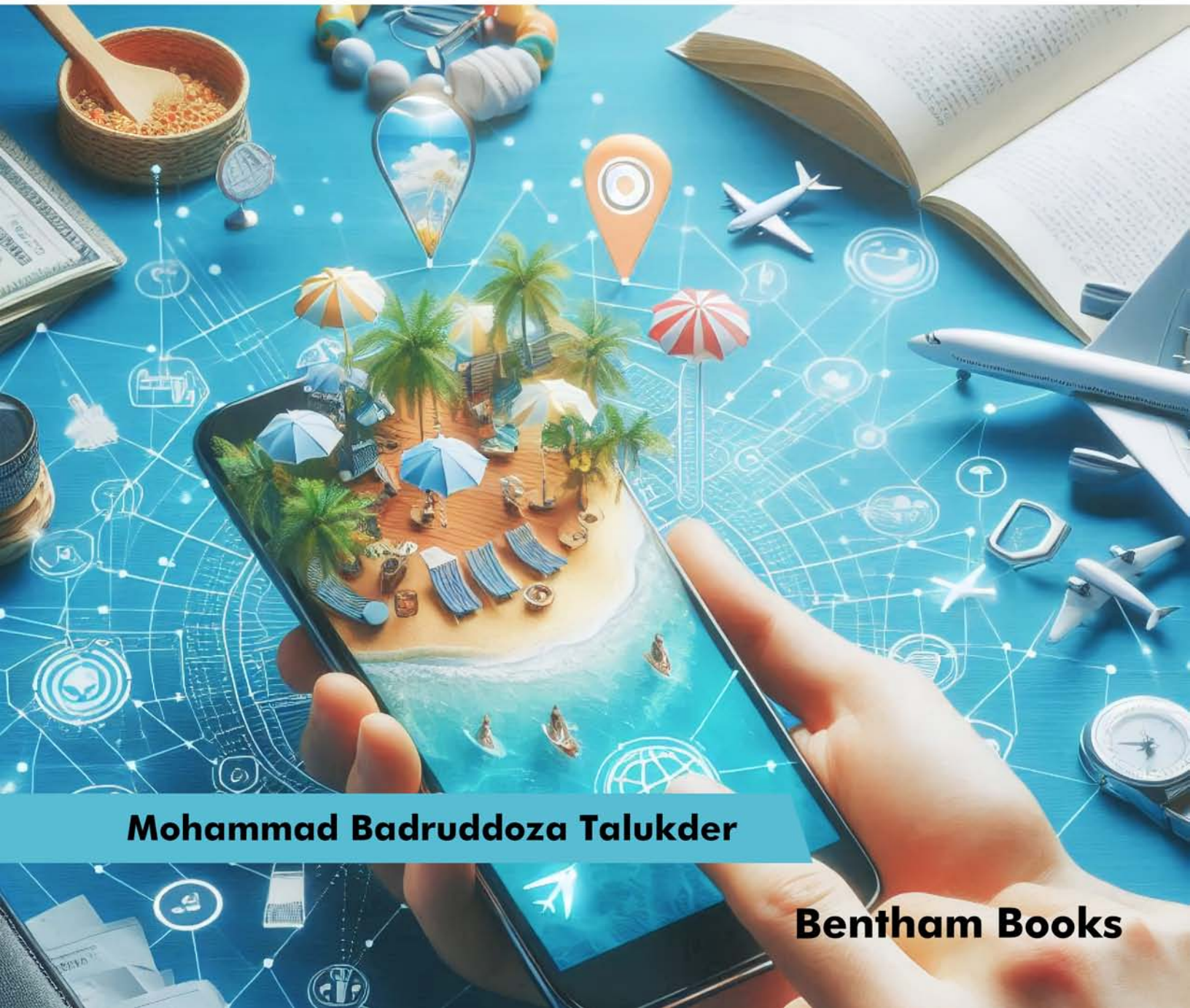
AI AND IOT APPLICATIONS FOR SMART TOURISM



Mohammad Badruddoza Talukder

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AI and IoT Applications for Smart Tourism

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FOREWORD

Tourism is undergoing one of the most revolutionary periods in its history. With the operational paradigms of destinations being endlessly redefined by artificial intelligence and the Internet of Things, the decision-making process of travelers and the experience of storytelling, the industry is on the brink of a new age. This age can be defined not only by technological innovation but also by intelligent empathy, sustainability, and human-focused design.

This book, titled *AI and IoT Applications for Smart Tourism*, arrives at the right time. Dr. Mohammad Badruddoza Talukder provides an insightful, future-oriented analysis of how emerging technologies are transforming tourism ecosystems. Clarity and intellectual rigor enable this work to bridge the fields of computer science, management, digital innovation, and hospitality, which explains why data-driven systems and interconnected devices can improve the organization's operations and travelers' well-being.

