MIKAILALSYS
Journal of Multidisciplinary Sciences

e-ISSN : 2987-2286
p-ISSN : 2987-3924

Index: Harvard, Boston, Sydney, Copernicus, Sinta 4, Scilit, Semantic, Google, etc

https://doi.org/10.58578/mikailalsys.v4i2.11343

Waste Management Strategies, Facility Enhancement, and Accident and Disaster Mitigation at Angke Kapuk Nature Tourism Park in Promoting the Achievement of the Sustainable Development Goals (SDGs)

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Article Info:

Submitted:	Revised:	Accepted:	Published:
Jun 4, 2026	Jul 2, 2026	Jul 14, 2026	Jul 19, 2026

Abstract

Mangrove ecotourism destinations require integrated management strategies to address environmental degradation, deteriorating facilities, visitor safety, and climate-related coastal risks while contributing to the Sustainable Development Goals (SDGs). Taman Wisata Alam (TWA) Angke Kapuk, a 99.82-hectare mangrove ecotourism area in North Jakarta, faces persistent challenges involving marine debris, facility deterioration, limited risk-mitigation systems, and a decline in domestic tourist visits from 88,516 in 2022 to 43,734 in 2025. This study aims to analyze waste management, tourism facility improvement, and accident and coastal environmental risk-mitigation strategies at TWA Angke Kapuk in support of the SDGs. Grounded in Sustainable Tourism Development, Destination Management, and Ecotourism theories, the study employed a descriptive qualitative case study design. Data were collected through semi-structured interviews with government representatives, site managers, tour guides, and visitors, supplemented by field observations and documentation. Internal and external strategic factors were examined using SWOT analysis

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supported by IFAS and EFAS matrices. The findings indicate that waste management incorporates segregated bins, internal waste sorting, collaboration with a waste bank, and debris nets, but remains constrained by limited personnel, low visitor awareness, inactive composting, and uncontrolled marine debris. Although tourism facilities are relatively complete, boardwalks, gazebos, bird observation towers, and toilets have deteriorated, while accessibility for persons with disabilities remains inadequate. Accident mitigation is still basic, whereas tidal flooding, extreme weather, and humidity-related infrastructure damage require adaptive coastal-risk management rather than exclusively disaster-oriented responses. IFAS and EFAS scores of 2.95 and 2.98, respectively, indicate a moderately strong internal position and a reasonable capacity to exploit external opportunities despite continuing threats. The study concludes that sustainable management at TWA Angke Kapuk is most directly associated with SDGs 11, 12, 13, 15, and 17, while SDG 14 constitutes a supporting linkage. These findings contribute an integrated strategic framework for mangrove ecotourism management and imply the need to strengthen visitor education, prioritize facility maintenance, implement adaptive coastal-risk mitigation, and expand multi-stakeholder collaboration.

Keywords: Coastal Risk Mitigation; Mangrove Ecotourism; Sustainable Development Goals; Sustainable Tourism Management; Waste Management

INTRODUCTION

Tourism is one of the strategic sectors that contributes significantly to the global economy. According to data from the United Nations World Tourism Organization (UNWTO), international tourism has experienced substantial growth over the past decades, accompanied by a shift in tourists' preferences toward ecotourism, which emphasizes sustainability, environmental conservation, and the empowerment of local communities (Kia, 2021; Yusuf & Kurniasih, 2024; Lasso & Dahles, 2023). As an archipelagic country endowed with abundant natural resources, Indonesia possesses considerable potential for ecotourism development, including mangrove ecotourism, which plays a vital role in protecting coastlines, providing habitats for biodiversity, and serving as a highly effective carbon sink (Aswim et al., 2023; Prihadi et al., 2023;Sukaryadi et al., 2020; Tjiong et al., 2021)

Angke Kapuk Nature Tourism Park (Taman Wisata Alam Angke Kapuk) is a mangrove ecotourism area covering approximately 99.82 hectares, located in Kamal Muara Village, Penjaringan District, North Jakarta. Managed by PT Murinda Karya Lestari under

the supervision of the Jakarta Natural Resources Conservation Agency (BKSDA Jakarta), the area functions as a mangrove conservation site, a nature-based tourism destination, and an environmental education center. Angke Kapuk Nature Tourism Park is characterized by rich biodiversity, comprising four true mangrove species (*Avicennia marina, Rhizophora mucronata, Sonneratia caseolaris,* and *Bruguiera gymnorrhiza*), 73 bird species, 19 reptile and mammal species, as well as a wide variety of coastal aquatic biota.

