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Digital Technology Transformation through Artificial Intelligence : An Analytical Study for Sustainable Tourism Operations

Abstract : Technology driven tourism and hospitality operation have always been a part of tourism industry. With the advent of Artificial Intelligence, tourism world has seen a rapid advancement and rapid adoption of artificial intelligence (AI) where destinations have reached at fast pace to the door of customers with a major overhaul through rapid adoption of artificial intelligence (AI). Present research paper attempts to analyse the importance of Artificial Intelligence in tourism business operations, its sustainable use and application for assisting operations in streamlining operations and to drive revenue management through AI-embedded technology. Study shows that AI technology is expected to rise rapidly from front to back office to power through virtual assistance where travel agents, tour operators and DMO's are ready to start using AI in their business operations. Data compilation work for the present research work is primarily based on the secondary sources to fetch entire spectrum of tourism industry readiness to use AI in their business operations. At the same time, tele-talks were conducted with major players in tourism industry to assimilate insights on the use and relevance of AI in tourism industry.

Primary research concluded that 45% travel agencies and other tourism players are planning to use AI in their business operations for enhanced customer service and personalized guest experiences. Other responded that use of AI in their business operations will be planned once they get use to this new technology, for enhanced marketing strategy to promote their tourism product and plans. Besides this, study also shows that tourism being a service industry, human element always remains at the core where services are being tangibilized in *'feel-the-*

fragrance' environs of personal touch. It can be extrapolated that the importance of artificial intelligence in tourism sector is essential to develop customized tourism products to add value to personalized customer experiences.

Keywords: AI, sustainability, tourism, technology, business, experiences, tourists.

1. Introduction and Conceptual Background : As per the study conducted by Forbes, AI will become a \$15.7 trillion industry by 2030, and investments are projected to reach approximately \$500 billion by 2025. The impact of AI on the global economy is expected to be profound, contributing significantly to its growth and transformation where 83% of companies claim that AI is a top priority in their business plans. Enterprises are investing in AI to automate processes, personalize customer and employee experiences, and transform their industries.

In the realm of tourism, there are several uses of AI system (Panigrahy & Verma, 2025). AI technologies are being harnessed to enhance tourist experiences (Samara et al., 2020), streamline operations, and introduce innovative services, as it can anticipate and meet the needs of travellers. Technology driven operations always have been a part of tourism industry and with the integration of Artificial Intelligence, it has seen a rapid advancement and significant transformation where destinations have reached at fast pace to the door of customers with personalized travel experiences. Efficiency in operations and sales volume pitching has emerged as a pivotal advantage. Virtual Reality (VR), robots, language translation applications, use of AI-powered chatbot tools & voice recognition and natural language processing systems (Gidumal, 2020) are offering noble ways to tourists to experience and explore destinations. Furthermore, this augmented approach allows for the creation of tailored travel recommendations, efficient booking processes, and intelligent customer service solutions. The integration of Artificial Intelligence into tourism can emerge as a transformative force, particularly in Uttarakhand, which is an ecologically sensitive region.

Artificial Intelligence (AI) is appearing in almost every area of travel and tourism (Gretzel, 2011) with high transformation in enhancing customer experiences and operational efficiency through personalized services and smart technology applications. Creativity, customer experiences, technical efficiency is pertinent with sustainability, being directly linked to tourism destinations where leading-edge companies are applying AI to help reduce their environmental footprint, accelerate positive change in meeting decarbonization goals, and identify opportunities for greater efficiency and growth to help combat climate change (Intel Corporation 2019). Recent studies by many researchers and policy reports highlighted AI's potential to enhance sustainability, optimize resource use, and mitigate environmental impact, being in transformative role in monitoring and mitigating the carbon footprint of tourism activities in ecologically sensitive regions of Uttarakhand like Rishikesh, Haridwar, Nainital, Kedarnath, and the Tungnath treks. A significant stride towards technological advancement was taken in Uttarakhand where it aims to become Centre of Excellence for Artificial Intelligence to manage the state's natural resources and enhancing tourist experiences and improve the efficiency of tourism-related services.

