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Building a Future Halal Tourism Model in the Takabonerate Atoll Area through the Synergy of Smart Tourism and Conservation

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ABSTRACT

The global tourism landscape has transformed into a value-based industry, with the Halal Tourism segment experiencing phenomenal growth. Indonesia has a comparative advantage to dominate this market, as evidenced by its top ranking in the Global Muslim Travel Index. However, development in eastern regions, such as Takabonerate National Park, the world's third-largest atoll, faces a fundamental paradox. The atoll's world-class ecological potential is inversely proportional to its vulnerability to uncontrolled tourism pressures and limited halal infrastructure, such as access to clean water for ablutions and precise determination of the direction of the Qibla at sea. This study aims to formulate a new management model to fill the strategic gap and literature that tends to discuss Halal Tourism, Conservation, and Smart Tourism separately. Using a descriptive qualitative approach, this study proposes the "Takabonerate Smart Halal Eco-System" model. This model consists of three synergistic pillars: Smart Halal Services (e.g., Digital Qibla and E-Halal Traceability for thayyib assurance), Digital Conservation (e.g., IoT Environmental Monitoring and E-Ticketing based on carrying capacity quota), and Community-Based Digital Economy. This model positions digital technology as a bridge (enabler) that harmonizes human vertical needs (worship/halal) with their horizontal responsibilities to nature (conservation). The synergy of the three produces a spiritual, sustainable, and seamless tourism model, while also providing a practical roadmap for its gradual implementation.

Keywords: Halal Tourism; Smart Tourism; Conservation; Takabonerate Atoll.

INTRODUCTION

Over the past two decades, the global tourism landscape has undergone a significant paradigm shift. Tourism is no longer viewed simply as a hedonistic recreational activity, but has transformed into a value-based industry, where lifestyle preferences and religious beliefs play a central role in travelers' decision-making. One market segment experiencing phenomenal growth is Muslim-friendly tourism, better known as halal tourism. This phenomenon is driven by the growth of the global Muslim population, which is projected to reach 2.2 billion by 2030, equivalent to 26.5% of the total world population.(DinarStandard, 2022)This demographic growth is directly proportional to the increasing purchasing power of the Muslim middle class, which is increasingly aware of the need for travel that does not conflict with sharia principles.

Indonesia, as the country with the largest Muslim population in the world, naturally has a comparative advantage to dominate this market. The 2023 Global Muslim Travel Index (GMTI) report once again ranked Indonesia at the top of the world's top halal tourism destinations, alongside Malaysia. (CrescentRating, 2023)This achievement confirms that the national tourism ecosystem has begun to adapt to the needs of the global Muslim market. However, upon closer examination, halal tourism development in Indonesia still exhibits significant spatial disparities. Development and promotion remain concentrated in "old players" such as Lombok (West Nusa Tenggara), West Sumatra, and Aceh. Meanwhile, Eastern Indonesia, particularly South Sulawesi, the main gateway to the eastern region, has yet to fully utilize the halal tourism narrative as its primary branding, despite its strong Islamic cultural foundation.

Amidst the discourse on developing new destinations, Takabonerate National Park in the Selayar Islands Regency has emerged as an entity offering a unique value proposition. This area is more than just an ordinary marine destination; Takabonerate is a world-class geological and ecological monument. As the third-largest atoll in the world after Kwajalein in the Marshall Islands and Suvadiva in the Maldives, Takabonerate covers a total area of 530,765 hectares, with coral reefs that provide habitat for thousands of marine species.(RI, 2022) Its geographical position in the heart of the Coral Triangle makes it a "Blue Paradise" that holds enormous tourism economic potential.

