Bali Journal of Hospitality, Tourism and Culture Research Volume 3 No.1 (2025)
ISSN 3031-8580 (Online)
ISSN XXXX-XXXX (Print)

BALI JOURNAL OF HOSPITALITY, TOURISM AND CULTURE RESEARCH

Journal Homepage: www.baliacademicpublishing.com

Gandhian Thoughts for sustainable Environment: Essential Requirements for the Bright future of Tourism in India

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ABSTRACT
There's a rapid rise in India's tourism industry, but this rapid rise creates an uptight situation regarding the environmental and ecological impact of this on our environment. In recent years sustainability has become talk of the town, carrying forward the trend this industry has also shifted towards to sustainable tourism. But the alignment with indigenous thought and Gandhian principles such as Ahimsa (non-violence), ecological wisdom and participatory democracy can provide a culturally rooted framework for sustainable tourism in India, still the part is a bit underexplored. This conceptual paper employs a qualitative analysis of Gandhian texts and secondary data. The finding indicates that to robust the ethical concerns of environmental degradation, cultural commodification and community disenfranchisement in Indian tourism can be rectified by Gandhian values and applying the principles as a framework. The study employs a qualitative case study of Nainital, Uttarakhand to illustrate the practical application of Gandhian principles in tourism management. The study concludes that integrating the Gandhian framework into tourism policy and practice is essential for achieving genuine, long-term sustainability in India.

ARTICLE HISTORY
Sent 15-September-2025
Accepted 17-September-2025
Approved 24-November-2025
Published 01-December-2025

KEYWORDS
Gandhian Thoughts; Tourism, Sustainable Development; Environmental Ethics.

1. Introduction

India's tourism industry is amongst the fastest growing industries in the world. It contributes significantly to national income and provides employment hand to hand. Yet this rapid expansion has come at a very hefty price, we paid the cost of socio-environmental change which led to ecological imbalance, overuse of resources and commercialization of local culture.

Many hill stations such as Nainital and Shimla now struggle with waste overload, water scarcity and loss of biodiversity and this story remains the same for the majority of the other tourist spots. According to the Ministry of Tourism in the year 2023 the tourism industry has recorded over 1.8 Billion domestic tourist visitors. A figure that underscores the need of sustainable management to keep the beauty and belongings of the place intact so that other generations can also live the joy of the place.

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Despite the extensive sustainable development efforts, prevailing models remain mechanistic, failing to integrate a meaningful culturally based ethical framework. This critical deficiency necessitates a reflection on the ecological intelligence inherent in the Indian tradition, particularly the Gandhian perspective.

Mahatma Gandhi's thoughts offer profound insights into the harmony between humans and nature. His ideas of Sarvodaya (welfare of all), Ahimsa (non-violence)and trusteeship establish a moral foundation for sustainable existence. Gandhi lived with the thought that “nature has enough to satisfy everyone's needs, but not anyone's greed" a statement that resonates strongly with contemporary sustainability concerns.

Scholars such as Ramchandra Guha (2019) and T.N.Khoosho (2002) have identified Gandhi as one of the earliest propagators of applied human ecology which highlights his vision of an ethical balance between progress and preservation. To this old man earth was a living organism governed by both cosmic law and the law of species, where cooperation and restraint were necessary to maintain life.

Gandhian environmental philosophy is very important as well as relevant in the modern Twenty-First century in India. The current ecological calamity from rising temperatures to air pollution becomes a big threat for the destination which has fragile conditioning with over dozing it with tourism. This reveals the fact that scientific progress without ethical guidance threatens both human and ecological well-being.

While modern policies focused on subjects like the Sustainable Development Goals (SDGs), responsible tourism, and regenerative tourism. The government and organisations emphasize sustainability; they often neglect the ethical and cultural dimension of sustainability rooted in indigenous traditions. It makes the framework too difficult to implement on ground from papers and discussion panels. Gandhian thought fills the ethical trench, proposing a value-based approach that prioritises simplicity, non-possession and maintains a healthy balance between human aspiration and natural limits.

This paper focuses on examining how Gandhian philosophy provides a cultural and ethical framework for sustainable tourism in India. It looks forward to answering two questions: How can Gandhian values such as non-violence, trusteeship and simplicity inform sustainable tourism practices? And in what ways can these principles address the current environmental and social crisis in Indian tourist destinations?