The book's value lies in its focus on integration, showing that AI and IoT do not operate independently but form a unified architecture that enables smart destinations, predictive services, sustainability goals, and more personalized visitor experiences. Dr. Talukder's interdisciplinary approach makes this volume a valuable tool for researchers, practitioners, policymakers, and students who want to understand or influence the development of tourism in the digital era.

In addition to outlining the possibilities of technology, the book offers a roadmap for responsible, ethical, and human-oriented use. Not only will readers have an enhanced knowledge base, but they will also gain a new perspective on the prospects of smart tourism innovation in relation to the potential liabilities associated with it.

It is my honor to contribute this valuable perspective to the international discussion on the future of tourism.

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PREFACE

The idea of developing smart tourism using Artificial Intelligence and the Internet of Things arose because the current tourism paradigm is changing faster than the existing theoretical background and practical solutions. As more destinations embrace sensor networks, intelligent platforms, and real-time data analytics, scholarly research and industry practice often struggle to keep pace with the scope and complexity of the change. This book aims to fill this gap by discussing the use of AI and IoT in smart tourist destinations, showcasing new technological advances, detailing implementation hurdles, and considering implications for tourism management, destination development, and sustainable tourism futures.

Over the course of the past several years, I have had the privilege of interacting with researchers, tourism experts, engineers, and students who all have a common curiosity: how can technologies that utilize artificial intelligence and the internet of things produce tourism experiences that are smarter, safer, more efficient, and more meaningful? Their inquiries, observations, and difficulties motivated me to investigate the interaction among technology, human behavior, and destination management through a more holistic lens.

This book brings together a variety of perspectives, including new ideas, practical applications, empirical insights, and forward-looking perspectives. In addition to being developed for academics, it is intended for tourism planners, digital strategists, business owners, and anyone else interested in shaping the future direction of tourism innovation. My goal throughout the chapters has been to demonstrate how intelligent systems can support sustainability, enhance operational intelligence, and enrich traveler interactions. I have done this by striking a balance between conceptual depth and real-world relevance.

Throughout this endeavor, I would like to express my appreciation to my coworkers, mentors, and students for their ideas and encouragement. Their assistance has been invaluable in polishing the perspectives presented in this book.

In the process of constructing the intelligent tourism landscapes of the future, I aim for this book to serve as both a basis and an inspiration, thereby fostering further exploration, cross-disciplinary collaboration, and ethical stewardship.

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CHAPTER 1

The Evolution of Tourism in the Digital Age

Abstract: Digital technologies have revolutionized the tourism sector as a whole, revolutionizing the planning, experience, and evaluation of tourism journeys around the globe. This chapter explores the journey from conventional tourism models to smart tourism ecosystems, with a particular focus on the main stages of the digital transformation of tourism, including the rise of online travel platforms, the impact of mobile technologies, the emergence of smart destinations, and the introduction of Artificial Intelligence (AI)-driven services. It examines the role of digital innovations in improving connectivity, personalization, operational efficiency, and destination management, and in bringing opportunities for sustainable tourism development. The chapter also explores the evolution of the tourist journey in the digital age and the impact of information-intensive decision-making in the tourism sector. Furthermore, it addresses key issues in digital transformation, including data privacy, digital inequality, algorithmic bias, and the preservation of a genuine tourism experience. The chapter provides a comprehensive overview of the opportunities and challenges that will define the future of smart tourism, synthesizing the latest literature and industry developments. It calls for the effective integration of digital technologies through a responsible, governance- and inclusion-focused approach to realize an innovative, sustainable, and resilient tourism sector.

Keywords: Artificial intelligence, Digital transformation, Smart destinations, Smart tourism, Sustainable tourism, Tourism evolution.

INTRODUCTION

Tourism is one of the world's fastest-growing economic sectors and has undergone substantial transformation due to technological advancements, evolving communication systems, and changing consumer behavior (Şimşek, 2024). The industry has progressed from traditional travel arrangements based on paper tickets, guidebooks, and travel agencies to digitally enabled experiences characterized by instant access to information, online booking systems, and personalized services (Lee *et al*., 2020). The digital revolution has fundamentally changed not only how tourism services are marketed and consumed but also how destinations, service providers, and tourists interact within increasingly connected environments (Kaakandikar *et al*., 2025).

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The evolution of tourism in the digital age has been driven by the emergence of smart tourism ecosystems that integrate digital technologies, data connectivity, and automated service systems to improve efficiency, personalization, and decision-making (Bhuiyan *et al*., 2022). These developments have transformed the tourism value chain, influencing all stages of the travel process, from trip planning and booking to on-site experiences and post-travel engagement. As a result, tourism organizations are increasingly adopting innovative technologies to respond to changing traveler expectations and enhance service quality (Berry *et al*., 2024).

Digital transformation has enabled tourism businesses and destinations to deliver more personalized and responsive services. Through data-driven approaches, tourism providers can better understand visitor preferences, improve customer engagement, and develop services tailored to individual needs (Mehataj *et al*., 2024; Saini *et al*., 2024). Furthermore, technological innovations support more efficient destination management by facilitating real-time information sharing, operational optimization, and improved visitor experiences (Khan *et al*., 2023).