However, this enormous potential carries with it equally great vulnerability. Atoll ecosystems are among the most fragile in the world. These geological structures, formed from the accumulation of dead and living coral over thousands of years, are highly sensitive to changes in water temperature, pollution, and physical stress from human activity. Herein lies a fundamental paradox in tourism development in conservation areas: on the one hand, tourism is expected to be an economic engine that improves the welfare of Selayar's coastal communities and funds independent conservation efforts; but on the other hand, uncontrolled mass tourism has the potential to become a major agent of destruction. The carbon footprint from transportation, liquid waste from accommodations, plastic waste, and even physical damage to the coral reefs from irresponsible snorkeling activities are real threats that could turn this paradise into an ecological hell in a short time. (Roberts, 1994).

The challenges in Takabonerate become even more complex when we consider the characteristics of the modern halal tourism target market. Today's Muslim travelers, particularly Millennials and Gen Z (Muslim Millennial Travelers/MMTs), have a psychographic profile that differs significantly from previous generations. For them, halal tourism is no longer simply about the availability of pork-free food or the absence of alcohol. The concept of halal has evolved into a lifestyle encompassing Thayyib (good, healthy, high-quality, and ethical) aspects. (Battour, M., & Ismail, 2016).

Modern Muslim travelers demand a holistic travel experience: they seek Instagrammable natural beauty and authentic cultural interactions, while still demanding hygienic and private prayer facilities. In remote islands like Takabonerate, meeting these basic spiritual needs often presents serious logistical challenges. The limited availability of clean fresh water for ablution on coral islands, the difficulty of determining the precise direction of the Qibla in the vast ocean, and doubts about the halal status of animal slaughtering or food preparation at local food stalls create friction that hinders the comfort of Muslim travelers

Furthermore, the concept of Khalifah fil Ard (leader/manager on earth) in Islamic theology teaches humans the obligation to maintain the balance of nature. This creates a strong connection between Islamic values and the principles of environmental conservation. Unfortunately, the narrative linking halal tourism with environmental conservation (Eco-Halal Tourism) has not been systematically implemented

in Takabonerate. This segment of tourists tends to be loyal and willing to pay more for services that ensure both Sharia compliance and environmental sustainability.

In facing the complexity of these challenges—balancing tourism economic growth, preserving the fragile atoll ecology, and meeting stringent halal service standards—conventional approaches are no longer sufficient. In the era of the Industrial Revolution 4.0 and welcoming Society 5.0, the integration of digital technology is a necessity. The concept of Smart Tourism offers a relevant solution framework. Gretzel et al. define Smart Tourism as a tourism ecosystem supported by integrated efforts to collect and aggregate data originating from physical infrastructure, social connections, government sources, and organizational bodies, combined with advanced technology to create efficiency, sustainability, and enrich experiences. (U. Gretzel, H. Werthner, C. Koo, 2015)

The implementation of Smart Tourism in conservation areas like Takabonerate is not just about providing free Wi-Fi access on the beach. It's more than that, it's about how Internet of Things (IoT) technology can be used to monitor coral reef health in real-time, how Big Data can be used to analyze tourist movement patterns to prevent overtourism at a single dive site, and how mobile apps can become personal assistants that guide tourists to find the accurate direction of the Qibla or verify the halal certification of a local seafood restaurant simply by scanning a QR code.

However, the reality on the ground shows a wide digital divide. Telecommunications infrastructure in the islands is often unstable, and the digital literacy of local communities still needs to be improved. Furthermore, existing academic literature tends to discuss the three main variables Halal Tourism, Atoll Conservation, and Smart Tourism—in silos. Studies on Smart Tourism mostly focus on urban destinations (Smart Cities), while studies on atoll conservation often neglect the technology-based spiritual aspects of visitor management.

The absence of an integrative model that unites these three elements creates a strategic vacuum in Takabonerate's development. Without the intervention of a new, intelligent, values-based management model, Takabonerate risks falling into two dire scenarios: failing to thrive due to a lack of global-standard amenities, or rapidly developing but ecologically devastated and losing its local identity.

Therefore, this research is highly urgent. This research aims not only to fill the gap in academic literature but also to offer a practical roadmap. Through the title "Building a Future Halal Tourism Model in the Takabonerate Atoll Region through the Synergy of Smart Tourism and Conservation," the author attempts to formulate a new paradigm. A paradigm in which digital technology serves as a bridge (enabler) that harmonizes human vertical needs (worship/halal) with their horizontal responsibilities towards nature (conservation).

