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THE ROLE OF SEAPLANE IN PROMOTING THE CONCEPT OF SUSTAINABLE TOURISM IN INDONESIA

Hadi Prayitno[(1)], Ahmad Hariri[(2)], Daniel D. Rumani[(3)], Andung Luwihono[(4)], Putra Wicaksono[(5)]

[1]Politeknik Penerbangan Surabaya, [2,3,4,5]Akademi Penerbang Indonesia Banyuwangi
e-mail: [1]hadi.stpi@gmail.com, [2]ahmadhariri.apib@gmail.com,
[3]daniel_dewantoro@dephub.go.id, [4]luwihono@gmail.com, [5]wicaksonopewe@gmail.com
coresponding: [1]hadi.stpi@gmail.com

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Abstract: This study discusses the role of amphibious aircraft in promoting the concept of sustainable tourism in Indonesia. Amphibious aircraft emerged as an innovative solution to the problem of accessibility to remote islands in Indonesia. Sustainable tourism is a global focus in the development of tourist destinations, including in Indonesia, where accessibility to remote islands remains a significant challenge. Amphibious aircraft, or seaplanes, offer a potential solution by providing access to isolated areas while minimizing the need for large-scale infrastructure. This study aims to examine the role of seaplanes in supporting the development of sustainable tourism in Indonesia. A qualitative descriptive method was applied using a literature review of national and international sources. The findings indicate that seaplanes can enhance connectivity, stimulate local economies, and reduce environmental pressures if managed properly. However, issues such as regulatory gaps, operational costs, and environmental risks must be addressed. With the right policies and community involvement, seaplanes can become an effective component of Indonesia's sustainable tourism strategy.

Keywords: Indonesia, promoting seaplane, sustainable, tourism

Introduction

Indonesia's intriguing archipelago of over 17,000 islands has a singular biodiversity, cultural heritage, and natural beauty, this combination is popular as a tourist destination. However, the country's physical location also has an adverse effect on the tourism sector via transportation and accessibility, this negatively affects the sector. Traditional methods of travel, while providing ease, often have an adverse effect on the environment, this is detrimental to pollution, habitat destruction, and a larger carbon footprint. These obstacles demonstrate the desperate necessity of environmentally sustainable tourism that not only preserves the country's natural and cultural resources, but also guarantees the long-term viability of the tourism industry.(Ristianti, 2016)

(El Hafizah et al., 2023a) believe that transportation in remote areas has the potential to be significant to sustainable and complete development. Taking actions that facilitate the connection of regions, especially island regions, through different transportation methods can enhance communication and development. Transport is important to the tourism industry and has significant environmental, economic and social effects. Sustainable mobility theory suggests methods of transportation evolution and management in conjunction with sustainable tourism goals. This involves analyzing the effectiveness of energy, reducing greenhouse gases, and the social effects of transportation choice. The influence of new transportation methods and

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technologies on reducing the environmental burden of tourism should be considered, as well as the equilibrium between accessibility and sustainability.

Water conditions imbue the assessment of factors that influence seaplane operations with a third dimension: water velocity, wind speed, wave height, and tides. As such, seaplanes are unable to perform effectively. However, they can operate up to 258 days per year outside of the typical operating hours every year. When amphibious aircraft are unable to function effectively, other transportation methods are employed (Shabrina et al., 2023). It's recognized that demand analysis for transportation is crucial to planning, dealing with congestion, reducing accidents, and preventing pollution, all of which are important to the development of a region .

Access to the outermost, remote, and under developed islands of Indonesia is gained. primarily composed of coastal regions and small islands that have historically had significance, architecture, and natural beauty. (Prayitno et al., 2022). Additionally, (Dewantoro et al., 2024b) remarked that seaplane services are in a strong position due to both benefits and opportunities. Seaplanes are a unique form of travel that can reach areas that are distant or underserved, with limited infrastructure. Reviewing the literature concerning the utilization of seaplanes in other fields can elucidate their benefits and drawbacks in the pursuit of sustainable tourism.