At the same time, digital transformation presents important challenges. Issues related to data privacy, security, digital inequality, and the preservation of authentic tourism experiences have become increasingly significant for tourism stakeholders (Trivedi *et al*., 2023). Addressing these concerns is essential to ensure that technological innovation contributes to sustainable and inclusive tourism development while maintaining visitor trust and cultural integrity (Al-Romeedy & Singh, 2024).

Against this background, this chapter examines the evolution of tourism in the digital age and explores how digital transformation has reshaped tourist behavior, service delivery, and destination management. Particular attention is given to the emergence of smart tourism ecosystems and their implications for the future development of tourism. The chapter also discusses the opportunities and challenges of tourism digitalization and highlights its role in fostering innovation, sustainability, and competitiveness in the global tourism industry.

The remainder of the chapter is organized as follows: First, the transition from traditional tourism systems to smart tourism ecosystems is examined. Second, the influence of digital technologies on the tourist journey is discussed. Third, the opportunities and challenges associated with tourism digitalization are analyzed. Finally, the chapter highlights the implications of digital transformation for the future development of smart tourism.

Chapter Objectives

The objectives of this chapter are as follows:

- Research on how digital innovations have changed the way people plan their travels in the 21st century, service delivery, and customer experience in light of the transformation of traditional tourism to smart tourism ecosystems.
- Explore how the most notable digital enablers (AI, IoT, big data, and blockchain) can shape the future of current tourism processes, including personalization, real-time projects, and safe service platforms.
- Highlight real-life examples and cases that could be utilized to define how smart tourism tools have positively impacted operating performance by achieving both traveler satisfaction and sustainable development.

THEORETICAL OVERVIEW

Traditional Tourism Model to Smart Tourism Ecosystems

In the traditional tourism model, physical infrastructure such as transportation terminals and human-centered service systems formed the foundation of tourism operations, with direct interpersonal interactions playing a central role in enhancing the travel experience. In contrast, smart tourism ecosystems integrate digital technologies, intelligent infrastructure, and data-driven services to create personalized, seamless, and interconnected travel experiences. In the pre-technological era, the majority of travelers relied on travel agents, paper-based travel guidebooks, and pre-programmed tour packages. Nevertheless, it is the digital evolution that has reinvented the tourism industry as a web of connected and intelligent objects—what we can now call the smart tourism ecosystem (Boes *et al*., 2016). It is shifting from the outdated passive, transactional service model to active, data-driven interactions among destinations, services, and consumers, driven by Industry 4.0. A smart tour system is a digital system (with an online hotel booking system, mobile applications (hotel room pages), a GPS navigator, and social networks) that is employed to guide tourists. It also requires collaboration between society and the business realm and the application of technology to increase destination management, efficiency, and the user experience of the services provided (Boes *et al*., 2016). One example is smart cities such as Seoul and Singapore, which have developed real-time monitoring systems for managing and controlling tourist flows, improving safety, and promoting sustainable tourism. This transformation is a radical change in the planning, delivery, and consumption of tourism (Buhalis *et al*., 2023).

CHAPTER 2

Framework for AI and IoT Integration in Tourism

Abstract: This chapter discusses how Artificial Intelligence (AI) and the Internet of Things (IoT) provide a strategic opportunity to make tourism smarter, more sustainable, and more resilient. Tourism is highly experience-based and thus should be personalized, efficient, and flexible, and the integration of AI and IoT will meet these requirements. The three objectives of the chapter are as follows: (a) to come up with a scalable model of integrating AI and IoT, (b) to make improvements in smart destinations with smart infrastructures and data analytics, and (c) to encourage sustainable digital progress of tourism enterprises and authorities. The overview is informed by three theoretical frameworks: Technological Convergence Theory, Service Innovation Theory, and Digital Transformation Theory, which collectively explain how intelligent infrastructure, smart destinations, and strategic governance can create value. The proposed framework places intelligent infrastructure at the center of focus, smart destinations as the field of application, and digital transformation strategies as the engine of scalability and inclusiveness. The results indicate that AI and IoT can be combined to provide a more enriching visitor experience, optimize operations, and support environmental oversight, social inclusivity, and crisis response. Finally, the framework is a strategic roadmap that helps align tourism innovation with long-term sustainability, competitiveness, and community well-being.

Keywords: Artificial intelligence, Data governance, Digital transformation, Internet of things, Smart destination, Smart tourism ecosystem, Sustainability.