The model proposed in this study is expected to serve as a blueprint for the development of other marine conservation areas in Indonesia with similar demographic and geographic characteristics. Therefore, the vision of making Takabonerate a world-class, sustainable, intelligent, and prosperous halal ecotourism destination is not merely a utopia, but a measurable and achievable future

LITERATURE REVIEW

This chapter outlines the theoretical and conceptual foundations that form the basis of the research analysis. The discussion focuses on three main variables: the evolution of the halal tourism concept from a global and local perspective, the Smart Tourism paradigm in the context of natural

destinations, and the urgency of atoll ecosystem conservation. Finally, the chapter synthesizes these three variables into an integrative framework, which constitutes the novelty of this research.

The Concept of Halal Tourism: From Dogma to Lifestyle

Definition and Paradigm ShiftHistorically, Islamic tourism has often been misunderstood as limited to pilgrimages (Hajj and Umrah). However, in the last decade, there has been a significant shift in terminology and substance toward what is now known as Halal Tourism. Battour, which provides a comprehensive definition that has become a global academic reference, defines halal tourism as "any object or action permitted by Islamic teachings for use or involvement by Muslim tourists in the tourism industry."(Ismail, 2016)This definition emphasizes that halal tourism does not aim to transform tourist destinations into exclusively religious destinations ("Islamization"), but rather emphasizes the provision of extended services that facilitate Muslim tourists to continue practicing their religious laws while on vacation.

It's important to note that halal tourism is inclusive, not exclusive. Facilities such as hygienic halal food and clean toilets (Muslim-friendly toilets with running water) are essentially quality standards that all travelers can enjoy, regardless of their religious background. Therefore, El-Gohary suggests that halal tourism should be viewed as a niche market strategy that offers ethically based quality assurance. (El-Gohary, 2016).

Dimensions of Muslim Visitor NeedsIn an operational context, the needs of Muslim tourists are not homogeneous. CrescentRating categorizes these needs based on their level of urgency. First, Primary Needs (Need to Have): The availability of halal food is essential. In the context of marine tourism, such as in Takabonerate, the challenge lies not only in raw materials (sea fish are generally halal), but also in the supply chain and cooking process, which are free from cross-contamination with non-halal ingredients such as alcohol or pork fat. Second, Need for Worship Facilities (Good to Have): Muslim tourists require prayer rooms that are not merely "available" but also meet the requirements of purity (thaharah). Challenges in remote island areas include the availability of sufficient fresh water for ablution and certainty about the direction of the Qibla. Disorientation often occurs in the middle of the sea or on small islands far from settlements, so the lack of Qibla signs can be a source of spiritual anxiety for tourists. Third, the Need for Privacy and Ethics (Nice to Have): Muslim families often seek destinations that are "safe" from vulgar hedonistic activities. In addition, water recreation facilities such as snorkeling or diving areas that allow the use of sharia swimwear (burkini) without stigma are becoming an increasing preference.

Integration of the Halal and Thayyiban ConceptRecent research has begun to link halal tourism to the concept of Thayyib (good, healthy, and quality). Henderson argues that the "Halal" label should not only focus on the substance itself, but also on the method of its production.(Henderson, 2016a)Halal food obtained through environmentally damaging means (e.g., fish caught in bombs) essentially contradicts the principles of Thayyib. This perspective is particularly relevant for Takabonerate, which demands that halal tourism there also be environmentally friendly (Eco-Halal)

Smart Tourism and Digital Transformation: Intelligent Ecosystems in Natural Destinations

Smart Tourism Architecture and ComponentsEntering the era of the Industrial Revolution 4.0, tourism is transforming into a data-driven industry. Smart tourism is defined as tourism supported by integrated efforts at a destination to collect, aggregate, and utilize data for service innovation, operational

efficiency, and enhanced tourist experiences. (Gretzel, 2015). Gretzel et al. emphasize that Smart Tourism relies on a technology ecosystem consisting of three main layers:

1. Infrastructure Layer (Cloud & IoT): The physical foundation includes internet networks, cloud data centers (Cloud Computing), and the Internet of Things (IoT) that connects physical objects to the digital world.
2. Data Layer (Big Data Analytics): The ability to process raw data into useful information. For example, analyzing tourist movement patterns to prevent congestion at specific tourist spots.
3. Service Layer (Apps & Interfaces): Touchpoints with tourists via mobile apps, websites, or Augmented Reality (AR) technology.