Despite its ecological significance, the area is confronted with serious challenges that threaten the sustainability of its functions. Visitor statistics reveal a continuous decline in domestic tourist arrivals, decreasing from 88,516 in 2022 to 75,295 in 2023, 46,560 in 2024, and 43,734 in 2025. This decline is attributable to both internal and external factors. Internal factors include suboptimal waste management practices, deteriorating tourism facilities, and the absence of an integrated accident mitigation system. External factors encompass increasing competition from commercial tourism destinations in PIK 2, as well as the accumulation of marine debris transported from surrounding coastal waters.

This study is motivated by the urgent need to strengthen the management of Angke Kapuk Nature Tourism Park in accordance with the principles of the Sustainable Development Goals (SDGs). Previous studies on mangrove ecotourism in Indonesia (Noor et al., 2021; Rachman et al., 2023; Rohmawati et al., 2022; Galvanis et al., 2024) have demonstrated that SDG-based management approaches generate significant positive impacts. Nevertheless, no previous study has specifically integrated the three principal aspects of waste management, tourism facility improvement, and accident and disaster mitigation within a single research framework while explicitly identifying their contributions to specific, disaggregated SDG targets rather than to the SDGs in general.

Theoretically, this study is grounded in the grand theory of Sustainable Tourism Development advanced by the World Tourism Organization (UNWTO), which asserts that tourism development must balance three central pillars—environmental sustainability, economic viability, and socio-cultural equity—so that its benefits can be sustained for present and future generations (Dobrea et al., 2023). This grand theory is further specified into two middle-range theories that guide the analysis: Destination Management Theory, which views a tourism destination as an integrated system of attractions, facilities, accessibility, safety, and stakeholders, and Ecotourism Theory, which positions environmental conservation and community empowerment at the core of nature-based tourism management. These three

layers of theory are applied hierarchically to examine the study's three main variables—waste management, facility improvement, and accident and coastal-risk mitigation—which are subsequently linked to the achievement of the SDGs as the most concrete and measurable operational framework for sustainability.

Based on this background, this study aims to: (1) analyze the waste management system implemented at Angke Kapuk Nature Tourism Park; (2) examine the current condition of tourism facilities and identify priorities for their improvement; (3) analyze accident mitigation and coastal environmental risk; (4) formulate sustainable management strategies based on SWOT analysis supported by IFAS and EFAS matrices; and (5) identify the specific contribution of these management strategies to the achievement of the Sustainable Development Goals (SDGs).

METHODS

This study employed a descriptive qualitative research approach to obtain an in-depth understanding of the management practices implemented at Angke Kapuk Nature Tourism Park (Taman Wisata Alam Angke Kapuk). Qualitative research is particularly appropriate for investigating complex social and environmental phenomena within their natural settings, enabling researchers to explore participants' experiences, perceptions, and contextual realities comprehensively (Nunkoo et al., 2020; Muhaimin et al., 2023).A descriptive qualitative design was selected because the present study sought to examine waste management practices, tourism facility enhancement, and accident and disaster mitigation strategies without manipulating the research setting or variables.

The study adopted a descriptive case study design, focusing on Angke Kapuk Nature Tourism Park as a single case representing an urban mangrove ecotourism destination. This design enabled a comprehensive exploration of the relationships among environmental management, tourism infrastructure, and disaster mitigation within the context of sustainable tourism development (Yin, 2018). The research specifically examined three principal dimensions of destination management: (1) waste management systems; (2) tourism facility conditions and improvement needs; and (3) accident and disaster mitigation practices. The findings from these three dimensions were subsequently integrated through SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to formulate sustainable management strategies aligned with the Sustainable Development Goals (SDGs).

Participants were selected using a purposive sampling technique, which allows researchers to recruit information-rich individuals possessing direct knowledge and experience relevant to the research objectives (Ahmad & Wilkins, 2025). The selection criteria included stakeholders actively involved in the management, supervision, operation, or utilization of Angke Kapuk Nature Tourism Park.

The participants consisted of seven key informants: (R1) the Resort Manager of Angke Kapuk Nature Tourism Park; (R2) a Forestry Extension Officer from the Jakarta Natural Resources Conservation Agency (BKSDA Jakarta) who also serves as the Head of the Resort; (R3) a local tour guide; and (R4–R7) four visitors representing diverse demographic backgrounds and visitation experiences. The inclusion of multiple stakeholder groups enabled the collection of diverse perspectives regarding operational management, visitor experiences, environmental conservation, and safety management.