The potential for marine tourism in Indonesia is enormous, but has not been effectively utilized, one of the reasons is the limited means of transportation that connect tourist destinations. To associate with other tourist destinations, transportation methods like airplanes are necessary that can fly at a low elevation and have the capacity to land and take off on water (Dedy Arianto; Iskendar; Windra Priatna Humang; Edward Marpaung; Johny Malisan; Feronika Sekar Puriningsih, 2024) . Indonesia's singular geographic design, which has over 17,000 islands, is beneficial due to its singular architecture, but it also has flaws. The government's commitment to tourism as a national priority, as well as the necessity of safeguarding its rich biodiversity and cultural heritage, grants this context to the investigation of the role of seaplanes. Literature on the policy regarding tourism in Indonesia, conservation efforts, and community-based tourism initiatives can be of great importance in the understanding of the subject.

According to (Sufa et al., 2024) The tourism management strategy known as tourism management is a holistic approach that involves multiple stakeholders and involves strategies that promote the long-term enhancement of tourism destinations. The theoretical review should conclude by combining the theories and literature discussed, and highlighting the gaps in current knowledge, as well as suggesting future research areas. Specifically, it should demonstrate the necessity of empirical studies that assess the actual effects of seaplanes on the sustainable development of tourism in Indonesia, considering the complex interactions between environmental, economic, and social factors.

(Khoirunnisa et al., 2021) It requires a seaplane or water-based platform for functioning as an amphibious aircraft's operational space. A platform that facilitates the employment of seaplanes is one of the transportation options utilized by island nations. This theoretical study serves as the impetus for a more extensive investigation of the potential effectiveness and impact of amphibious aircraft in the tourism industry of Indonesia, it also provides a comprehensive understanding of the various issues involved. According to (Nadhifatur Rifdah & Kusdiwanggo, 2024), community participation has a significant impact on the development of tourism areas in Indonesia. Government assistance, superior tourist amenities, enhanced facilities and infrastructure, community participation, and training are all significant factors in community participation.

Airports serve as a node in the transportation network according to its design, a gateway to economic activity, a place for transportation mode conversion, a driver and supporter of industrial development, an opener of regional isolation, development of border areas, and disaster

management. These activities augment the country's national prestige and sovereignty. The building and evolution of airports is based on the specific location of the airport. The upgrade of existing airports is accomplished by taking into consideration the initial criteria for a successful airport that involves airside amenities and landside amenities. Airports serve as a node in the transportation network according to its design, a gateway to economic activity, a place for transportation mode conversion, a driver and supporter of industrial development, an opener of regional isolation, development of border areas, and disaster management. These activities augment the country's national prestige and sovereignty. The building and evolution of airports is based on the master plan's determination of the location. The upgrade of existing airports is accomplished by taking into consideration the initial criteria for a successful airport that involves airside amenities and landside amenities.

The Transportation Policy Agency states that water-based airports are comprised of Organizations that hold water-based registers and that operate water-based airports, the association between water-based airports and other airports is through the possession of water-based registers. However, there was no regulation or technical documentation regarding the planning or determination of the location of Water Airports in Indonesia. Aquatic Airports serve as a link between centers for economic growth and are capable of causing the birth of economic growth centers in rural areas, especially in the sphere of tourism. To execute a transportation plan based on integrating the intermodal and connecting transportation services, the location of the airport must take into account the available transportation infrastructure as a supplement. How can seaplanes be effectively utilized as a sustainable transportation solution to support tourism development in remote and underdeveloped island regions of Indonesia, while addressing environmental, economic, and policy-related challenges ?

Method

This study employs a literature review methodology of research. Literature was collected systematically using academic databases such as Google Scholar, ResearchGate, ScienceDirect, and DOAJ. Keywords used included: seaplane tourism, sustainable transportation, archipelagic connectivity, and Indonesia marine tourism. According to (Prayitno, 2023) , literature review is the selection of documents pertaining to a topic, which contains information, concepts, data, and arguments that are written from a particular perspective in order to achieve a particular goal or express a particular belief regarding the nature of the subject and how it will be effectively conducted, investigated, and evaluated in relation to the proposed research.

It describes the stages of research in the literature review method as follows: **initially**, choosing a topic for review. At this point, the researcher chooses a topic that is of interest. This is the first strategy as well as the process of calculating the number of literature and data that will be considered by scientists. **Second**, Searching the literature. At this point, the researcher identifies structured data that is pertinent and associated with the chosen subject. Literature searches are typically conducted using computers and electronic sources. **Third**, the analysis and synthesis of the literature. At this point, the information that was gathered is evaluated and summarized by the researcher. And the **last**, writing the review. At this point, the researcher combines and writes the findings of the literature study. During the preparation and writing of the review, it is important to avoid long, complex words.