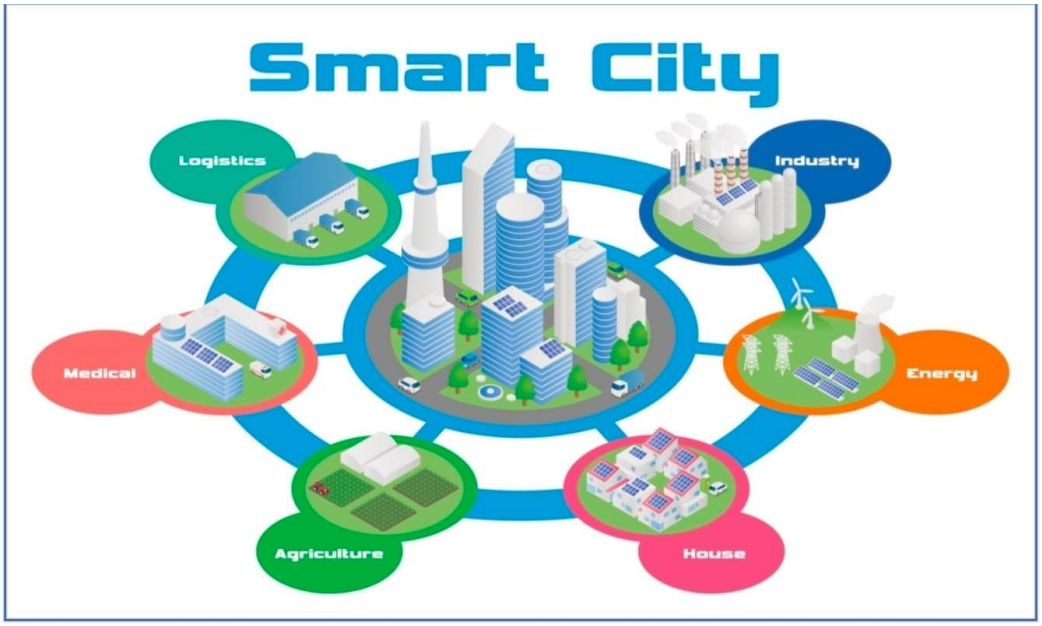

Figure 2.1 Smart City

Implementation of Smart Tourism in Natural Destinations (Smart Nature) The application of this concept in conservation areas or national parks (Smart Park) has different characteristics than in urban areas (Smart City). In natural destinations like Takabonerate, technology must act as an "invisible enabler" to avoid damaging the natural aesthetic. Its primary functions are divided into three phases of the journey:

1. Pre-tour (Planning): Precision digital marketing uses AI algorithms to target special-interest travelers (e.g., Muslim eco-tourists). An online reservation system integrated with visitor quotas (carrying capacity) serves as a key control tool to prevent overtourism.
2. In-tour (Experience & Management):

    a. *Navigation & Safety:* The use of GPS and geo-fencing to monitor tourists' positions. If tourists enter the core zone (red conservation zone) or a danger area, the system will send an automatic warning notification to their mobile phone. (Amaranggana, 2014).

b. *Digital Interpretation:* Replacing physical information boards susceptible to damage from seawater corrosion with QR or AR codes, visitors can scan specific corals to receive encyclopedic information about the species in real time, creating an immersive educational experience.

3. Post-tour (Evaluation): The use of User Generated Content (UGC) and sentiment analysis on social media to evaluate visitor satisfaction and monitor environmental conditions based on reports from residents/tourists (Crowdsourcing).