The primary research instrument was the researcher (human instrument), who was responsible for planning, collecting, interpreting, and validating the data throughout the research process. To enhance consistency during fieldwork, the researcher employed interview guidelines, observation sheets, field notes, and documentation records as supporting instruments.

Data were collected through three complementary techniques. First, semi-structured interviews were conducted using flexible interview protocols that allowed participants to elaborate on issues related to waste management, tourism facilities, accident mitigation, and sustainable management practices while ensuring consistency across interviews. Second, field observations were undertaken to directly examine the physical condition of tourism facilities, waste management infrastructure, environmental conditions, visitor behavior, and the implementation of accident and disaster mitigation measures within the study area. Third, documentation analysis was conducted by reviewing secondary data, including management reports, visitor statistics provided by the Jakarta Natural Resources Conservation Agency (BKSDA), Google Reviews, photographs, policy documents, and other supporting administrative records relevant to destination management.

The combination of interviews, observations, and documentary evidence enabled comprehensive data triangulation and strengthened the richness of qualitative findings. The trustworthiness of the research was established following the criteria proposed by Lincoln and Guba (1985), namely credibility, transferability, dependability, and confirmability.

Credibility was achieved through source triangulation, whereby information obtained from destination managers, government representatives, tour guides, and visitors was systematically compared to identify converging and diverging perspectives.

Transferability was enhanced by providing rich descriptions of the research context, participant characteristics, and management conditions, thereby enabling readers to assess the applicability of the findings to similar ecotourism destinations. Dependability was ensured through systematic documentation of the research procedures, including interview protocols, observation records, and data analysis processes. Confirmability was maintained by preserving field notes, interview transcripts, documentary evidence, and analytical records to minimize researcher bias and ensure that interpretations were grounded in empirical evidence.

The collected data were analyzed using the interactive qualitative data analysis framework developed by Miles, Huberman, and Saldaña (2020), consisting of four sequential stages. (1) stage involved data reduction, in which interview transcripts, observation notes, and documentary evidence were organized, coded, categorized, and simplified according to the research objectives. (2) stage comprised data display, whereby the categorized information was presented in descriptive narratives, matrices, and comparative tables to facilitate interpretation. (3) stage involved SWOT analysis, which identified internal factors (strengths and weaknesses) and external factors (opportunities and threats) influencing the sustainable management of Angke Kapuk Nature Tourism Park. These factors were further weighted and rated using an Internal Factor Analysis Summary (IFAS) matrix and an External Factor Analysis Summary (EFAS) matrix, each factor being assigned a weight (0.0–1.0, totaling 1.00) and a rating (1–4), which were multiplied to obtain a weighted score; the sum of all weighted scores yields a total score ranging from 1.0 to 4.0, with 2.5 as the midpoint separating a weak from a strong position (Wibowo et al., 2021). The SWOT-IFAS-EFAS matrices jointly served as the basis for formulating strategic recommendations for improving waste management, tourism facilities, and accident and coastal-risk mitigation.

The final stage consisted of drawing conclusions and verification, during which interpretations were continuously refined through triangulation among interview data, field observations, and documentary evidence to ensure analytical consistency and validity.

Prior to data collection, the study obtained official research authorization through a SIMAKSI (Conservation Area Entry Permit) issued by the relevant conservation authority.

Participation was entirely voluntary, and all participants were informed about the objectives of the study before providing their consent. Confidentiality and anonymity were maintained throughout the research process, and all collected information was used exclusively for academic purposes in accordance with established ethical principles for qualitative research.

The study was conducted at Angke Kapuk Nature Tourism Park, located in Kamal Muara Village, Penjaringan District, North Jakarta, Indonesia, a protected mangrove ecotourism area covering approximately 99.82 hectares under the management of PT Murinda Karya Lestari and the supervision of the Jakarta Natural Resources Conservation Agency (BKSDA Jakarta). Fieldwork, including interviews, observations, and document collection, was undertaken during the 2026 research period.

RESULTS

The findings of this study are presented according to the three main research objectives, namely waste management, tourism facility improvement, and accident and disaster mitigation at Taman Wisata Alam (TWA) Angke Kapuk. The presentation of the results is based on field observations, semi-structured interviews with managers, government representatives, tour guides, and visitors, as well as documentation collected during the research process. The findings are organized systematically to describe the existing management conditions without interpretation.