This research takes Mahatma Gandhi's timeless wisdom on respecting the Earth and merges it with modern ideas of sustainable travel. This paper argues that Gandhian philosophy offers a vital framework for sustainable tourism in India. It will first elaborate the framework, then analyze the state of Indian tourism through its lens, and finally, demonstrate its practical relevance through a case study of Nainital. Through this study, the paper highlights the continuing importance of Gandhian reasoning in shaping a sustainable and ethically conscious future for Indian tourism.

2. Literature Reviews

Lakes are vital components of the Earth’s landscape, serving as essential water sources, supporting diverse habitats, regulating hydrological cycles, influencing microclimates, enhancing scenic value, and providing recreational opportunities. They also supply water for drinking, irrigation, fishing, and ecotourism. However, many lakes face serious threats, including sedimentation from catchments, untreated sewage and industrial effluents, solid waste disposal, nutrient runoff, poor storm water management, overuse, and encroachment. These pressures lead to shrinking water bodies, shoreline erosion, degraded water quality, disrupted hydrology, and biodiversity loss. Assessing a lake’s pollution status is therefore crucial for implementing timely conservation measures and restoring ecosystem health (Sharma, 2010). The increasing risks of water depletion,

contamination, and misuse necessitate the adoption of innovative management strategies to ensure ecosystem conservation, safeguard environmental quality, and sustain human activities and well-being (Martínez-Gil, 2010). Evolving societal awareness of water's significance for health underscores the potential to cultivate enhanced social consciousness that can stimulate new business opportunities and generate value for both regions and water users. This emerging "water culture" highlights the need for a balanced, high-quality, and sustainable relationship with water resources (Folgado-Fernández et al., 2019).

Boating and shipping activities, along with their associated operations and supporting infrastructure, pose significant potential for environmental impacts. These impacts include physical alterations to benthic substrates and habitats caused by anchoring, mooring, and vessel groundings; changes to the physico-chemical properties of the water column due to antifouling paints; and contamination arising from operational or accidental discharges such as ballast water, bilge water, hydrocarbons, solid waste, and sewage (Byrnes & Dunn, 2020). The unregulated operation of houseboats further exacerbates ecological stress, as the disposal of toilet waste, plastics, and oil residues directly into the water body contributes to pollution and degrades ecosystem health. The growing number of houseboats has sometimes surpassed the lake's carrying capacity, disturbing the ecological balance of the backwater system (John, 2018). To mitigate these issues, sector-specific environmental guidelines could be introduced through relevant industry associations, enabling these bodies to adopt and promote best practices among their members (Byrnes & Warnken, 2003).

Online information significantly influences the decision-making process for choosing tourism destinations, with social media serving as modern tourist information hubs. The swift spread of content in online communities shapes the image and reputation of various tourism destinations. New media have become essential for discovering and showcasing the natural and cultural heritage of lesser-known regions (Celotto et al., 2015). Information about travel destinations is extensively shared online, particularly through social media, which serves both as a platform for gathering information on tourism products and for facilitating purchases. Given that tourism products necessitate comprehensive and reliable information, the tourism sector has significantly benefited from Information and Communication Technologies (ICTs) (Garcia-Gonzalez & Mugica, 2012). Consequently, ICTs are vital in enhancing the competitiveness of tourism destinations (Buhalis & Law, 2008).

Several tourism scholars argue that visitor characteristics play a significant role in shaping satisfaction levels with tourism destinations. Consequently, the tourism market is often segmented based on shared attributes such as age group, frequency of trips taken annually or seasonally, education, occupation, income, and purpose of travel (Foxall, 2013). Profiling constitutes a key phase in this broader process of market segmentation (Perera et al., 2012).

Understanding visitor profiles in ecotourism destinations can serve as a strategic tool in an increasingly competitive tourism landscape. Such profiling enables practitioners to identify target markets, design effective communication strategies, and develop products and services that respond to specific visitor needs (Stange et al., 2011). Furthermore, visitor profiles significantly influence destination management strategies aimed at achieving critical outcomes, including enhanced visitor satisfaction and long-term site sustainability (Weaver, 2012).

In the tourism and hospitality sector, AI-driven services now appear in multiple forms, including chatbots, self-service technologies, virtual reality applications, digital assistants, service robots, and automated check-in/check-out kiosks. These technologies are

anticipated to substantially benefit the industry by promoting growth while enabling service delivery that is efficient, accurate, fast, and cost-effective. As a result, interactions within tourism and hospitality settings are expected to evolve progressively from traditional human–human exchanges to human–machine and eventually human–robot interactions.