Many AI-related applications have already been adopted in the tourism sector, with further scope for innovation to support sustainable and inclusive tourism development (OECD, 2024). Agentic AI is a class of artificial intelligence that focuses on autonomous systems that can make decisions and perform tasks with limited or no human intervention. When it comes to reduce human interface, Agentic AI is important system, allowing for autonomy to perform tasks without constant human oversight. This is even important in tourism and travel industry where human interface seems to be quite high. Given the tremendous potential of agentic AI, travel and

hospitality companies are beginning to experiment with it.

Applications and potential of AI in tourism shows the variety of implemented and planned AI applications in place with the potential to (*Adopted from OCED Tourism Papers 2024/02*):

- Enhance the visitor experience with more interactive, personalised experiences and seamless travel, while increasing responsiveness to demand with 24/7 and more personalised services.
- Improve accessibility and audience engagement with greater accessibility of content and diversified offer of culture and recreation services.
- Enhance market intelligence and data use, as well as capacity for market segmentation and customer profiling.
- Optimise visitor flows and traffic management with real-time data and automated decision making.
- Support price/cost optimisation, through predictive maintenance, resource use and procurement.
- Automate internal processes and basic customer services.

Tourism services are relying on AI-supported tools to enhance customer experiences, stand out from the competition, and maximize profits. Chatbots are used to provide assistance and service to customers online. Melián-González et al. (2019) discussed the determinants of Chatbots usage by tourists. In fact, the global Chatbots market is projected to reach \$15.5 billion by 2028, demonstrating how pervasive these tools have become. Since 2023, Expedia group is using a new in-app travel planning experience supported by ChatGPT. It supports global travel with its suite of online products, and the company is making trip planning even easier with its AI travel agent. Sabre delivers AI and machine learning solutions to travel companies in the form of Sabre Travel AI. TripAdvisor is known for guiding travelers with tips and insights ahead of their journey, but the company has made waves for its AI virtual voice tour to revamp tourism activity in Orlando and Abu Dhabi.

SmarterTravel serves as an online hub compiling information on destinations, hotels, travel tips, gear and other travel trends. Generative AI is unlocking new opportunities like personalized recommendations, Operational Efficiency, Predictive Pricing Models, Dynamic Itinerary Creation, AI-Generated Marketing Content, and Virtual Travel Assistants. Given the tremendous potential of Agentic AI, travel and companies are beginning to experiment with it to transform enterprise-scale operations. Ixigo Group, MakeMyTrip, and Thomas Cook are using AI for personalized recommendations, AI-powered Chatbots, and voice-based travel advisors to enhance customer service and trip planning. Online travel booking platform MakeMyTrip has introduced an AI-powered virtual travel agent that can guide users through every step of their journey on the website, from trip planning and booking to handling post-sales queries such as cancellations and refunds, via both voice and text. Thomas Cook has proactively embedded AI into its Omni-channel platforms for personalised travel solutions, better booking processes, and quality real-time support for customers. Booking.com, one of the world's leading digital travel platforms, is expanding its AI-powered features to deliver more tailored and time-saving solutions for travelers. ixigo's AI chatbot, Tara, handles 86.95 per cent of customer service queries without human intervention.

As compared to their global counterparts, Indian travel companies are ahead in adopting AI and GenAI in enhancing customer experiences, personalized trip planning. Table 1 illustrates the major travel companies of India using AI-embedded technology to provide better tourism experiences to tourists.