INTRODUCTION

With the rapid development of Artificial Intelligence (AI) and the Internet of Things (IoT), industries across the globe are being redefined, and the tourism sector is among the most dynamic areas undergoing digital transformation. Tourism is an experiential world that relies on flawless service delivery, efficient operations, and timely responses to the diverse needs of travelers. In the current environment, where the world is becoming more interconnected and passengers require customized, real-time, and eco-friendly services, the use of AI and IoT is being considered a potentially significant competitive edge. IoT complements these attributes by connecting physical spaces through smart devices, sensors, beacons, and wearables. This has increased the tendency to capture data everywhere and make systems communicate with each other. The integration of

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AI and IoT enables the development of smart tourism ecosystems and can transform traditional tourism models. These technologies facilitate personalized experiences, improve operational efficiency, and enhance communication with travelers. They can also help address challenges such as congestion, incidents, and pollution. In a rapidly changing world shaped by globalization, sustainability concerns, and unprecedented disruptions, such as pandemics, siloed approaches are no longer viable. Instead, integrated solutions are essential for enhancing resilience and promoting growth (Suanpang & Pothipassa, 2024).

This chapter provides a vivid account of the integration of AI and IoT in the tourism sector, including smart infrastructure, smart destinations, and business and government strategies for digital transformation. Intelligent infrastructure is the most significant part of this framework: an integrated, robust platform of IoT devices, data processing platforms, and AI-based analytics engines. The infrastructure enables destinations to retrieve real-time data on visitor counts, facility occupancy, and environmental and transport systems, which can be mined to generate actionable information. For example, AI algorithms can forecast the most frequented times of visit and redistribute resources accordingly, and IoT-linked devices may simply turn the lights on or off, regulate the climate, or send guests safety notifications to make them feel more comfortable and secure. These roads will enable smart destinations to become immersive. These are the kinds of strategic plans that will also advance cross-sector relationships among governments, tourism boards, and tech providers. They also emphasize the need for clear rules and ethical guidance, and the development of capacities. This makes the integration of technology inclusive, safe, and sustainable. Integrating AI and IoT with long-term tourism development goals can improve operational efficiency at destinations. This approach not only attracts more visitors but also ensures that technological advancements benefit local communities as well as tourists (Novera *et al*. 2022).

Finally, the framework itself could be adopted as an action plan, which could be implemented by the concerned stakeholders who could be interested in bringing AI and IoT solutions in a manner that would bring them sustainable and scalable results. It also points out that technology, infrastructure, and governance are complementary, and that balancing their combination is a harmonized exercise across policy, investment, and innovation ecosystems. When applied effectively, AI and IoT can also promote environmental sustainability by monitoring and optimizing resource utilization, reducing energy consumption, and supporting environmentally friendly transportation. The technologies can also enhance social inclusiveness by ensuring that travel is affordable for travelers with diverse needs, digitizing heritage as a form of cultural preservation, and enabling local communities to participate in tourism value chains. Additionally, any exogenous

shock, be it an economic shock, climate change, or even a health crisis, can be mitigated by AI and IoT, which provide real-time situational awareness and enable swift response. As the industry enters the digital age, how it employs these technologies to its advantage will determine its ability to be creative and competitive, as well as to meet the new demands of travelers around the globe. In this way, the chapter not only describes the theoretical background and the practical process of AI and IoT integration but also offers a vision of the future in which tourism can coexist with technological development, environmental sustainability, and social well-being (Veshohilova, 1975).

Chapter Objectives

The following are the objectives of this chapter:

- To establish an AI and IoT scalable platform technology.
- To create smart destinations, smart infrastructure, and data analytics.
- To improve sustainable online change in tourism companies and the state.

THEORETICAL OVERVIEW

The theoretical part of the AI and IoT integration in the tourism sector examines the key concepts and models for creating smart tourism environments. In simple terms, artificial intelligence enables machines to process large volumes of data, identify trends, and make smart decisions. Otherwise, the Internet of Things connects physical items and sensors to gather information in real time and establish a stream of data. Digital Transformation Theory emphasizes the strategic role of companies and governments in implementing AI and IoT to drive innovation, sustainability, and competitiveness. The given theoretical background provides valuable concepts on how the collective development of smart destinations by tourism stakeholders could both increase tourist satisfaction and address environmental and socio-economic issues. The background theories will be particularly useful in designing scalable and effective models that will inform sustainable integration of AI and IoT in the tourism industry (Tong *et al*., 2022).

Foundations and Models for AI and IoT Integration in Tourism

The figure presents a framework for integrating Artificial Intelligence (AI) and the Internet of Things (IoT) in tourism through technological infrastructure, data analytics, and user-centered services. These components work together to support smart applications such as machine learning, predictive analytics, personalization, and virtual assistants. The integration ultimately enhances visitor experiences, improves operational efficiency, and promotes sustainable tourism practices.