Visitors increasingly recognize the advantages of AI-enabled services, noting that interacting with AI devices is enjoyable and engaging; AI technologies operate faster than human staff; they deliver services with greater accuracy and fewer errors; they offer more consistent information; and they can communicate in a wider range of languages than human employees (Abd El-Kafy et al., 2022).

Despite these advancements, the application of AI in water-related domains remains comparatively limited when contrasted with sectors such as energy, healthcare, or transportation. Nonetheless, AI-powered recommendation systems hold significant potential by matching travelers with sustainable accommodations, activities, and transport options, thereby encouraging more responsible tourism consumption. Beyond sustainability, AI technologies also enhance visitor engagement and satisfaction. Chatbots and virtual assistants equipped with natural language processing offer immediate assistance and personalized guidance, enriching both the planning phase and the on-site tourism experience (Fatima & Arsalan, 2024). Based on above discussions, the following hypotheses are proposed:

H1: Visitors are not interested in venturing out at Dumboor Lake

H2: The adoption and effective use of AI in lake tourism—including VR/AR experiences, AI-driven management applications, stakeholder readiness, safety and environmental monitoring needs, ecosystem sensitivity, policy support, and community acceptance—is significantly influenced by technological, environmental, institutional, and social factors

3. Research Methods

This study draws on both primary and secondary data. Primary data were collected through a structured field survey designed to assess visitors' perceptions regarding tour party composition, place of origin, type of tour, daily expenditure, mode of transport, duration of stay (day trip or night halt), and overall tourism experience at Dumboor Lake. A dedicated section of the survey focuses on the potential application of AI in areas such as ecosystem management, real-time navigation, intelligent guiding systems, safety monitoring, and VR/AR-based nature interpretation of Dumboor Lake. It also evaluates the capacity of local authorities, tourism operators, and service providers to adopt AI tools; the need for monitoring water conditions, detecting hazards, forecasting weather changes, and managing visitor flows; AI-enabled biodiversity monitoring, pollution detection, and resource management; relevant conservation policies, regulations, funding opportunities, and digital tourism initiatives; and community perceptions of technology and willingness to engage with smart systems.

A total of 112 tourists at the lakeside participated in the study, which utilized a field survey method for data collection. Trained enumerators gathered data through structured schedules, acknowledging the inherent limitations associated with the chosen approach.

Secondary information was sourced from online materials and official publications, including reports from the Ministry of Tourism (Government of India), the Department of Tourism (Government of Tripura), and established travel platforms such as TripAdvisor, MakeMyTrip, and Google. Data were analysed using basic statistical tools, including averages and t-tests, in accordance with the analytical requirements of the study.

4. Result

Table 1. Major Ecotourism Destinations in Tripura

Destinations	Specializes in	Location	Distance from capital	Known for
Dumboor Lake	Adventure tourism/ Ecotourism	Dhalai	125 km	Houseboats, Boating, Coconut Island
Jampui Hills	Adventure tourism/ Ecotourism	North Tripura	220 km	Highest peak, picturesque landscape, Orange garden
Baramura Eco-park	Ecotourism	Khowai	37 km	Eco-biodiversity
Tepania Eco-park	Ecotourism	Udaipur	55 km	House of 225 orchids.
Chhabimura	Ecotourism	Gomati	82 km	Rock carvings on the steep slope mountain range.
Sepahijala Wildlife Sanctuary	Wildlife/ Ecotourism	Sepahijala	28 km	Rich biodiversity of Tripura
Trishna Wildlife Sanctuary	Wildlife/ Ecotourism	Belonia	111 km	Bison and endangered ape species
Ujjayanta Palace	Archeological/ Ecotourism	Agartala	0 km	Royal Palace and state museum.

Table 1 presents a comprehensive overview of the major ecotourism destinations in Tripura, highlighting their unique characteristics, spatial distribution, and tourism specialisations. The destinations reflect a diverse blend of ecological, adventure, wildlife, and cultural tourism resources spread across different districts of the state. Dumboor Lake, located 125 km from the capital, stands out as a key hub for adventure and ecotourism, known for its houseboats, boating facilities, and the scenic Coconut Island. Jampui Hills, the farthest destination at 220 km, is renowned for its picturesque landscape, highest peak, and the famous orange gardens, making it a prominent site for nature-based adventure tourism.