The method of analysis employed is qualitative descriptive. The descriptive qualitative research method is a method of finding knowledge about previous research through books, national and international journals. During the review process, researchers seek similarities, they find dissimilarities, they provide opinions, they summarize and combine into a new concept. The data were organized thematically based on recurring issues such as accessibility, environmental

impact, community participation, policy readiness, and technical feasibility. Thematic analysis was conducted by identifying patterns, comparing findings, and synthesizing key insights into a coherent framework. The findings from various sources were summarized, compared, and synthesized to form new concepts and research directions. The writing process avoided overly technical or complex language to maintain clarity and focus.

Discussion

The Transportation Policy Board has a significant strategy regarding the development of water airports in Indonesia that will promote sustainable tourism. Key suggestions include creating a regulatory framework for civil aviation that involves studies that assess the water conditions and the seaplane's characteristics. Technical feasibility should be considered during the selection of sites, environmental factors like topography and hydrography should be taken into account. Additionally, existing harbors can be utilized to connect to the network, with different models of operation including waterborne airports in the port area or stand-alone facilities. Effective navigational aides and communication systems are crucial to ensuring safe operations, particularly in avoiding transportation in designated areas of aerodrome.

The necessary facilities for the water aerodrome and its associated organization concerned the water aerodome that previously existed and was operated, namely as follows:

Table 1. Existing and operating water aerodrome in Indonesia

ICAO	IATA	Province	Airport Name	Use	Class	Organizer
-	-	Riau Island	Pulau Bawah	Domestic	Non Class	Private
-	-	Central Borneo	Kahayan River	Domestic	Non Class	Private
-	-	West Nusa Tenggara	Amanwana	Domestic	Non Class	Private
-	-	West Nusa Tenggara	Benete	Domestic	Non Class	Private
-	-	East Java	API Pangpang	Training	Non Class	Private

Some of the information the author investigates suggests that there are still few flight operators who operate seaplanes in Indonesia, as follows:

Table 2. Operators that operate seaplanes in Indonesia

AOC	Operator	Aircraft
135-002	Airfast Indonesia	DHC-6-300 (Amphibious)
135-009	Travira Air	Cessna Grand Caravan 208A
141D-014	API Banyuwangi	Cessna 172S
91-015	Dirgantara Indonesia	N219 Amphibious
135-032	Express Transportasi Antarbenua	Cessna Grand Caravan 208B

By employing explicit and systematic approaches during the reviewing of articles and all available evidence, bias can be reduced, which results in reliable findings that can be applied to conclusions and decisions, as described by (Snyder, 2019). Some studies related to the role of seaplanes in sustainable tourism are as follows:

Table 3. Research related to the role of seaplane in supporting sustainable tourism

Authors	Year	Results
(Habibi et al., 2019)	2019	The results of the analysis, to start with, can growth analysis be projected for the number of tourist visits, projections for 5 and 20 years obtained the potential number of tourists who get off and on at Waisai port. From 2023 to 2035, tourist growth has increased from 63% to a maximum of 488% in 2035. Having to develop docks and other facilities that adapt to the development of transportation technology with a multimodal concept which combines sea and air transportation modes with seaplanes. In the planning process for the development of this port,