CHAPTER 3

Personalized Travel Experiences through AI

Abstract: Artificial Intelligence (AI) is enabling hyper-personalized and real-time travel experiences that react to personal preferences, behaviors, and situations and transform the tourism industry. This chapter will address how travel companies can integrate AI technologies (chatbots, machine learning algorithms, virtual assistants, and predictive analytics) into their travel planning and service delivery processes. Using custom recommendations, automatic bookings, sentiment analysis, and artificial intelligence-assisted safety systems, tourism companies can introduce a new dimension of customer satisfaction, efficiency, and safety to their operations. The practical impact of AI on increased traveler interest can also be demonstrated through case studies on major platforms such as TripAdvisor, Booking.com, and Expedia. The chapter also explores ethical issues, including data privacy, algorithmic discrimination, and cultural adaptability, and provides strategic guidance on the sustainable use of AI. The tourism sector can leverage AI to enhance its services, develop high-value, more sustainable, and inclusive tourism destinations, and bridge the gap between technological innovation and responsible practices.

Keywords: Artificial intelligence, Machine learning, Personalized tourism, Predictive analytics, Tourism technology.

INTRODUCTION

The development of artificial intelligence in tourism has been rapidly evolving. Previously constrained by rule-based systems and simple automation, such as booking systems or fixed lists of recommendations, AI has since become fertile ground for more awareness-based, predictive, and adaptive technologies. AI-driven chatbots can offer multilingual, 24/7 customer service via natural language processing, and virtual travel assistants can use real-time data to create itineraries that dynamically adapt to weather, crowd levels, or transportation delays. The ability to predict travelers' needs before they are explicitly expressed is enabled by machine learning algorithms trained on extensive datasets derived from user interactions, historical bookings, and social media. This shift from reactive to proactive service delivery has made AI a strategic partner, not just a tool, in destination management, travel planning, and on-site engagement. As such, tourism providers are investing more in AI to remain competitive in a market

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where personalization is no longer optional: it is an important brand differentiator and a customer loyalty attribute (McMartin *et al*., 2018).

The contemporary traveller wants to experience what is special to them and shuns pre-packaged offers in favor of customized trips that are symbolic of who they are in terms of lifestyle, values, and their changing tastes. Such a desire to hyper-personalize is more closely connected to a wider culture of consumption inculcated by streaming services such as Netflix, Amazon, and Spotify, where consumers are rendered relevant and tailored by algorithms. In tourism, AI is used to meet this need by integrating behavioral analytics, location data, sentiment analysis, and context to provide recommendations at the right moment, with higher precision and greater emotional appeal. For example, a single traveler who likes local food may be offered AI-generated dish recommendations based on the current location, optimal dining time, and authentic feedback from people with a similar profile in the tourist group. Similarly, route plans could be provided to families in a convenient, safe, and entertaining way. Integrating structured and unstructured data (*e.g*., booking history, social media posts, and online reviews) using AI creates a rich traveler profile that can inform real-time decision support. This means that each traveler's experience is designed as a responsive and immersive journey in which every touchpoint, whether online or in person, reflects a sense of care and attention to the traveler's individual needs and preferences (Eagan *et al*., 2025).

The opportunities for AI-based personalization in the tourism industry are immense; however, there are barriers to its adoption. These include data privacy, algorithmic bias, and the ethical implications of using personal data. Implementing AI in tourism ecosystems also requires significant investment to create infrastructure, build a high-skill workforce, and integrate platforms, which is a significant barrier for SMEs. Conversely, the opportunities presented by these technologies may also entail risks and challenges. Implementing AI can enhance customer satisfaction and efficiency, simplify resource allocation, and provide valuable information to Destination Management Organizations (DMOs) (Sheehan *et al*., 2016). The advent of generative AI, augmented reality synthesis, and predictive analytics opens new possibilities for developing the most engaging travel experiences. In this chapter, we will examine the theoretical foundations, practices, values, concerns, and future of AI-empowered individualized travel to provide a comprehensive description of intelligent tourism's future.

Chapter Objectives

The objectives of this chapter are as follows:

- To improve customization, provide custom recommendations and trips with real-time generation on the basis of user information.
- To enhance decision-making, use AI analytics to plan travel better and interact with customers.
- To improve the automation of service delivery, minimize wait times, and enhance operational flow.

THEORETICAL OVERVIEW

AI as a Catalyst for Personalized Tourism

Artificial Intelligence (AI) has been a game-changer in the tourism industry, revolutionizing how individuals plan their trips, explore new destinations, and get the most out of their travels. The personalization provided by AI can also be highly customized and adaptable to the traveler's preferences and context-dependent requirements through machine learning, natural language processing, and real-time data analysis. The shift extends beyond typical travel advice to more personal, experience-focused travel that can anticipate user behavior and help create greater satisfaction. As one of the most important technologies in the smart tourism ecosystem, AI does not merely personalize interactions; it can also be easily integrated into operational agendas and sustainability goals, becoming a competitive advantage in the global tourism industry.