Baramura Eco-park in Khowai and Tepania Eco-park in Udaipur, situated relatively close to Agartala at 37 km and 55 km respectively, offer eco-biodiversity attractions and orchid conservation, reflecting the state's emphasis on preserving ecological assets. Cultural and archaeological tourism are represented by Chhabimura and Ujjayanta Palace. Chhabimura, located 82 km away, is famous for its ancient rock carvings along steep mountain slopes, while Ujjayanta Palace—situated within the capital city—serves as an iconic heritage site and state museum.

Tripura’s wildlife wealth is captured through the Sepahijala and Trishna Wildlife Sanctuaries. Sepahijala, only 28 km from the capital, is well known for its rich biodiversity, whereas Trishna Wildlife Sanctuary, 111 km away in Belonia, is home to bison and several endangered ape species. Overall, the distribution of these destinations shows a balanced mix of natural, cultural, and wildlife-based attractions, underscoring Tripura’s strong potential for sustainable and eco-friendly tourism development.

Table 2. Tourist Arrivals in Dumboor Lake

Year	Domestic Tourist (Nos)	Foreign Tourist (Nos)	Total (Nos)	Lake	
				1% of total arrivals#	From Tripura#
2022	236000	8000	244000	2440	10000
2023	366000	67000	433000	4330	12000
2024	601000	91000	692000	6920	20000
Cronbach alpha reliability					0.7205

Table 2 presents the trend in tourist inflow to Dumboor Lake over three consecutive years, showing a consistent and substantial rise in both domestic and foreign visitors. Domestic tourist arrivals in Tripura increased from 236,000 in 2022 to 366,000 in 2023,

marking a 55.1% increase, and further rose to 601,000 in 2024, representing an additional 64.2% growth over the previous year. A similar upward pattern is visible in foreign tourist arrivals, which rose dramatically from 8,000 in 2022 to 67,000 in 2023, a remarkable 737.5% increase, followed by another 35.8% rise to 91,000 in 2024. Overall, the total number of tourists visiting the lake increased from 244,000 in 2022 to 692,000 in 2024, reflecting a cumulative growth of 183.6% over the three-year period and indicating a strong positive trend in tourism performance.

Column 5, showing 1% of total arrivals, provides a benchmark to gauge the scale of visitation pressure; these figures also rise proportionately from 2,440 in 2022 to 6,920 in 2024, underscoring the increasing tourism footprint around the lake ecosystem. Additionally, the number of tourists originating from Tripura shows gradual growth, from 10,000 in 2022 to 20,000 in 2024, suggesting strengthening local engagement and regional mobility.

The Cronbach's alpha value of 0.7205 indicates an acceptable level of internal consistency in the stakeholder-derived data used in the analysis. Overall, the table highlights a steep rise in visitor arrivals at Dumboor Lake, which carries substantial economic significance for the region. The expanding volume of domestic and foreign tourists directly contributes to increased revenue generation through transportation, accommodation, food services, recreational activities, and local handicraft markets. The growing share of visitors from within Tripura further supports local enterprises and community-based tourism initiatives. Collectively, the upward trend in tourist numbers signals a strengthening tourism economy with the potential to enhance livelihoods and stimulate broader regional development, provided that growth is aligned with sustainable lake management practices.

Table 3. Tourist Arrivals in Dumboor Lake

	Respective Ranks		
Attractions	www.tripadvisor.in	www.makemytrip.com	www.google.com
Unakoti Rock Carvings	1	4	2
Ujjayanta Palace	2	9	1
Neermahal Palace	3	2	3
Tripurasundari Temple	5	1	5
Sepahijala Wildlife Sanctuary	6	8	4
Jampui Hill	7	3	6
Dumboor Lake	11	7	7
Pilak	12	6	8

Table 3 showcases the ranking of Tripura's major tourism attractions across three leading travel platforms—Tripadvisor, MakeMyTrip, and Google. The analysis illustrates the recognition and popularity of these destinations among travelers in both domestic and global contexts. Unakoti Rock Carvings emerges as the top-ranked attraction overall, consistently holding high positions across all platforms, resulting in the best average ranking (2.33). Ujjayanta Palace follows closely, being ranked first by Google and holding a strong overall position despite variability across platforms (average rank: 4.00).