S. No.	Travel Company	AI-enabled tool	Application and Use
1.	MakeMyTrip	Myra	Guide users through every step of their journey on the website, from trip planning and booking, cancellations and refunds
2.	Expedia Group	Expedia Chatbot, Romie	Employs AI to enhance user experience through its virtual travel agent. Uses natural language processing and machine learning algorithms to understand user queries and provide real-time assistance.
3.	TripAdvisor	TripAdvisor's virtual tool	Leveraging AI algorithms, TripAdvisor's virtual tours allow users to explore destinations and attractions worldwide using natural language commands.
4.	Booking.com	AI Trip Planner	Uses AI for dynamic pricing optimization that allows the platform to adjust room rates in real time based on factors such as demand, seasonality, and competitor pricing. Uses NLP technology to enhance its customer service through Chatbots and virtual assistants.
5.	Thomas Cook India & SOTC	AI-powered platform	Allow travellers book custom itineraries, including real-time availability of hotels and experiences. By leveraging natural language processing (NLP) and sentiment analysis tools, we can track customer feedback across various channels
6.	Ixigo	Ixibaba Tara-AI Chatboat	AI for personalized trip planning, flight price prediction, and post-booking support like airport navigation.
7.	Cleartrip	Trippy	Uses AI for tasks like generating trip itineraries, analysing flight trends, and automating customer service.
8.	Air India	AI.g	Innovative potential to elevate travel experience and assisting in flight status, confirmation of your baggage allowance, or assisting in boarding pass.
9.	Yatra.com	DIYA	advanced AI-powered travel assistant designed to help users plan, book, and manage trips through a conversational interface.

Source: Compiled from various web-links and literature.

2. Aims and Objectives : Present research paper is based on the following aims and objectives.

- Highlighting the potential to harness AI as a tool to promote innovation and enhance the sustainable business operations.
- Analysing the role of AI is sustainable tourism business operations in the study area.
- Studying the readiness and promptness of travel professional to take on to the world of AI in business domain.
- To analyse the changing dimensions of AI in the tourism industry.

3. Review of Literature : In 1956, John McCarthy introduced Artificial Intelligence which paved the way for future advancement (Goswami et al. 2024). Artificial intelligence is

particularly relevant to travel and tourism for several reasons, as Tourists need to make a series of decisions about future trips, for example, choosing a destination, transport, accommodation, and activities, among other things (Gidumal, 2020). To quote, Milton (2023) discussed that the relationship between Artificial Intelligence (AI) and tourism is multifaceted and dynamic. Artificial Intelligence (AI) is emerging as a transformative force in tourism, offering significant innovation potential to address pressing challenges within the sector (OECD, 2024). Innovations such as AI-powered sentiment analysis, real-time translation, and augmented reality tours underscore the potential of AI to revolutionize tourist experiences (Milton, 2023). Report of HTC Global services in 2017 highlights that AI is changing the entire spectrum of work environment where tourism business is working in the midst of machine-learning environment. Goyal et al. (2024) provide a thematic analysis of sustainability-focused tourism research in the Indian Himalayan Region over four decades. Their review notes a growing interest in emerging technologies, including AI, as enablers of climate resilience and community welfare. This aligns with the broader shift toward data-driven governance and smart tourism infrastructure.

Artificial intelligence is usually defined as a set of technologies that can imitate human intelligence in the process of problem solving (Lai and Hung 2018). Evolved over time (Buhalis et al. 2019), able to act autonomously on large amounts of data (Sterne 2017). The Ministry has launched the revamped version of Incredible India Digital Platform (IIDP) as a comprehensive resource for travellers and stakeholders interested in exploring the country's rich cultural heritage, natural beauty, and diverse attractions of the country. This digital platform leverages AI for personalized recommendations, seamless booking, and virtual tours (PIB, 2025). Digital India focuses on digital infrastructure, online governance, and services to enhance digital literacy (Goswami, 2016). Russell and Norvig (2010) organized artificial intelligence into four categories of Thinking Humanly, Acting Humanly, Thinking Rationally and Acting Rationally where they highlighted that a system is rational if it does the "right thing," given what it knows.