The study found that TWA Angke Kapuk occupies approximately 99.82 hectares of rehabilitated mangrove forest located in North Jakarta. The conservation area supports high biodiversity, including four true mangrove species, 73 bird species, 19 reptile and mammal species, and various coastal aquatic organisms. The tourism area is equipped with environmentally oriented facilities, including wooden boardwalks, bird observation towers, mangrove planting sites, kayaking facilities, Mangrove House Café, educational interpretation boards, and eco-lodge accommodations. These facilities support the conservation, educational, and recreational functions of the ecotourism destination.

The findings further reveal that waste management has been implemented through the provision of waste segregation bins, internal waste sorting, collaboration with a Waste Bank (Bank Sampah), and the installation of debris retention nets at the water gate. Organic and inorganic wastes are separated before recyclable materials are transferred to external waste management partners. However, mixed waste containers are still used in several

boardwalk sections to reduce structural loads, requiring sanitation personnel to conduct additional manual waste separation before disposal. Organic waste composting, which had previously been implemented, has not resumed following the COVID-19 pandemic because of operational limitations. The number of sanitation personnel is also insufficient relative to the size of the conservation area, resulting in waste collection activities being conducted only once per week during working days.

Another important finding concerns the dominance of marine debris entering the conservation area. During high tides, plastic waste, Styrofoam, bottles, and other floating materials originating from surrounding coastal waters become trapped within mangrove root systems. Although debris retention nets have been installed, their capacity remains inadequate during periods of extreme tidal flooding. Visitor observations also confirmed that floating waste continues to be visible within the aquatic areas despite relatively clean terrestrial tourism facilities.

Regarding tourism facilities, the findings indicate that TWA Angke Kapuk provides relatively complete infrastructure supporting ecotourism activities. Primary facilities include boardwalks, bird observation towers, mangrove planting areas, and piers, while supporting facilities consist of cafés, gazebos, food courts, playgrounds, meeting halls, eco-lodges, and educational nurseries. Safety facilities include a first-aid room and luggage storage services. Nevertheless, field observations identified several physical deficiencies affecting visitor comfort and safety.

The boardwalk, which functions as the primary tourism infrastructure, shows signs of deterioration in several locations due to weathered bamboo materials and uneven walking surfaces. Several sections are not equipped with handrails and remain inaccessible to wheelchair users and visitors with disabilities. Similar conditions were identified at the bird observation tower, where deteriorated stairways, weathered supporting structures, non-functioning lighting systems, and visitor graffiti were documented. Several gazebos also exhibit damaged seating components and deteriorated backrests, while toilet cleanliness remains one of the most frequently reported concerns among visitors. Accessibility improvements have only been implemented in limited areas, with ramps unavailable along several important visitor routes, including boardwalk sections, piers, and mangrove planting areas.

The results also demonstrate that accident and disaster mitigation has been implemented through several preventive measures. Visitor groups are accompanied by tour guides, safety instructions are provided before entering the conservation area, regular security patrols are conducted, hazardous sections are temporarily closed when necessary, and routine maintenance is performed on priority boardwalk sections. Emergency preparedness currently includes a first-aid room located within the reservation office, basic medical supplies, integrated visitor accident insurance, and cooperation with Tzu Chi Hospital as the nearest emergency referral facility.

For coastal disaster preparedness, management routinely monitors tidal water levels, prepares water pumps during tidal flooding events, and identifies multi-story buildings such as halls, guest houses, and villas as temporary safe locations. However, field observations indicate that several components of disaster preparedness remain unavailable. Formal emergency response procedures have not yet been established, officially designated emergency assembly points are absent, and CCTV coverage remains limited because internet connectivity is restricted within the Flight Operation Safety Zone (KKOP). Visitor interviews also revealed concerns regarding limited supervision along isolated boardwalk sections surrounded by dense mangrove vegetation.

The SWOT analysis identified several internal and external factors influencing sustainable management at TWA Angke Kapuk. The principal strengths include the area's high biodiversity, diverse tourism facilities, collaboration with the Waste Bank, integrated visitor insurance, regular security patrols, CSR support from private companies, and institutional collaboration with the Natural Resources Conservation Agency (BKSDA). Meanwhile, the principal weaknesses include limited maintenance budgets, deteriorating tourism facilities, dependence on third-party waste management, low visitor awareness regarding waste segregation, insufficient cleaning personnel, inadequate CCTV coverage, the absence of formal emergency operating procedures, and limited accessibility for persons with disabilities.