Neermahal Palace secures the third position, supported by positive rankings across the platforms (average rank: 2.67). Tripurasundari Temple also performs prominently with its first-place ranking on MakeMyTrip, demonstrating its religious significance and tourism appeal. Sepahijala Wildlife Sanctuary and Jampui Hill occupy mid-level rankings, reflecting their ecological and adventure tourism strengths and steady visitor interest.

Dumboor Lake and Pilak are positioned toward the bottom of the rankings, with higher numerical ranks indicating relatively lower visibility or accessibility compared to other

destinations. This suggests a need for enhanced tourism promotion, infrastructure, and experience diversification for these sites. To quantify platform consistency and overall attractiveness, the mean ranking scores were computed (lower mean = better rank):

Table 4. Overall Attractiveness and Mean Ranking of Top Tourism Destinations

Attraction	Average Rank	Overall Order
Unakoti Rock Carvings	2.33	1
Neermahal Palace	2.67	2
Tripurasundari Temple	3.67	3
Ujjayanta Palace	4.0	4
Jampui Hill	5.33	5
Sepahijala Wildlife Sanctuary	6.0	6
Dumboor Lake	8.33	7
Pilak	8.67	8

Cultural heritage and archaeological sites (Unakoti, Ujjayanta Palace, Neermahal, and Tripurasundari Temple) dominate the top four positions (Table 4), indicating a strong tourist preference for heritage tourism in Tripura. Natural and ecotourism locations such as Sepahijala, Jampui Hill, and Dumboor Lake appear in mid-to-lower tiers, implying opportunities for enhanced promotion, accessibility, and infrastructure improvement.

Ranking variations across platforms highlights differences in audience preference: Google reflects broader public popularity, TripAdvisor emphasises global travelers, and MakeMyTrip captures domestic tourist priorities. Overall, the results emphasise the potential to balance heritage-based tourism with the growing prospects of eco-adventure tourism by prioritising sustainable development, marketing outreach, and improved tourism services at lower-ranked destinations.

Table 5. Demographics of Visitors Survey (N: 112)

Parameters	No of visitors	%age of the total
Nature of tour party		
Family tour	43	38.39
Excursion	34	30.36
Friends	21	18.75
Others, including picnic	14	12.50
State/region of origin		
From the state itself	32	28.57
From other North Eastern states'	47	41.96
From other parts of India	30	26.79
Outside India	3	2.68
Type of tours		
Personal/self arranged	82	73.21
Conducted tours	30	26.79
Expenditure per visitor/ day		
Below 50 USD	41	36.61
50-100 USD	35	31.25
100-200 USD	19	16.96
200 USD +	17	15.18
Mode of transport to reach destination		
Hired Cabs/ Bus	33	29.46
Hired Cabs	25	22.32
Train + Hired Cabs	31	27.68
Air + Hired cabs	23	20.54
Day-tripper/ Night-halt		
Day-tripper	68	60.71
Night-halt	44	39.29

Cronbach alpha reliability	99.68
t-value of 0.6676; P-value of 0.254211	

Table 5 presents the demographic characteristics of the 112 visitors surveyed across Dumboor Lake. The nature of the tour party indicates that family tours dominate the visitor profile, accounting for 38.39%, followed by excursion groups at 30.36%. Visits undertaken with friends represent 18.75%, while picnics and other informal groups constitute the remaining 12.50%, suggesting that ecotourism sites in Tripura attract both family-oriented and educational or recreational group travelers.

Regarding the region of origin, a substantial proportion of visitors (41.96%) arrive from other Northeastern states, highlighting the regional appeal of Tripura's ecotourism attractions. Visitors from within the state itself form 28.57%, while those from other parts of India account for 26.79%. International visitors constitute only 2.68%, reflecting limited global penetration and the need for stronger international marketing strategies.

The data indicates that a significant majority of tourists (73.21%) prefer self-arranged or personal tours, while a smaller portion (26.79%) opts for conducted or organised tours. This pattern suggests that tourists largely prefer flexible, self-managed travel plans, possibly due to cost considerations or ease of access. Visitor expenditure patterns indicate that most tourists spend below moderate levels per day. About 36.61% spend below USD 50, followed by 31.25% spending USD 50–100. Higher spending categories, including USD 100–200 (16.96%) and above USD 200 (15.18%), represent a smaller fraction, suggesting that the destinations surveyed largely attract budget-conscious or mid-range travelers.