Infrastructure Challenges and the Digital DivideBuhalis and Amaranggana caution that the success of Smart Tourism relies heavily on connectivity. In archipelagic regions, white-out areas are a real obstacle. Therefore, the Smart Tourism model in Takabonerate cannot rely entirely on a continuous online connection. A hybrid approach or an application with offline mode features is a technical solution that should be considered in the literature.

Atoll Conservation and Ecotourism: Fragility and Carrying Capacity

Ecological Characteristics of Atolls and Their VulnerabilityTakabonerate National Park represent an atoll ecosystem, a unique geological structure formed by the growth of coral reefs around a slowly sinking volcanic island. Kench explained that atoll islands are highly dynamic and fragile.(Kench, 2005)This vulnerability includes sensitivity to rising sea temperatures, which trigger coral bleaching, and physical damage from human activities. Unlike continental islands, atolls have very limited freshwater resources (groundwater lenses), making them highly vulnerable to exploitation by mass tourism.

Ecotourism as a Sustainable SolutionEcotourism exists as the antithesis of mass tourism. The International Ecotourism Society (TIES) defines ecotourism as responsible travel to natural areas that conserves the environment, supports the well-being of local communities, and involves interpretation and education.((TIES), 2015). The main principles of ecotourism relevant to Takabonerate include:

1. Conservation: Tourism should make a direct financial contribution to nature conservation.
2. Community Empowerment (Community Based): Local communities must be subjects (actors), not objects. This is crucial because coastal communities are often at the forefront of protecting or, if not empowered, destroying coral ecosystems.
3. Education: Tourists come to learn, build environmental and cultural awareness.

Carrying Capacity and LAC ConceptIn atoll management, the concept of carrying capacity is fundamental. O'Reilly differentiates it into physical carrying capacity (space), ecological (ecosystem tolerance), and social (comfort).(O'Reilly, 1986)However, the modern conservation paradigm has shifted from simply limiting numbers to the concept of Limits of Acceptable Change (LAC). LAC focuses more on impact monitoring: how much environmental change is tolerable? This is where Smart Tourism technology (such as IoT sensors) can play a role in providing accurate data for implementing LAC policies, replacing slow and imprecise manual methods.

Framework of Thinking: Three Pillars Synergy (The Nexus Framework)

This research starts from the premise that Takabonerate management cannot be carried out in isolation. There is an urgent need to synergize the three variables mentioned above into a single, comprehensive framework. Interconnection Between Variables:

1. Halal & Conservation (The Ethical Bond): Both share strong overlapping values. In Islam, humans are Khalifah fil Ard (leaders on earth) tasked with prospering the earth, not destroying it. The concept of Himah (conservation zones in Islam) aligns with national park zoning. Halal tourism in Takabonerate should be interpreted as an implementation of religious observance of nature.
2. Smart & Halal (The Service Enabler): Technology is breaking down barriers to worship in remote locations. Satellite-based Qibla direction apps, digital prayer schedules that adapt to island coordinates (geo-tagging), and blockchain-based food halal verification are examples of how Smart Tourism serves the needs of Halal Tourism.
3. Smart & Conservation (The Management Tool): Technology is the eyes and ears of national park managers. Water quality sensors, trash-monitoring drones, and digital ticketing systems are tools for efficiently enforcing conservation regulations.

Conceptual Model: "Smart Halal Ecotourism System"Based on this literature review, the author proposes a framework in which Halal Tourism provides an ethical and market foundation (who visits), Conservation safeguards the destination's core assets (what is visited), and Smart Tourism provides management tools (how to manage it). The synergy of these three will produce a tourism model that:

1. Spiritual: Fulfilling the spiritual needs of tourists.
2. Sustainable: Ensuring long-term sustainability.
3. Seamless: Providing an easy and convenient experience through technology.

This framework of thinking is the basis for the formulation of the model that will be discussed in the Results and Discussion chapter, answering the challenges of managing marine tourism destinations in the digital era.