The analysis also identified several external opportunities. Increasing public interest in ecotourism, expanding partnerships with educational institutions, environmental organizations, and corporate CSR programs, as well as the growing implementation of Sustainable Development Goals (SDGs), provide opportunities for strengthening sustainable tourism management. Furthermore, the increasing number of international

visitors and the potential development of educational mangrove tourism packages offer additional opportunities to diversify tourism products and improve conservation-based income generation.

Conversely, several external threats were identified during the research. Continuous marine debris transported by tidal currents remains the most significant environmental challenge affecting the conservation area. Additional threats include increasing competition from commercial tourism developments surrounding Pantai Indah Kapuk (PIK) 2, illegal fishing activities occurring within conservation waters, increasing vulnerability to tidal flooding and sea-level rise, and the local Fang Shen tradition, which potentially introduces invasive aquatic species into the mangrove ecosystem.

When weighted through the IFAS matrix, the identified strengths and weaknesses produced a total internal score of 2.95, above the 2.50 midpoint, indicating that TWA Angke Kapuk holds a moderately strong internal position anchored in its mangrove conservation value, educational function, and nature-tourism experience, while facility deterioration, budget constraints, inactive composting, and an unintegrated safety system remain priority weaknesses. Correspondingly, the EFAS matrix produced a total external score of 2.98, indicating that the area is reasonably able to capture external opportunities—growing ecotourism interest, CSR and academic partnerships, and BKSDA institutional support—while still facing considerable external threats, particularly incoming marine debris, competition from nearby commercial destinations, tidal and extreme-weather risks, and limited internet connectivity for digital monitoring.

Overall, the findings demonstrate that waste management, tourism facility provision, and accident and coastal-risk mitigation at TWA Angke Kapuk have established the fundamental components required for sustainable ecotourism management. Nevertheless, several operational limitations remain evident. Waste management continues to depend on external partnerships, tourism facilities require selective rehabilitation and accessibility improvements, and accident mitigation has not yet developed into a comprehensive, adaptive coastal-risk management system. These findings collectively indicate that additional institutional strengthening, infrastructure maintenance, visitor environmental education, and adaptive coastal-risk preparedness are necessary to further enhance the sustainable management of TWA Angke Kapuk and support its contribution toward the achievement of the Sustainable Development Goals (SDGs).

DISCUSSION

The findings indicate that sustainable management at Taman Wisata Alam (TWA) Angke Kapuk has been implemented through waste management, tourism facility improvement, and accident and disaster mitigation. However, these initiatives have not yet been fully integrated into a comprehensive management system capable of optimally supporting the achievement of the Sustainable Development Goals (SDGs). The results demonstrate that while various management practices have been established, operational limitations and external environmental pressures continue to reduce their overall effectiveness.

Regarding waste management, the study reveals that TWA Angke Kapuk has adopted several environmentally oriented practices, including the provision of segregated waste bins, internal waste sorting, collaboration with a Waste Bank, and the installation of debris retention nets to reduce marine debris entering the conservation area. Nevertheless, these measures remain constrained by low visitor awareness regarding waste segregation, limited sanitation personnel, and the continuous influx of marine debris transported from surrounding coastal waters. Consequently, waste management remains partially dependent on external stakeholders and has not yet achieved an independent circular waste management system. These findings support the argument of Ferguson et al. (2021), who emphasized that waste management infrastructure alone cannot ensure environmental sustainability without continuous environmental education that encourages responsible visitor behavior. Similarly, Thảo et al. (2023) highlighted that unmanaged marine debris threatens mangrove regeneration, biodiversity, and ecosystem health, reinforcing the necessity for integrated coastal waste management beyond the boundaries of individual conservation areas.

The evaluation of tourism facilities further indicates that TWA Angke Kapuk possesses relatively complete tourism infrastructure, including boardwalks, bird observation towers, mangrove planting areas, cafés, eco-lodges, educational facilities, and supporting amenities. Nevertheless, field observations identified substantial deterioration in several critical facilities, particularly wooden boardwalks, gazebos, observation towers, and public toilets. Accessibility for visitors with disabilities also remains insufficient because accessible pathways are only available in limited locations. These findings are consistent with Aguilar-Carrasco et al. (2023) and Fennell and Garrod (2021), who argued that tourism facility quality should be evaluated not only by availability but also by safety, accessibility, maintenance, and

inclusiveness. In conservation-based destinations, maintaining a balance between infrastructure development and environmental protection remains essential, especially where regulatory restrictions limit large-scale physical development.