At the core of AI technology lies the ability to analyze vast amounts of data, recognize patterns, and make decisions at a speed and scale beyond human abilities (Gidumal, 2020). Rajput and Kaur (2025) emphasize the role of AI in optimizing electricity, water, waste, and transportation systems in tourism destinations. Their study suggested that AI could help in predicting efficient resource management to reduce the carbon footprint of tourism operations and sustainable development in fragile ecosystems such as Uttarakhand's hill stations and pilgrimage corridors. Further, they highlighted the role of AI in conserving biodiversity through data analysis and predicting and keeping the visitors' behaviour under surveillance. The Govind Ballabh Pant National Institute of Himalayan Environment (2022) identifies tourism-induced ecological stress in the Himalayan region, as noted in its environmental assessment submitted to the Ministry of Environment, Forests, and Climate Change (MoEFCC). The report recommends the adoption of AI and GIS-based monitoring systems to track environmental degradation, manage visitor flows, and support disaster preparedness—particularly relevant for landslide-prone zones and high-altitude destinations like Kedarnath Valley of Flowers, and Tungnath.

As regards to practical implementations of AI are concerned, partnership between LastClues and Uttarakhand Tourism (ETTravelWorld, 2025) showcases how AI-powered digital platforms are being used to promote local tourism ecosystems. These platforms curate culturally rich content, personalize travel recommendations, and support decentralized tourism models that reduce pressure on popular destinations like Haridwar, Rishikesh, and Nainital. Complementing these insights, the Green Initiative (2025) outlines how AI can support climate action in tourism by enabling carbon tracking, predictive analytics, and eco-conscious itinerary planning. This

reinforces the argument that AI is not merely a technological upgrade but a strategic enabler of sustainable tourism policy.

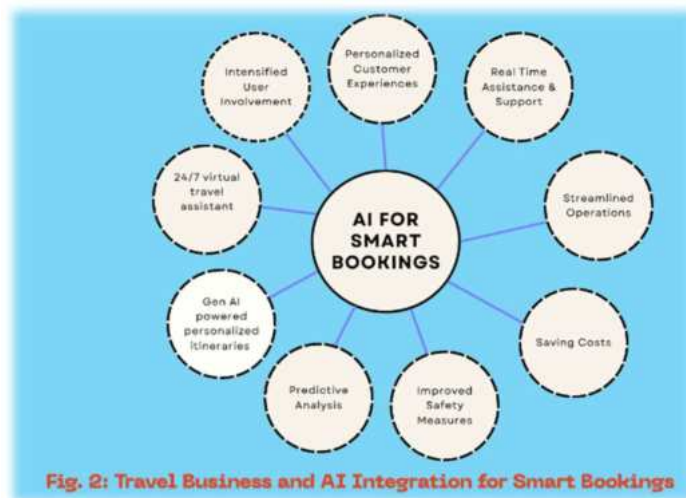
4. AI-embedded Digital Technology for Tourism Industry : AI in tourism is revolutionizing the way to travel, creating more personalized, efficient, and enjoyable journeys (fig. 1). AI support efforts to promote sustainable tourism practices with enhanced the efficiency, responsiveness, and accountability of tourism business towards environment. New technologies are reshaping tourism and represent a powerful catalyst for innovation in the sector which is a key driver of growth, job creation, and business dynamics, and a vital source of prosperity for many local communities (OECD, 2024).



The launch of ChatGPT in November 2022 brought AI into the public sphere and generative AI to the fingertips of all. In tourism, AI has the ability to enhance innovation and unleash its potential to drive sustainable and inclusive economic development. Travel agencies, tour operators and other intermediary travel services are more rapid adopters, combining different AI systems with enabling technologies, and leading in the global adoption of chatbots and virtual assistants (Eurostat, 2024).

AI can reason, recognise patterns and make predictions or decisions, create images, text, videos and other content, control smart connected devices and robots, and have basic conversations. AI is data-driven and performs with (intangible) resources such as data, algorithms and skills, and (tangible) assets which make up the AI computing infrastructure (OECD, 2024).