RESEARCH METHODS

Research Approach

This research uses a descriptive qualitative approach with a case study method. This approach was chosen to explore tourism phenomena in the specific Takabonerate area in depth and to design a model that is adaptive to the local context.

RESULTS AND DISCUSSION

This chapter presents the results of an analysis of the existing conditions of Takabonerate National Park (TNTB) and formulates a proposed conceptual model. The discussion focuses on synthesizing field findings with a theoretical framework involving halal tourism, atoll conservation, and the implementation of Smart Tourism

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Analysis of the Existing Conditions of Takabonerate: An Ecological and Spiritual Dilemma

An analysis of Takabonerate's existing conditions reveals a profound dichotomy between its natural potential and infrastructure readiness. Based on observations and literature reviews, the area possesses an undeniable key strength: its globally recognized underwater beauty, marked by its status as the third-largest atoll in the world. The serenity of the island also offers a unique attraction for tourists seeking tranquility and relaxation (wellness and healing tourism). This strength is reinforced by international recognition in the form of UNESCO Biosphere Reserve status, which provides high brand value and affirms the region's commitment to conservation. (UNESCO, 2017).

However, these internal strengths are offset by significant structural weaknesses. One major obstacle is difficult accessibility; the long, multimodal journey from downtown Makassar creates physical barriers that limit visitation. More critically, from a halal tourism perspective, adequate sanitation and prayer facilities on small islands remain minimal. Access to clean water for ablution (wudu) is a technical challenge that requires specific solutions, given the limited and brackish freshwater resources on the atolls. This challenge directly creates spiritual anxiety for Muslim tourists, reducing their comfort in performing their religious duties. (El-Gohary, 2016).

From a digital perspective, uneven internet infrastructure in some remote areas is a major obstacle to implementing Smart Tourism. Although the conservation area reservation and entry permit system (SIMAKSI) has begun to be digitized, it remains partial and not fully integrated with tourism amenity services such as homestay reservations or diving equipment rentals.

Strategic Analysis (Narrative SWOT)

Takabonerate currently faces significant opportunities, particularly with the rise of the Muslim digital nomad trend and the growth of the global halal tourism market seeking off-the-beaten-path destinations with Sharia-compliant standards. Central government support through the "10 New Balis" program, which positions Selayar as a buffer zone, is also a powerful political catalyst. However, this potential is overshadowed by real threats. Coral reef damage due to climate change and plastic waste pose ecological risks that could destroy the destination's key assets. In terms of competition, Takabonerate must compete with other marine destinations like Wakatobi or Raja Ampat, which may have more established infrastructure and global promotion.

Strategically, weaknesses in digital infrastructure directly limit opportunities to capture the Muslim digital nomad market. If tourists arrive but cannot work or access essential information (digital services), they will turn to other destinations. Therefore, the proposed solution must be a model that can transform weaknesses into strengths by leveraging technology to mitigate ecological threats and fulfill spiritual needs.

Building a Model: "*Takabonerate Smart Halal Eco-System*"

Based on an analysis of existing conditions and a synthesis of the literature, this study proposes an integration model called the "Takabonerate Smart Halal Eco-System." This model is designed to address the trilemma (economy, ecology, and spirituality) faced by the atoll region, by positioning technology as an enabler that connects halal tourism ethics with conservation principles. This model consists of three main, synergistic components: Smart Halal Services, Digital Conservation, and a Community-Based Digital Economy.

Smart Halal Services: Ensuring Peace of Mind During Worship

This component focuses on the use of ICT to overcome physical limitations in ensuring the comfort of worship and the halal needs of tourists amidst the geographical limitations of the archipelago.