The analysis of accident and disaster mitigation demonstrates that TWA Angke Kapuk has implemented several preventive and emergency response measures, including visitor assistance, security patrols, first-aid facilities, accident insurance, temporary closure of hazardous areas, and cooperation with nearby hospitals. Despite these efforts, the mitigation system remains largely reactive rather than systematic because formal emergency response procedures, designated assembly points, evacuation routes, and comprehensive CCTV coverage have not yet been established. This condition indicates that visitor safety management has not fully adopted an integrated disaster risk management approach. These findings correspond with Arianto et al. (2022), who emphasized that effective disaster mitigation in nature-based tourism destinations requires comprehensive risk identification, documented emergency procedures, adequate safety infrastructure, regular evacuation planning, and strong institutional coordination. Considering the increasing risks associated with climate change, coastal flooding, and extreme weather events, strengthening disaster preparedness has become increasingly important for the long-term sustainability of mangrove ecotourism destinations.

The SWOT analysis confirms that TWA Angke Kapuk possesses considerable internal strengths, including high biodiversity, strong conservation value, diverse tourism facilities, active collaboration with governmental agencies, environmental communities, and corporate social responsibility (CSR) programs. Simultaneously, several internal weaknesses persist, including budget constraints, infrastructure degradation, insufficient human resources, incomplete emergency management systems, and limited accessibility. Externally, growing public interest in ecotourism, expanding conservation partnerships, and increasing international tourist arrivals create significant opportunities for sustainable development. Conversely, marine debris, coastal environmental degradation, illegal fishing activities, urban development pressures surrounding the conservation area, and climate-related hazards continue to threaten long-term sustainability. These findings demonstrate that SWOT analysis effectively provides a strategic framework for developing adaptive management policies by integrating internal capabilities with external environmental conditions, consistent with the strategic management perspective proposed by Gurel and Tat (2021). Quantifying these factors through the IFAS and EFAS matrices reinforces this interpretation: the internal

score of 2.95 and external score of 2.98, both above the 2.50 midpoint, indicate that TWA Angke Kapuk is positioned for a growth-oriented (WO/SO-leaning) strategy that leverages conservation and educational strengths and external partnership opportunities to offset facility, budget, and safety-system weaknesses, while remaining exposed to persistent coastal and competitive threats (Wibowo et al., 2021).

From a scientific perspective, this study contributes to the ecotourism literature by integrating three essential management dimensions—waste management, tourism facility improvement, and accident and coastal-risk mitigation—within a single analytical framework linked explicitly to specific, field-validated SDG targets rather than to the SDGs in general. Previous studies on Indonesian mangrove ecotourism have generally discussed these aspects separately or claimed broad SDG relevance without disaggregating which goals are directly supported. Instead of mapping all seventeen goals, this study followed a selective procedure validated through a supplementary interview with the government informant (R2), who confirmed that SDGs should be attached only to goals with a direct empirical basis in the findings. On this basis, the study demonstrates a direct, interconnected contribution to SDG 11 (Sustainable Cities and Communities), covering the inclusiveness, safety, and resilience of the urban conservation area; SDG 12 (Responsible Consumption and Production), covering waste segregation, Bank Sampah collaboration, and organic waste reduction; SDG 13 (Climate Action), covering the adaptive function of mangroves against tidal flooding and extreme weather; SDG 15 (Life on Land), covering mangrove habitat protection, replanting, and seedling monitoring; and SDG 17 (Partnerships for the Goals), covering collaboration among BKSDA, the site manager, government, CSR partners, academia, and visitors. SDG 3 was deliberately not treated as a primary goal, since visitor-safety issues in this study are more accurately absorbed under SDG 11's resilience dimension, while SDG 14 (Life Below Water) is positioned as a supporting rather than primary linkage, reflecting the area's exposure to marine debris without a dedicated assessment of marine water quality or biota. This disaggregated, evidence-based mapping provides a more precise and defensible understanding of sustainable conservation area management and expands the application of SDGs within urban mangrove ecotourism.