		3 stages were made, namely stage 1 in 2020, Stage 2 in 2027, and stage 3 in 2034.
(Prayitno et al., 2022)	2022	Research analysis proved that inter-island connectivity in Indonesia could be uplifted with the emergence of a new mode of transportation like seaplanes. The study revealed that using seaplanes would provide easy access for tourists and the local community to attractions on a long hour of travel or to dispersed islands. Seaplanes would save a lot of travel time, but then, on the other side, its passenger capacity is very limited and the travel cost is much higher than using boats. From these findings, one can draw the detection of the importance of time efficiency equilibrium with the costing aspect in constructing inter-island transportation in Indonesia.
(El Hafizah et al., 2023b)	2023	The research analysis shows that the transportation preferences of local and international tourists are mainly based on their social characteristics, demographics, and travel characteristics, especially when visiting different islands. The research shows that public transportation is the most popular option in these situations. This investigation shows the need to develop a new transportation system that utilizes the coastline and islands to increase the number of tourists. Technical aspects such as alternative routes and methods are important as links between islands. Infrastructure improvements are projected to improve accessibility and mobility, encourage economic revitalization in local areas, and increase tourism revenue.
(Shabrina et al., 2023)	2023	Research results indicate that the potential water areas around Gili Iyang have very high prospects for the development of maritime tourism, particularly with seaplane operations. The most used model in Indonesia is the Twin Otter model, with specifications suitable for this kind of operation. The efficiency of Twin Otter aircraft is greatly affected by the speed current, wind speed, wave height, and tides. The airplane cannot be operated on a day when the conditions are not optimum but can fly at least 258 days a year. Other infrastructures represent runways, taxiways as well as passenger facilities, already available on Gili Iyang, supporting infrastructure development for public interests and tourism in relation to its neighboring ports, mainly Kalianget Port and Dungkek Port.
(El Hafizah et al., 2023b)	2023	This study highlights the potential of seaplanes to enhance accessibility in Indonesia's remote island tourism. Seaplanes can operate without large airport infrastructure, making them suitable for small island destinations. Utilizing fishing ports as seadromes is cost-efficient and practical. Improved access through seaplanes can boost local economies and increase tourist visits. The research emphasizes the integration of transportation, infrastructure, and tourism planning. It also identifies a gap in studies that fully address accessibility alongside economic and environmental factors. System dynamics modeling is recommended for policy and infrastructure planning. Overall, seaplanes offer a strategic solution for sustainable tourism growth in archipelagic regions.
(Dewantoro et al., 2024a)	2024	Research analysis reveals that the IFAS computation results, based on seaplane services, indicated a strength factor score of 1.40 and a weakness factor of 0.66, totaling an IFAS table score of 2.06. This means that strengths of seaplane services are greater than weaknesses. Meanwhile, from the EFAS computation, an opportunity factor score of 1.12 and a threat factor of 0.74, with a total IFAS table score of 1.86, were obtained. This implies that opportunities for seaplane services are greater than threats. Thus, seaplane services are in very favorable position since they have strengths and opportunities, which can be maximally used.
(Sufa et al., 2024)	2024	The readiness of Giliyang for tourism was questioned between the Tourism Board and Transport Board as related through research analysis. With respect to the trials of the Seaplane transportation system and development initiatives, the Tourism Board highlighted, while the Transport Board played down alleging the same due to the lack of infrastructure, instead recommending a better alternative in Gili Genting. Such misalignment in communication replicates a more general challenge for preparing Giliyang for tourism, which is further complicated by the remote location. The tourism promotion in Sumenep depends upon the

		Sumenep Pentahelix collaboration in which the policymakers, communities, businesses, academics and media are involved. This aims at developing a sustainable tourism ecosystem via the strengths of individual stakeholders. Keeping in view the challenges available surrounding them, the beautiful tourist attraction at Sumenep, namely Asta Tinggi and Rami Mosque, is to be developed as a lead destination.
(Salsabilla et al., 2024)	2024	This study sets the probability of shift from current modes (ship or land transportation) to sea-planes. High-quality future research will be based on market research using stated preference surveys to determine the probability of shift by factors influencing the same, and estimating demand for sea-planes. The analyses should consider factors that may be influenced by the shift in principle mode choice to seaplanes. Preliminary comprehension of inter-island mobility conditions in East Java enables this study to be valuable in shedding light on market potential for seaplane services and the benefits that can be accrued in enhancing inter-island connectivity. Enhanced connectivity is expected to boost economic activities as well as tourism and trade in the area.
(Triangle et al., 2024)	2024	Research indicates that the introduction of AAM by e-VTOL systems poses an attractive means of transport beyond the common issues of mainland regions such as Riau Islands in Indonesia. The AAM service would overcome the weaknesses governments in the area often encounter in budgeting for transportation, offering a direct link that takes much less time to cover with travel access to more remote areas. Integration with the existing modes of transportation will also enhance the inter-island linkage of travels that can foster economic growth. AAM serves multiple purposes from secure disaster response to national defense operations. More research should be carried out on the feasibility and impact, taking socio-economic benefits such as job creation and tourism growth into account. Key participants in the academic, industry, and government sectors should enable the automation of innovative AAM technologies and their governing standards by providing involvement.
(Arianto et al., 2024)	2024	Research shows that Indonesia's marine tourism potential is of course gigantic but has never reached fully developed because the way of means of transportation connecting tourist sites is limited. Second in the world after Giliyang Island in Sumenep, East Java it would need a specific type of transportation like an aircraft that can land on the water to visit this location from other tourist attractions.