The transportation data indicates that visitors utilise a variety of travel modes to reach their destination. Hired cabs and buses are the most common (29.46%), followed closely by mixed modes such as train plus hired cabs (27.68%) and air plus hired cabs (20.54%). Only 22.32% rely solely on hired cabs. This distribution indicates that accessibility and multimodal transport connectivity play a significant role in tourism flow. The duration of visit shows that day-trippers (60.71%) significantly outnumber those opting for night-halts (39.29%), implying that many destinations may be perceived as short-visit attractions or may lack adequate accommodation infrastructure to encourage overnight stays. The reliability of the survey instrument is extremely high, with a Cronbach's alpha of 0.9968, indicating excellent internal consistency across the measurement items.

The test results indicate a t-value of 0.6676 and a p-value of 0.254211. Since the p-value is greater than the alpha level of 0.05, the result is not statistically significant at the 5% level. Consequently, the null hypothesis stating that "visitors are not interested in venturing out at Dumboor Lake" is rejected. Alternatively, the findings support the acceptance of the hypothesis that visitors are indeed interested in venturing out at Dumboor Lake.

Table 6. Tourism Experience of Dumboor Lake and Use of AI

Attributes	Yes (%)	No (%)
Is incorporating virtual reality (VR) or augmented reality (AR) experiences essential for effectively promoting Dumboor Lake?	59	41
Do you believe that AI-driven applications—such as real-time navigation, intelligent guides, and safety monitoring—are necessary for the effective management of the lake?	65	35
Do the willingness and capacity of local authorities, tourism operators, and service providers to adopt AI tools—such as chatbots, predictive analytics, and automated ticketing—significantly influence implementation outcomes?	57	43
Is the adoption of AI driven by the need to monitor water conditions, detect hazards, forecast weather changes, and manage crowd flows to ensure visitor safety in lake environments?	60	40

Do lakes with sensitive ecosystems benefit from AI-enabled biodiversity monitoring, pollution detection, and resource management, and do conservation policies further motivate the deployment of such technologies?	63	37
Do regulations, funding opportunities, digital tourism policies, and smart-destination initiatives significantly influence the pace of AI adoption?	55	45
Do community perceptions of technology, willingness to engage with smart systems, and concerns about job displacement or surveillance influence the integration of AI-based tourism initiatives?	53	47
Cronbach alpha reliability	0.9189	
t-value 7.78045; p-value of 0.00001		

Table 6 presents the respondents' perceptions regarding the application of artificial intelligence (AI) and immersive technologies in promoting and managing Dumboor Lake. Overall, the results indicate a generally positive attitude toward the integration of AI in lake tourism. A majority of respondents (59%) view virtual reality (VR) and augmented reality (AR) as essential for promoting Dumboor Lake, indicating a rising acceptance of immersive technologies in tourism. Similarly, 65% believe that AI-driven applications—such as real-time navigation, intelligent guides, and safety monitoring—are necessary for the effective management of the lake, highlighting the perceived value of digital tools in enhancing visitor experience and operational efficiency.

Stakeholder readiness also emerges as an important factor, with 57% agreeing that the willingness and capacity of authorities and service providers significantly influence the outcomes of AI implementation. Safety and environmental monitoring appear to be strong drivers of AI adoption, as evidenced by 60% affirming the need for AI to monitor water conditions, forecast weather, detect hazards, and manage crowd flows. Environmental conservation is another area where AI adoption is strongly supported; 63% of respondents believe that sensitive lake ecosystems benefit from AI-enabled biodiversity monitoring, pollution detection, and resource management, further motivated by conservation policies. Institutional factors also play a crucial role, with 55% of respondents agreeing that regulations, funding, and digital tourism policies impact the speed of AI integration.

Community-level factors show a comparatively balanced perception: 53% of respondents agree that community acceptance, willingness to use smart systems, and concerns about privacy or job displacement affect the integration of AI-based tourism initiatives. The high Cronbach's alpha value of 0.9189 indicates excellent internal consistency among items, confirming strong reliability of the scale measuring perceptions related to tourism experience and AI use.