1. Digital Qibla & Prayer Time Precision: In the middle of the ocean, determining the direction of the Qibla can be confusing and requires complex astronomical calculations. This model proposes providing precise digital coordinates embedded through geo-tagging technology at every cottage, dock, and tourist boat. An integrated application will use GPS algorithms to display the accurate direction of the Qibla in real time as well as prayer times according to the position of the sun at those coordinates. This effectively eliminates the spiritual anxiety of Muslim tourists, in line with the principle of Maqasid Syariah (protection of religion/faith). (Ismail, 2016).
2. E-Halal Food Traceability (Halal, Safe, and Ethical Trace): Technology is being used to build trust through transparency. The app allows tourists to scan QR codes on local seafood menus. The system not only verifies that the food is halal (halal certification) but also provides information on the origin of the fish. By knowing that the fish were caught with lines (environmentally friendly) and not with fish bombs (destructive), tourists are assured of thayyib (good, ethical, and sustainable). The implementation of this system also encourages local fishermen to shift away from destructive fishing methods. (Henderson, 2016).
3. Virtual Mosque Locator & Thaharah Assistance: This GIS-based digital map serves as a critical prayer guide. This feature not only shows the location of the nearest prayer room within the island group but also provides information on the availability of adequate fresh water for ablution. For atolls where fresh water is scarce, the app can provide tips or specific locations where clean water is available, helping tourists fulfill the requirements for purification before prayer, thus addressing the technical sanitation challenges identified in the existing condition analysis.

Digital Conservation: Maintaining the Atoll's Carrying Capacity

The second pillar is the application of Smart Tourism technology as an effective management tool to ensure that tourism does not exceed the carrying capacity of the highly sensitive atoll environment.

1. IoT Environmental Monitoring (Water Quality Monitoring System): The installation of water quality and temperature sensors at key diving spots and snorkeling areas is the core of digital conservation. These sensors continuously transmit data to a cloud server. This data, accessible to tourists through an app, serves as an ecological early warning system. If the sensors detect excessively high-water temperatures (an indication of coral bleaching risk), the app automatically notifies management and recommends other spots. This action is a real-time implementation of the Limits of Acceptable Change (LAC) theory, distributing visitor load (distributing ecological pressure) and preventing overtourism at a critical point.(U. Gretzel, H. Werthner, C. Koo, 2015).
2. E-Ticketing & Dynamic Quota Management (Capacity Control): The online reservation system is fully integrated with the daily carrying capacity policy for each island or zone in TNTB. This intelligent e-ticketing system automatically closes ticket sales once the daily quota (e.g., 150 visitors per day for Tinabo Island) has been reached. This is a robust administrative mechanism to prevent overtourism, ensuring that visitor numbers do not damage natural assets. Data from this

3. system can also be used to predict peak visitor numbers and allocate conservation resources more efficiently.
4. Conservation Gamification (Eco-Gamification): To increase tourist participation in environmental protection, this model proposes a gamification element. The travel app awards points (rewards) to tourists who take pro-conservation actions, such as uploading photos of collected plastic waste (marine debris hunters) or reporting coral damage. These points can be exchanged for discounts on diving equipment rentals, souvenirs from local MSMEs, or extended stays. This approach leverages Gen Z's behavioral psychology to transform conservation obligations into a fun and rewarding activity. (CK Lee, YJK Kim, 2019).

Community-Based Digital Economy

This component focuses on the direct and fair transfer of economic benefits from tourism to the local Selayar community, ensuring sustainable livelihoods.

1. Integrated Local MSME Marketplace: The digital platform provides a platform for communities to sell crafts, Selayar culinary specialties, and tourism services (boat rentals and guide services). This platform cuts the chain of middlemen, ensures fairer prices for local producers, and minimizes economic leakage from the region. Cashless transactions integrated into the marketplace also increase financial inclusion in coastal communities.
2. Sharia Homestay Training and Marketing Digitalization: Educating homestay owners about Muslim-friendly service standards (strict cleanliness, provision of clean prayer equipment, and privacy) is imperative. Certified homestays will be marketed through online travel agent (OTA) platforms integrated with the "Verified Halal/Muslim-Friendly" badge from the Takabonerate Super App. This digital marketing initiative opens up access to a broader international market without having to rely on conventional travel agents.