5. Leveraging AI for Smarter Bookings : A recent study by *Statista* revealed that over 60% of travelers globally are open to using AI-powered tools for trip planning. Personalized experiences, Real-Time Assistance and Support, Improved Safety Measures, Intensified User Involvement for tourists, on the one hand, and Streamlined Operations, Predictive Analysis, cutting-down on operational expenses are a big boon of AI, on the other (fig. 2).



However, widespread adoption will be slow. In 2023, 11% of firms in the travel agency and tour operator sector used at least one AI technology. This number drops to 4% in accommodation and food services (Eurostat, 2024). 60% of tourists prefer AI-driven personalized experiences. 40% of travel agents reported that AI will have a positive impact on

tourism. Additionally, a *Travelport* report highlights that 77% of leisure travelers rely on AI-driven platforms like Google Flights or Expedia to compare prices and find deals. AI adoption in travel is on the rise, with a significant number of travelers relying on AI-powered tools to:

- Predict and Compare Prices: AI models analyze historical and real-time data to predict price trends, helping travelers book at the right time.
- Receive Tailored Suggestions: Platforms like Google Flights and Expedia use AI to recommend flights and accommodations based on user behaviour.
- Enhance Booking Convenience: AI Chatbots and virtual assistants simplify the booking process, from flights to car rentals.
- Enhanced visitor experience with more interactive and seamless travel services.
- Automate internal processes and basic customer services.

These numbers underscore the growing influence of AI in the travel industry and its pivotal role in shaping the future of bookings. For businesses, integrating AI tools is no longer optional it's a necessity to meet evolving consumer expectations.

6. Harnessing AI for tourism innovation and sustainability : AI can drive innovation, handle difficulties, and achieve policy goals. Artificial Intelligence (AI) is rapidly becoming a game-changer in the tourism industry, unlocking innovative solutions to tackle the sector's most pressing challenges. Although AI adoption varies across tourism segments, its current and emerging impacts are becoming increasingly evident, highlighting the need to strategically navigate its opportunities, challenges, and risks. To promote sustainable tourism practices, AI assist in managing resources in a more efficient manner. Waste reduction, sustainable Energy use, skilled workforce and optimising tourist flows with greener transport system are utilized in a sustained manner. Environmental and sustainable goals are in focus, ensuring that tourism sector contributes to conservation efforts and benefits for local economy (OECD, 2024).

Recent advances in technology are changing the travel and tourist industry, which is an important engine of innovation, growth, job creation, and company dynamics. It is also a major source of income for many local communities. Through the development of central repositories, virtual assistants for teamwork, natural language processing for document management, simulations, and scenarios, AI can improve interoperability, data sharing, communication, and interagency coordination.

7. Discussion : The study explores the transformational role of Artificial Intelligence for sustainable tourism operations and it's relevance for tourism and travel industry which is changing the entire process and it's functioning. Our survey indicates that travel and tour operation business professional knows the importance of AI in their business but most are reluctant to use it currently. Reasons may be costly affairs, risky or it's tediousness to use in business where human element is given much importance. Respondents were asked to specify which areas of digital business they include in their tourism profession. Almost, all respondents indicate that they include both off-line and online business tools. However, due to the presence of human-centric service element of tourism industry, offline business is preferred over digital tools and component. Most respondents (82%) also indicated that they consider online business as an important part of modern-day tourism portfolio and business style. Secondary sources including weblinks, articles, journals, published government documents were used to study AI in Tourism industry.

Survey findings also shed light on how travel organizations are gearing up to structure their AI deployment efforts. It is also analysed that most respondents have yet to see organization wide impact, leaving them in wait-and-watch frame—and most aren't yet implementing the

adoption and scaling practices. The integration of AI in tourism brings about significant benefits, but it also presents various challenges and ethical considerations that must be addressed to ensure responsible use. Responsible AI use must prioritize data privacy, cultural sensitivity, and community consent—especially when digitizing sacred or indigenous heritage. Also, the use of collaborative AI models involving local stakeholders ensures that technology complements rather than replaces human custodianship of heritage.