Practically, the findings suggest that managers should prioritize visitor environmental education, strengthen independent waste processing systems, reactivate organic composting programs, implement preventive facility maintenance, improve inclusive infrastructure for persons with disabilities, develop formal emergency response procedures, designate

evacuation assembly points, and expand monitoring systems where technically feasible. Furthermore, stronger collaboration among conservation authorities, local governments, private-sector partners, educational institutions, and surrounding communities is necessary to address challenges such as marine debris and climate-related hazards that cannot be resolved by site managers alone. These collaborative efforts are expected to strengthen institutional resilience while improving visitor safety, environmental quality, and destination competitiveness.

Furthermore, this study did not quantitatively assess environmental quality indicators such as waste generation, biodiversity conditions, visitor carrying capacity, or economic impacts of tourism management. Consequently, the effectiveness of the proposed strategies could not be evaluated statistically. Future studies are encouraged to integrate ecological measurements and quantitative performance indicators to complement qualitative findings.

Future research should examine the effectiveness of integrated waste management, inclusive tourism infrastructure, and disaster preparedness using longitudinal and comparative approaches across multiple mangrove ecotourism destinations. Employing mixed-methods designs that combine qualitative insights with quantitative environmental and visitor-based indicators would generate stronger empirical evidence for sustainable destination management and SDGs implementation.

Overall, the discussion demonstrates that sustainable management of urban mangrove ecotourism requires an integrated approach encompassing environmental conservation, infrastructure quality, visitor safety, institutional collaboration, and adaptive governance. The interaction among these dimensions determines not only destination competitiveness but also long-term ecological sustainability. Therefore, strengthening coordination among stakeholders and implementing continuous management improvements are essential to ensure that urban mangrove ecotourism contributes effectively to sustainable development and the achievement of the Sustainable Development Goals.

CONCLUSION

This study concludes that Taman Wisata Alam (TWA) Angke Kapuk possesses significant potential as an urban mangrove ecotourism destination capable of supporting the achievement of the Sustainable Development Goals (SDGs), provided that its management strategy is selective, adaptive, and collaborative rather than broadly claimed. The findings

indicate that waste management, tourism facility improvement, and accident and coastal-risk mitigation have been implemented as the fundamental pillars of sustainable destination management. However, several limitations remain. Waste management is still constrained by dependence on external partners, inactive organic composting, low visitor awareness, and the continuous influx of marine debris. Tourism facilities require more systematic, priority-based maintenance and greater accessibility for visitors with disabilities, while accident mitigation needs to be strengthened through formal emergency procedures, designated assembly points, improved surveillance systems, and adaptive coastal-risk management rather than disaster response alone. The IFAS score of 2.95 and EFAS score of 2.98 confirm that the destination holds a moderately strong internal position and a reasonable capacity to capture external opportunities, positioning it to pursue growth-oriented strategies that pair conservation and educational strengths with external partnerships. Overall, the study successfully addresses the research objectives by identifying the current conditions of waste management, tourism facilities, and coastal-risk mitigation, as well as formulating strategic recommendations through SWOT analysis supported by IFAS and EFAS matrices to enhance sustainable destination management.

From a scientific perspective, this study contributes to the literature on sustainable tourism by integrating waste management, tourism facility enhancement, and accident and coastal-risk mitigation into a comprehensive management framework explicitly and selectively linked to validated SDG targets, grounded in Sustainable Tourism Development, Destination Management, and Ecotourism theories. Unlike previous studies that generally examined these dimensions separately or claimed broad SDG relevance, this research demonstrates their interrelationships in promoting environmentally responsible, safe, inclusive, and resilient urban mangrove ecotourism while disaggregating exactly which goals are supported. Practically, the findings provide destination managers and policymakers with strategic guidance for strengthening environmental education, improving tourism infrastructure, enhancing adaptive coastal-risk preparedness, and fostering multi-stakeholder collaboration to support SDG 11, SDG 12, SDG 13, SDG 15, and SDG 17, with SDG 14 as a supporting linkage.

Future research is recommended to employ mixed-methods or quantitative approaches to evaluate the effectiveness of sustainable management strategies using measurable indicators, such as visitor satisfaction, environmental quality, waste reduction performance, disaster preparedness, and tourism carrying capacity. Comparative studies

involving multiple mangrove ecotourism destinations in different geographical contexts are also encouraged to improve the generalizability of findings and to develop more comprehensive evidence-based models for sustainable ecotourism management.

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