To address the issues given to research the use of seaplanes in tourism in Indonesia, a comprehensive exploration of the environmental, economic, and social impacts is needed. This study will also investigate the challenges and opportunities for expanding seaplane services and identify policy measures that can support sustainable tourism development.

Environmental Impacts of Seaplane Use on Tourism in Indonesia.

The environmental impacts of seaplane use in Indonesia are primarily the environmental impacts on the ecological footprint of aviation activities and their effects on marine and coastal ecosystems. Seaplanes, while offering a unique and efficient mode of transportation for tourists, can contribute to air and water pollution. Emissions from seaplane engines can affect air quality, and fuel spills or leaks can compromise air quality, potentially endangering marine life and coral reefs. For example, noise pollution generated by seaplanes can disturb wildlife, especially in sensitive areas such as national parks and marine reserves. In addition, increased tourist traffic facilitated by seaplanes can lead to over-tourism, which can strain natural resources and disrupt local ecosystems. Mitigating these impacts includes implementing stricter environmental regulations, such as the use of cleaner fuels, aircraft maintenance to prevent leaks, and enforcing no-fly zones over ecologically sensitive areas.

Economic and Social Impacts of Seaplane Tourism

Economic Impacts: On the economic side, seaplanes can significantly increase tourism by providing access to remote areas, leading to increased income for local communities and the national economy. This can create jobs and stimulate investment in infrastructure. However, it is important to ensure that economic benefits are distributed equitably and that local communities are not marginalized.

Social Impacts: Socially, seaplanes can increase connectivity, enable cultural exchange and improve access to services for isolated communities. However, there is a risk of cultural homogenization and loss of local traditions if tourism is not managed sustainably. Balancing economic benefits with the preservation of cultural heritage is essential.

Barriers and Opportunities for Expanding Seaplane Services

Barriers: Expanding seaplane services faces several challenges, including regulatory hurdles, high operating costs, and the need for specialized infrastructure such as water airstrips. Environmental concerns and community resistance due to noise and potential disturbance are also significant barriers.

Opportunities: Despite these challenges, there are many opportunities. Strategic use of seaplanes can reduce congestion at traditional tourist destinations by diverting visitors to less-visited areas, thereby encouraging regional development. Technological advances, such as the development of more efficient and environmentally friendly aircraft, could further enhance the viability of seaplanes in tourism.

Contribution to Sustainable Tourism Goals and Policy Measures

Contribution to Sustainable Tourism Goals: Seaplanes can contribute to sustainable tourism by facilitating responsible travel to remote destinations, promoting environmentally friendly tourism practices, and supporting conservation efforts through regulated visitor access. Seaplanes can also encourage the development of niche tourism markets, such as adventure and ecotourism.

Policy Measures To integrate seaplanes into sustainable tourism, several policy steps are required. These steps include:

1. Environmental Regulation: Implement stringent emission and noise standards for seaplanes, along with regular environmental impact assessments.
2. Infrastructure Development: Invest in sustainable infrastructure, such as environmentally friendly waterstrips and facilities powered by renewable energy.
3. Community Engagement: Ensure that local communities are involved in the tourism planning process and benefit from the economic opportunities provided by seaplane services.
4. Research and Monitoring: Support ongoing research into the environmental and social impacts of seaplanes, with mechanisms to monitor and adjust practices as necessary.
5. Incentives for Innovation: Encourage the development and use of low-emission seaplanes through subsidies or tax incentives.

By addressing these areas, seaplanes can become a valuable component of Indonesia's sustainable tourism strategy, providing economic benefits while preserving the country's rich natural and cultural heritage.

Conclusion

Seaplanes have the potential to support sustainable tourism in Indonesia by improving connectivity and local economies. However, they also pose environmental and social risks. To maximize benefits and minimize impacts, proper regulations, infrastructure planning, and community involvement are essential. This study concludes that seaplanes can be a viable solution if aligned with sustainability objectives.With these steps, seaplanes can be an important component of Indonesia's sustainable tourism strategy.

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