One of the primary concerns in the adoption of AI in tourism sector is data privacy. AI systems often rely on vast amounts of personal data to function effectively, raising issues about how this data is collected, stored, and used. Since AI systems often depend on large volumes of personal data to deliver personalized services and insights, questions naturally arise about how this data is collected, stored, and utilized. To address these concerns, it is essential to implement robust data governance practices. Personal information should be anonymized wherever feasible to prevent identification, and secure, encrypted systems must be used to manage and store data responsibly. Ensuring transparency in data usage and obtaining informed consent from users are also critical steps toward building trust and promoting ethical AI deployment in tourism.

Artificial Intelligence (AI) is going to change the travel industry a lot in the coming years. With AI, travel companies can give customers really personalized experiences. For example, AI can look at what customers like and what they've booked before and then suggest customized travel packages, destinations, and activities. This kind of personalization makes the customer's experience better and helps travel agencies build stronger relationships with their customers. Companies that use AI technology are leading the way in giving these advanced, personalized services.

Also, AI-powered Chatbots and virtual assistants are becoming more common in the travel industry. These tools can answer customer questions all the time, give instant help, and even handle bookings and cancellations. By making these routine tasks automatic, travel companies can work more efficiently and focus on providing great service. As AI keeps getting better, companies that use AI will be really important in making travel more convenient, fun, and all about the customer.

8. Conclusion : The travel and tourism industry has seen a surge of AI applications on every spectrum. Despite remarkable advances in AI travel planning, certain aspects of traditional travel agents remain challenging to replicate fully. Understanding these limitations helps set realistic expectations for AI travel tools. AI technology is evolving quickly and becoming more accessible to businesses and end users globally, driving the emergence of new AI use cases. Regardless of where enterprises are in their AI journey today, opportunities exist to start incorporating AI into business workflows and to use AI to improve decision-making, gain competitive advantage, and improve experiences for customers and employees. The future of AI in tourism is bright, with emerging trends and potential developments promising to further revolutionize the industry.

Despite growing enthusiasm towards adoption of AI, however, the travel and hospitality sectors still appear to lag behind others in terms of AI maturity. Travel companies' AI-based efforts have largely cantered on creating enterprise-wide copilots and chatbots, and such efforts have scaled quickly. But for the most part, these more horizontal initiatives have delivered diffuse, hard-to-measure gains. Travel companies tend to favor investment in human interconnection instead of tech innovation.

Governments and tourism boards must invest in AI literacy for peoples to learn how to use AI and the technology enabled infrastructure to democratize access and reduce the digital

divide in heritage-rich but resource-constrained regions. With optimism about the promising future of AI integration in the tourism industry, it can be concluded that AI should be viewed not merely as a tool for efficiency, but as a catalyst for deeper cultural engagement, sustainable practices, and inclusive growth across the sector. Artificial Intelligence (AI) is at the forefront of revolutionising the travel industry. It has the potential to improve tourism policymaking's effectiveness, responsiveness, and accountability. It can also facilitate better decision-making by gathering and analysing timely, detailed data to create a stronger body of evidence. From personalized recommendations to streamlined booking processes and enhanced safety measures, these companies have shown the transformative power of AI in transforming the travel experience.

However, due to lack of expertise, ethical consideration and difficulty in accessing quality inputs are the common barriers to use AI in tourism operation. As India continues its journey towards becoming a global tourism hub, AI and digital platforms will play a pivotal role in reshaping visitor experiences. State Governments and UTAs are increasingly incorporating AI-driven solutions to improve accessibility, enhance engagement, and ensure seamless travel experiences. With government-backed initiatives like the Incredible India Digital Platform (IIDP) and AI-driven smart tourism infrastructure, India is set to emerge as a world leader in AI-powered tourism, offering visitors an unparalleled blend of tradition and technology.

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