The t-value of 7.78045 and the p-value of 0.00001 indicate a statistically significant result, as the p-value is well below the 0.05 alpha level. Therefore, the hypothesis that the adoption and effective use of AI in lake tourism—including VR/AR experiences, AI-driven management applications, stakeholder readiness, safety and environmental monitoring needs, ecosystem sensitivity, policy support, and community acceptance—is significantly influenced by technological, environmental, institutional, and social factors is accepted.

5. Discussion

The analysis of Tripura's ecotourism landscape reveals a diverse and evolving tourism environment shaped by natural, cultural, adventure, and wildlife attractions. Table 1 illustrates the spatial distribution and thematic specialisation of major destinations across the state. Locations such as Dumboor Lake, Jampui Hills, Baramura Eco-park, and Tepania Eco-park highlight Tripura's ecological richness and scenic appeal, while heritage landmarks like Ujjayanta Palace, Chhabimura, and Neermahal emphasise the state's deep cultural and archaeological significance. The presence of Sepahijala and Trishna Wildlife

Sanctuaries further strengthens the state's wildlife tourism potential. Collectively, these destinations demonstrate a balanced portfolio of tourism resources that, if systematically developed, can position Tripura as a leading ecotourism destination in Northeast India.

A closer examination of tourist inflow patterns (Table 2) underscores the rising prominence of Dumboor Lake within this tourism framework. Tourist arrivals have increased sharply over the three-year period (2022–2024), with domestic visitors growing by 55.1% from 2022 to 2023 and by another 64.2% the following year. Foreign tourist arrivals, though smaller in absolute numbers, exhibit exceptional growth—737.5% between 2022 and 2023 and 35.8% between 2023 and 2024. This consistent upward trend demonstrates expanding awareness, improved accessibility, and the growing appeal of Dumboor Lake as an ecotourism destination. The cumulative increase of 183.6% in total tourist arrivals indicates a rapidly strengthening tourism base, which significantly boosts the economic prospects of the region.

The increase in the number of visitors in Tripura—from 10,000 in 2022 to 20,000 in 2024—signals rising local engagement and the emergence of domestic tourism circuits within the state. The 1% benchmark of total arrivals, rising from 2,440 to 6,920 during the period, underscores the growing visitation pressure and the need for sustainable tourism planning. The economic implications of these trends are substantial. Increased tourist arrivals stimulate revenue across multiple sectors, including transportation, accommodation, food services, recreation, and the local handicraft industry. Such growth benefits local communities, enhances livelihood opportunities, and supports small-scale enterprises. However, rapid tourism expansion also necessitates thoughtful strategies to safeguard the ecological integrity of sensitive lake ecosystems.

Tourism platform rankings (Table 3) provide additional insight into visitor perceptions and destination visibility. Unakoti Rock Carvings and Ujjayanta Palace consistently rank high across platforms such as TripAdvisor, Google, and MakeMyTrip, reflecting strong cultural and heritage-based appeal. Neermahal Palace and Tripurasundari Temple further reinforce the dominance of heritage tourism in Tripura. Mid-ranked destinations such as Sepahijala Wildlife Sanctuary and Jampui Hill highlight steady interest in ecological and adventure-based tourism. Conversely, the lower rankings of Dumboor Lake and Pilak point toward gaps in promotion, accessibility, and tourism infrastructure. These variations across platforms suggest that domestic and international audiences differ in their travel priorities, and tailored marketing strategies will be essential to enhance visibility for underperforming destinations. Strengthening digital presence, improving infrastructure, and diversifying tourism experiences could elevate the standing of natural attractions such as Dumboor Lake in the future.

Visitor characteristics presented in Table 5 offer further insights into tourist behaviour and preferences. Family groups (38.39%) and excursion groups (30.36%) dominate the visitor profile, highlighting Dumboor Lake's appeal for social, recreational, and educational activities. The regional composition of visitors shows a strong presence from other Northeastern states (41.96%), while local visitors constitute 28.57%, and tourists from other parts of India represent 26.79%. Limited foreign visitation (2.68%) highlights potential for international market expansion through targeted campaigns.

The predominance of self-arranged tours (73.21%) suggests that visitors prefer flexible and independent travel arrangements, likely facilitated by improved road connectivity and the ease of accessing information online. Expenditure patterns indicate that most visitors fall into budget or mid-range categories, with 36.61% spending below USD 50 per day and 31.25% spending between USD 50 and 100. This aligns with Tripura's positioning as an affordable ecotourism destination. Transportation choices reflect the reliance on hired cabs, buses, and multimodal options such as air-plus-cab and train-plus-cab combinations,

indicating moderate but growing connectivity. The dominance of day trips (60.71%) suggests either limited accommodation facilities near Dumboor Lake or visitor preferences for short excursions, indicating a need to expand lodging and recreational amenities to promote longer stays.