Enhancing Traveler Experience through AI Integration

The introduction of AI in the tourism ecosystem also creates numerous personalized touchpoints that make the traveler's journey highly personalized, from planning to the follow-up contact after the visit. Chatbots enabled by AI and Natural Language Processing (NLP) are capable of giving immediate and multilingual customer service, addressing complicated inquiries and even processing booking requests without the assistance of a human operator. They are designed by virtual assistants, who assess users' preferences, travel history, and contextual information to create an itinerary that adjusts on the fly for new locations, dining, or events as circumstances arise. For example, weather forecasts can indicate rain, and AI can propose indoor activities aligned with traveler preferences (Yuan *et al*., 2023). In addition, recommendation engines are based on collaborative filtering and content-based filtering to provide highly relevant suggestions (Javed *et al*., 2021). The capabilities of Augmented Reality (AR), coupled with AI, can provide an immersive guided tour system that varies its content based on visitors' active involvement (Rane *et al*., 2023). As personalization becomes part of the competition, AI integration alters the vision of how customers are expected to be approached in the industry (Varsha P. S. *et al*., 2021).

CHAPTER 4

AI in Tourism Marketing and Customer Engagement

Abstract: Artificial Intelligence (AI) is reshaping tourism marketing and customer relationship management by enabling personalized service, real-time engagement, and data-driven decision-making. This chapter discusses the use of AI in tourism marketing, including personalization, sentiment analysis, predictive analytics, and the development of AI-based customer care systems. AI technologies, by analyzing large volumes of customer data, can provide a customized experience that enhances customer satisfaction, engagement, and loyalty in tourism businesses. AI-based recommendation engines enable customized travel experiences, and predictive analytics can guide businesses in making informed marketing decisions. AI-powered chatbots and virtual assistants offer round-the-clock customer service, facilitate communication, and optimize operations. Despite all of this, certain challenges arise when incorporating AI into the tourism industry, including data privacy, algorithmic bias, transparency, and the ethical use of customer information. These concerns are explored in this chapter, and the need for implement AI responsibly to preserve tourists' trust and ensure sustainable tourism development is emphasized. Informed by theories of personalization, sentiment analysis, and service automation, the chapter comprehensively addresses the impact of AI on tourism marketing and customer relationship management.

Keywords: Artificial intelligence, Customer engagement, Marketing, Predictive analytics, Personalized experience, Tourism.

INTRODUCTION

The primary issue this chapter addresses is how AI transforms tourism marketing and customer communication. In this regard, we describe the relevance of AI uses, such as predictions, automatic content generation, and sentiment analysis, in the context of customer experience, operational efficiency, and business development. Greater, more personalized interaction with customers and travelers, along with more targeted and personalized marketing strategies, is being facilitated by AI, transforming the way businesses engage with their customers in an increasingly digital world. The use of AI in tourism marketing is profound, and the digital market is likely to be among the most competitive areas. The travel

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market has contributed almost 10 percent to global GDP, while AI is the latest tool driving advances in marketing strategies.

Nevertheless, the implementation of AI also presents challenges, particularly regarding data privacy, algorithmic bias, and ethical considerations. One reason the integration of AI in tourism marketing has increased is the evolving consumer patterns and external forces such as the COVID-19 pandemic. AI has also enabled business organizations to respond to change quickly by providing more targeted, personalized marketing messages, regardless of shifting needs. As an example, AI-based recommendation engines (So *et al*., 2020) can create vacation packages tailored to specific preferences, contributing to a business's competitiveness. Touni *et al.,* (2020) found that AI-based personalization increases engagement and conversion rates. The analysis of customer data allows businesses to offer personalized recommendations for travel destinations that align with customers' personal preferences, thereby improving customer experience. Sentiment analysis is another major area of interest. Being able to analyze all the online reviews, social media, and other kinds of customer feedback being sent through AI will allow companies to track the general mood and respond immediately to a customer's concerns. So *et al.,* (2014) claimed that sentiment analysis boosts customer satisfaction by enabling an enterprise to adjust its service in real time based on feedback. It is also useful in helping businesses determine consumer tastes and trends, improve the delivery of products and services, and enhance their competitiveness in a rapidly evolving market. Artificial intelligence chatbots are also important in customer engagement.

The tools will be associated with 24/7 customer support, managing queries and real-time assistance, which will lower operational expenses and enhance efficiency (So & Li, 2020). Chatbots have issues with empathy, especially in complex cases. Striking a balance between AI efficiency and personal touch is one of the key issues. Although the number of studies on AI in tourism is increasing, several gaps remain to be addressed. Long-term effects on customer behavior, trust, and loyalty are under-researched compared to the immediate benefits (Hollebeek *et al*., 2014). The ethical dimensions of AI, including data privacy and algorithmic bias, have also not been adequately explored.

This chapter aims to bridge these gaps by reviewing how AI has been employed in tourism marketing and engagement, as well as the associated ethical considerations. Briefly, AI offers robust infrastructure and significant impact on tourism marketing, as personalized services can be developed, sentiment analysis can be refined, and chatbots could support better customer service. However, as

AI becomes increasingly widespread, ethical concerns and privacy issues are gaining prominence. Future research should investigate the long-term effects of AI use on customer behavior and privacy in tourism marketing (Le *et al*., 2019).

