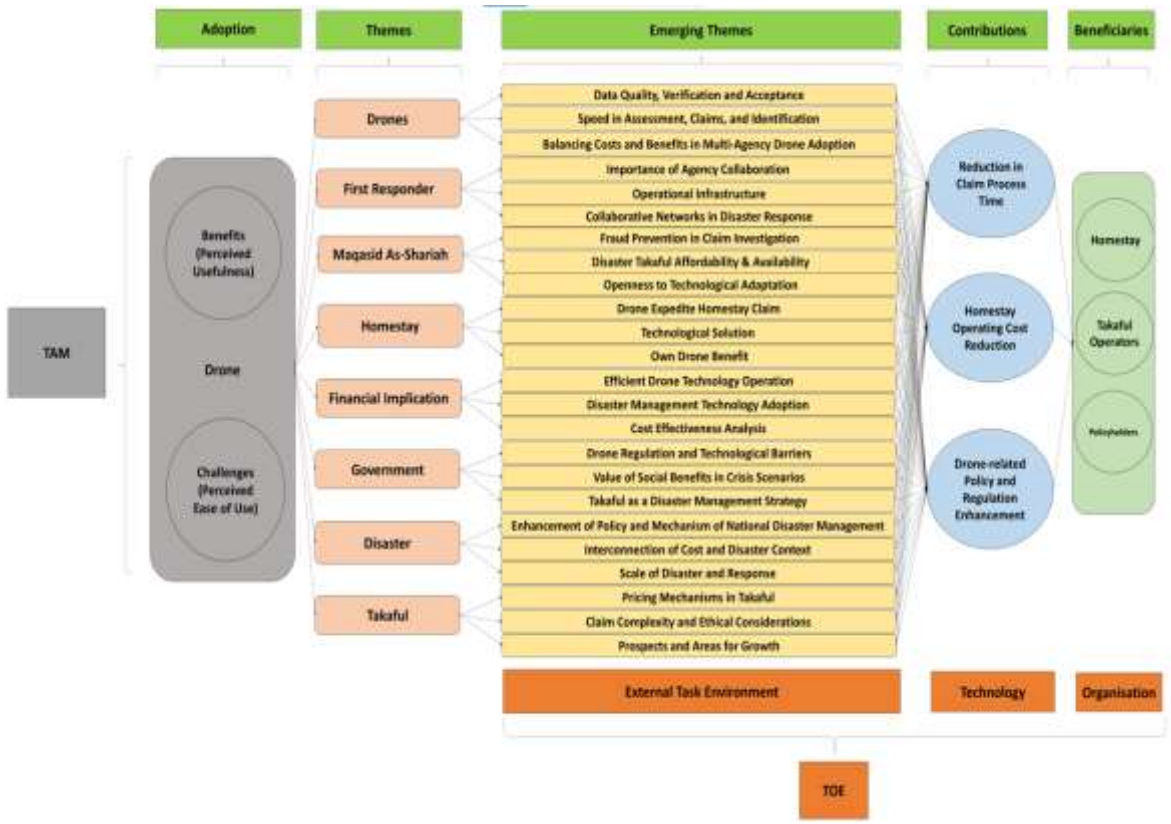

Figure 1: Model For Drone Adoption by Homestay Operator

Based on the interview and simulation findings revealed significant improvements in claims processing when drones were utilized. Drones reduced the average claim assessment time from 14 days to under 5 days (Muhamat et al., 2017; Ahmad et al., 2022). Homestay operators noted that drone-assisted documentation enhanced transparency and speed up approvals. One operator in Selangor mentioned, "Using drone footage helped my takaful agent approve the claim in just a few days compare to before this, we used to wait weeks."

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Marketing Impact When Using Drones

In addition, drones also had a strong marketing impact. Operators who used drone imagery for online promotion reported increased web traffic, more bookings and better customer engagement. Hence, several expressed interest in forming cooperatives to share drone ownership and reduce individual costs.

Regulatory Complexity, Limited Operator Training and Privacy Concern

Despite these benefits, challenges were evident. Regulatory complexity, limited operator training and fears over privacy and surveillance discouraged widespread adoption (Daud et al., 2022; Zulkifli et al., 2022). Nonetheless, all respondents agreed that integrating drones into takaful workflows aligns with Islamic ethics, particularly in protecting community welfare and dignity.

Implications

This study has important implications for policy makers, Islamic finance institutions, and homestay operators. Policymakers need to create supportive regulations that allow for responsible drone use in post-disaster contexts while safeguarding privacy and data rights (Shmat, 2018). Meanwhile for Takaful operators, they should consider partnerships with drone companies to streamline operations, improve claim accuracy, and enhance customer satisfaction (Ahmad et al., 2022).

On top of it, for homestay businesses, drones present a dual opportunity. Firstly, in term of operational efficiency and the second on is acting as promotional power. Drone cooperatives or shared ownership models can reduce the technology's entry cost, making it accessible to rural communities (Ali et al., 2021). Educators and NGOs should develop localized training modules to ensure safe and ethical drone usage.

Significances of the Study

This study is significant because it bridges Islamic finance, emerging technology and homestay program where all these areas often studied separately. It provides a practical model for integrating innovation with Shariah-compliant finance, promoting resilience and ethical development (Al-Jayyousi et al., 2022). The findings enhance understanding of TAM and TOE frameworks in real-world contexts, supporting their application in rural technology adoption (Guillerme et al., 2020).

Moreover, for scholars, the research contributes to the literature on ethical fintech and CBT performance. Meanwhile, for practitioners, it offers a roadmap for digital transformation in low-income tourism communities. The study also aligns technological advancement with religious values, demonstrating that the two can coexist in mutually reinforcing ways.

Limitations

Although the findings offer valuable insights, several limitations must be acknowledged. The qualitative approach limits generalizability beyond Malaysia. The small sample size may not reflect all possible viewpoints, particularly in regions with different disaster risk profiles (Creswell, 2009). The simulation was controlled and may not fully represent real-life unpredictability in disaster response (Ahmad et al., 2022).

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Furthermore, the study did not evaluate cost-benefit metrics of drone integration, nor did it assess tourist perceptions of drone use in rural settings. Future studies should apply mixed methods and include broader stakeholder groups such as guests, government planners and drone vendors. Exploring UTAUT or other models may provide additional insights into behavioral intention.

Conclusion And Recommendations

The integration of drone technology with takaful presents a high-impact solution for improving homestay resilience and sustainability in Malaysia. Drones enhance operational performance by expediting claims, improving promotional content and supporting safe disaster assessments. Takaful processes become more transparent and aligned with Islamic ethics, particularly in protecting life and property.

This study recommends greater investment in drone infrastructure, targeted training for homestay operators and regulatory frameworks that support ethical drone usage. Additionally, collaborative models like shared drone ownership among rural entrepreneurs could lower barriers to entry. Further research should assess economic feasibility, stakeholder trust, and cross-border replicability.

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