The reliability of the survey instrument is strongly supported by a Cronbach's alpha of 0.9968, indicating excellent internal consistency among responses and ensuring the robustness of the findings. The t-test results demonstrate that visitors are significantly interested in venturing out at Dumboor Lake, further validating the destination's potential for expanded ecotourism offerings such as guided nature walks, boat tours, and community-based activities.

Perceptions regarding the incorporation of AI and immersive technologies (Table 6) reveal strong support for technological integration in tourism promotion and management. A majority of respondents emphasise the importance of VR and AR applications for destination promotion, pointing toward the growing relevance of digital storytelling and virtual experiences in modern tourism marketing. Similarly, AI-driven tools for navigation, intelligent guiding, and safety monitoring are essential for improving visitor experience and operational efficiency. Stakeholder readiness, environmental monitoring, and ecosystem sensitivity emerge as key determinants of AI adoption, reflecting broader trends in sustainable tourism and digital governance.

Environmental conservation receives notable support, with respondents acknowledging the role of AI in pollution detection, biodiversity monitoring, and resource management. Institutional factors—such as regulations, funding, and digital tourism policies—also influence the pace of AI integration. While community acceptance is balanced, however, issues related to privacy, technological awareness, and job displacement necessitate focused sensitisation efforts. The AI perception scale demonstrates high reliability (Cronbach's alpha: 0.9189), with significant t-test results indicating that technological, environmental, institutional, and social factors notably influence AI adoption in lake tourism.

In nutshell, the findings underscore Tripura's rich ecotourism potential, strong tourism growth trends, evolving visitor profiles, and a favorable environment for technological innovation. Realising this potential requires strategic interventions in infrastructure, marketing, sustainability planning, and technology integration to ensure that tourism growth remains both economically beneficial and environmentally responsible.

5. Conclusion

The overall analysis highlights Tripura's significant potential as an emerging ecotourism destination, supported by a rich blend of natural, cultural, wildlife, and heritage resources. Dumboor Lake, in particular, has demonstrated remarkable growth in tourist inflows, accompanied by increasing local participation and expanding regional appeal. The steady rise in domestic and foreign arrivals underscores the destination's growing visibility and economic relevance, with important implications for livelihood generation and community development. Visitor profiles further reveal strong interest from family groups and educational/excursion parties, a preference for self-arranged travel, and spending patterns characteristic of budget-to-mid-range tourism markets. While heritage sites dominate online travel rankings, natural attractions such as Dumboor Lake show untapped potential that requires enhanced promotion, infrastructural development, and diversified tourism experiences.

The study also highlights increasing acceptance of artificial intelligence and immersive technologies as valuable tools for tourism management, conservation, and visitor experience enhancement. Respondents recognise the potential of AI-driven systems for safety monitoring, environmental protection, stakeholder coordination, and digital

promotion. The significant relationships identified in the statistical analysis confirm that technological, institutional, environmental, and social factors collectively shape AI adoption in lake tourism. These findings point toward a future in which digital innovation and sustainable ecotourism development can be strategically integrated to strengthen Tripura's tourism sector.

Future research can examine how visitor motivations, preferences, and spending patterns evolve over time, especially as infrastructure and digital technologies expand. As tourist numbers continue to grow, studies are needed to evaluate environmental thresholds, ecosystem sensitivity, and sustainable visitation limits for Dumboor Lake and other ecotourism sites. Detailed assessments of the economic benefits derived from lake ecosystems and surrounding communities can provide stronger justification for conservation-oriented tourism planning. Further research can explore capacity-building needs, technological barriers, and community perceptions to support successful AI adoption in tourism management. Comparative studies can analyse the effectiveness of digital marketing strategies, social media presence, and platform-based rankings in enhancing destination visibility. Future work can examine the relationship between transport connectivity, accommodation availability, and tourist satisfaction, identifying key areas for improvement. Research can evaluate participatory frameworks for local involvement, benefit-sharing mechanisms, and the socio-cultural impacts of increasing tourism activities. By addressing these research gaps, future studies can contribute to more sustainable, technology-enabled

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