Chapter's Objectives

The objectives of the chapter are as follows:

- To determine the relevance of AI in enhancing personal marketing approaches in the tourism sector.
- To determine the effects of AI-based tools on customer interaction and satisfaction.
- To investigate the ethical issues related to the use of AI in tourism marketing and customer service.

THEORETICAL OVERVIEW

The theoretical overview section provides background on the use of AI in tourism marketing. It analyzes key theories and concepts that drive the application and implementation of AI technology in the tourism industry. This section elucidates the assumptions underlying the personalized marketing strategy, customer interaction, and service automation from the perspective of AI and the marketing interface (Rather, 2020).

AI's Impact on Tourism Marketing

Fig. (**1**) presents a conceptual framework showing how AI in tourism marketing influences customer experiences through algorithmic sentiment analysis. The framework is grounded in several theories, including Personalization Theory, Consumer Decision-Making Theory, Sentiment Analysis Theory, Expectancy-Confirmation Theory, Automation Theory, and Service Automation Theory. Together, these theories explain how AI-driven personalization and sentiment analysis shape travelers' perceptions, support decision-making, and ultimately lead to automation effects that enhance marketing effectiveness and service delivery.

The Personalization Paradigm: AI in Consumer Behavior in Tourism Marketing

AI has changed the concept of marketing in tourism. The world had been accustomed to more generalized marketing strategies that targeted the general public. The Personality Theory suggests that people tend to identify with brands that know them and respond to their personal needs. This is particularly significant in the tourism industry, where customer loyalty depends on

CHAPTER 5

Leveraging AI and IoT for Sustainable Overtourism Management

Abstract: This chapter examines the convergence of Artificial Intelligence (AI) and the Internet of Things (IoT) in overtourism management, which is a growing issue as the number of tourists per destination is rapidly increasing, overwhelming global destinations. AI using predictive analytics will help forecast tourist flows, identify hotspots, and take proactive steps to distribute visitors more evenly. IoT devices provide real-time tracking of environmental and behavioral data, which helps enable dynamic changes in resource allocation and infrastructure use. The chapter also examines case studies of Barcelona and Amsterdam, which have successfully reduced congestion and enhanced sustainability. It emphasizes that when combined, AI and IoT can provide a comprehensive solution for sustainable tourism management, enabling more efficient resource allocation, improved visitor experiences, and reduced adverse environmental impact. The chapter also addresses issues with these technologies, such as cost, data privacy, and the technical expertise required to implement them, and points out future research directions to improve and broaden their use in global tourism management systems.

Keywords: AI in tourism management, AI and IoT for overtourism, IoT for sustainable solutions, Sustainable tourism technology.

INTRODUCTION

The worldwide growth of the tourism industry has led to substantial economic gains in most destination areas. However, it is also accompanied by overtourism, which is becoming increasingly serious as tourist flows increase. Tourist attractions are being oversaturated by tourists since numerous tourists visit certain areas that are regarded as tourist attraction sites, and this can present serious challenges such as environmental destruction, infrastructure crowding, and even cultural disruption (Kumar *et al*., 2024). Job performance should be addressed using more conventional management techniques, which are often well-suited to such challenging issues. This has contributed to the growing need for innovative solutions that provide data-driven insights and dynamic management capabilities for real-time response.

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The chapter in question explores how Artificial Intelligence (AI) and the Internet of Things (IoT) could be used to manage and mitigate the impact of overtourism (Veronica *et al*., 2024). AI offers significant opportunities to process large volumes of data and generate predictive analytics, enabling tourism businesses to forecast tourist flows, identify potential overcrowding hotspots, and develop proactive strategies to distribute visitors more evenly across destinations. These capabilities provide promising approaches to mitigating overtourism. Meanwhile, IoT devices can provide more information on environmental and tourist behavior by tracking conditions in real time, thereby enabling dynamic resource allocation and infrastructure use (Agus Kiswantono, 2024). By integrating AI and IoT, tourism industry managers could consider visitor patterns and their environmental impact in greater depth and control the tourism process in a more proactive and sustainable way.

This section explores the theoretical foundations of these technologies, their implementation capabilities, best-practice examples, and case studies of cities such as Barcelona and Amsterdam to illustrate the practical application of these theories (İştin & Turpcu, 2021). This chapter will provide a close-up perspective on establishing an efficient paradigm for implementing AI and IoT in tourism to manage tourism businesses; as such, it will also provide pointers useful to stakeholders, as well as measures for stakeholders eager to contribute to sustainable tourism in an already overcrowded world.

Chapters' Objectives

The objectives of the chapter are as follows:

- To discuss the potential role of AI and IoT in the management and mitigation of overtourism by using predictive analytics and real-time monitoring.
- To assess the effectiveness of the application of AI and IoT in mitigating tourism pressure through selected case studies of destinations.
- To make strategic recommendations for integrating AI and IoT into sustainable tourism management.