Phased Implementation Strategy: Transformation Roadmap

Implementation of the “Takabonerate Smart Halal Eco-System” model requires a realistic, phased strategy, considering budget constraints and geographical challenges.

1. Short Term (1-2 Years): Human Resource Foundation and ReadinessThe main focus is to address fundamental weaknesses (infrastructure and literacy).
    a. Priority Infrastructure: Strengthening the 4G network, particularly on Tinabo Island and the main port. Installing renewable energy (solar panel) Wi-Fi hotspots in select public areas.
    b. Digitalization of Administration: Total digitalization of the licensing system (SIMAKSI) and integration with digital payments (QRIS).
    c. Digital Literacy & Halal: Basic halal tourism training for the community (including sanitation standards) and basic application operation training for local MSMEs.
2. Medium Term (3-5 Years): System Integration and ExpansionThis phase is the core implementation of the proposed model.
    a. Full Application Development: Launch of the integrated application "Takabonerate Super App" with Digital Qibla, Virtual Mosque Locator, and fully functional E-Ticketing features with Quota Management.
    b. Massive Certification: Accelerated halal certification program for all culinary and homestay service providers operating in and around TNTB.
    c. Technology Installation: Pilot project installation of environmental IoT sensors at 3-5 main dive spots

3. Long Term (>5 Years): Data Optimization and GlobalizationThis phase focuses on leveraging advanced data for global management and branding.
    a. Application of Artificial Intelligence (AI): Data collected from IoT sensors and e-ticketing over five years was used to train an AI algorithm. The AI can predict future coral bleaching risk levels or dynamically optimize ticket prices based on demand (dynamic pricing).
    b. Global Promotion: Promote Takabonerate on the international stage (especially the Middle East and European markets) as a "World Class Smart Halal Ecotourism Destination", capitalizing on its UNESCO status and smart management model.

This implementation model and strategy offers a structured roadmap, enabling Takabonerate to transform from a destination facing an ecological dilemma into a smart, ethical and sustainable Blue Paradise.

Conclusion

Research on the synergy of Smart Tourism, Halal Tourism, and Conservation in Takabonerate produced three main conclusions that address the challenges of managing atoll areas in the digital era.

1. Paradigm Shift as a Sustainability Imperative. The future of Takabonerate as the world's third largest atoll destinationcannot be achieved through mass tourism which threatens its fragile ecosystem. The solution is a shift towards a value-based tourism model that emphasizes spirituality and sustainability. The region's main strength is its natural beauty.and UNESCO Biosphere Reserve status, must be protected by the principles of Halal Tourism which are rooted in the ethics of Khalifah fil Ard (the obligation to protect nature).

2. Effectiveness of the "Takabonerate Smart Halal Eco-System" Model. The proposed integrative model proved to be conceptually effective in addressing two main types of barriers found in the existing condition analysis:

- **Spiritual and Physical Barriers:** Smart Halal Services uses technology to eliminate the spiritual anxiety of Muslim tourists. for example, Digital Qibla provides precise Qibla direction in the middle of the ocean, and Virtual Mosque Locator overcomes the technical challenge of providing fresh water for thaharah on small islands.
- **Ecological and Management Barriers:** Digital Conservation uses technology as a conservation control tool. The installation of IoT (Internet of Things) sensors allows real-time monitoring of coral bleaching risks, while an automatic E-Ticketing system controls the daily visit quota (Carrying Capacity), thus preventing overtourism.

3. Priority-Based Implementation Strategy.

This transformation must be implemented in stages. The key to short-term success (1-2 years) lies in strengthening 4G infrastructure and digitizing licensing administration (SIMAKSI). The key to medium-term success (3-5 years) is system integration through the "Takabonerate Super App." Meanwhile, the long-term (>5 years) involves advanced data utilization, such as the application of Artificial Intelligence (AI) to optimize visitor management and global promotion. The synergy of these three pillars ensures that Halal Tourism provides an ethical and marketable foundation, Conservation safeguards key assets, and Smart Tourism provides efficient management tools.

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