LITERATURE REVIEW

Research on addressing overtourism with advanced technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) is also growing, as the world requires novel interventions to this global issue (Mohammad & Iva, 2024). The present review is a synthesis of existing research on the use of AI and IoT in tourism management, considering their theoretical foundations, actual adoption, and the accomplishments achieved. Artificial intelligence is largely known for

processing large volumes of information and providing substantial insights for tourism management (Cayan Haider & Alhassan, 2024). With AI-powered predictive analytics, tourist flows and demand can be forecast, enabling destination managers to anticipate a rush and allocate resources accordingly (Share Pasand, 2023). In addition, AI algorithms can identify patterns and trends from past data, which will help with strategic design and decision-making.

The impact of AI in the sphere of customer experience, where customers are offered personal recommendations and service can be modified in real time, can help regulate visitors' satisfaction levels and decongest crowds (Share Pasand, 2023). The Internet of Things (IoT) and its network of connected devices can provide real-time information on environmental conditions, tourist flows, and infrastructure utilization. IoT sensors can be used to track the number of people present in tourist hotspots, air quality, and noise, so these can be managed dynamically and overcrowding can be avoided, reducing environmental impacts. Furthermore, IoT used in tourism services, with smart parking, adaptive lighting, and waste management, would increase operational efficiency and result in more sustainable tourism infrastructure. Some of these destinations have managed to put AI technology and IoT in use in an attempt to alleviate overtourism (Pasupuleti, 2024).

For example, Barcelona can use AI to analyze social media data and forecast tourist behavior, helping distribute visitors more effectively throughout the city. Amsterdam has used IoT sensors to monitor tourist density in specific areas and guide visitors towards alternative attractions and routes, thereby reducing congestion in overcrowded areas. These case studies illustrate the potential of AI and IoT in practical tourism management (Xu *et al*., 2024). Along with the bright prospects for their application, there are also challenges in integrating AI and IoT into tourism management. Concerns such as data privacy, the exorbitant cost of implementing technology, and the difficulty of utilizing technical skills are serious stumbling blocks (Dogra *et al*., 2023). Future studies should focus on overcoming obstacles to technology adoption and on developing new innovations in AI and IoT for the tourism industry. This informed knowledge lays the groundwork for developing feasible models and actionable advice for managing sustainable tourism in the following chapters (Juwita *et al*., 2024).

METHODOLOGY

The research methodology of the present study on managing overtourism through the adoption of available AI and IoT technologies is a mixed-methods one wherein qualitative and quantitative research methods are applied to the problem by focusing on the investigation of tourism management systems through AI and

CHAPTER 6

IoT in Smart Destination Management

Abstract: The Internet of Things (IoT) is radically changing the way destination management is done by creating data-driven, responsive, and sustainable tourism practices. Technologies such as GPS tracking, environmental sensing, AI-supported monitoring, and RFID ticketing systems play a vital role in gathering and analyzing real-time data to enhance decision-making and operational efficiency within smart tourism ecosystems. This chapter delves into the crucial applications of IoT in smart destination management, spanning from crowd monitoring and automated ticketing systems to environmental sustainability, personalized visitor interactions, and operational optimization. The chapter provides insights into the application of IoT technologies to improve the experiences of visitors, manage resources, and support sustainable tourism development from case studies of smart destinations in Barcelona, Singapore, Dubai, and Venice. Issues with IoT implementation are also explored, including data privacy, implementation costs, and interoperability. In addition, opportunities arising from 5G connectivity, Artificial Intelligence (AI), and digital twin technologies are discussed. Successful implementation of IoT requires cooperation among government, tourism organizations, technology providers, and local communities. IoT has the potential to play a key role in establishing a smart and resilient tourism destination by combining technological advancements with sustainable management practices.

Keywords: Destination management, Environmental sustainability, Internet of Things (IoT), Real-time crowd monitoring, Smart tourism destinations.

INTRODUCTION

Tourism destinations are becoming smart environments enabled by technology, with Internet of Things (IoT) taking center stage (Shdifat *et al*., 2021). IoT enables the collection and analysis of real-time data by connecting devices, sensors, and systems, enhancing visitor experiences, optimizing resource management, and achieving sustainability outcomes. Smart tourism involves integrating advanced digital technologies into destination management to create connected, data-driven ecosystems. Concepts such as Industry 4.0, IoT, artificial intelligence, cloud computing, and mobile applications are the driving forces behind this transition (Anning-Dorson, 2025). They enable destinations to differentiate experiences, optimize and manage operational dynamics, and strengthen competitiveness in an increasingly competitive and global tourism

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landscape. Smart tourism transforms traditional attractions into interactive, two-way experiences, ensuring that tourism experiences are no longer passive or one-dimensional (Kumar *et al*., 2024).

One of the greatest and most consistent determining factors is the handling of heavy tourist traffic and limited resources in destinations worldwide. Overpopulation, poor transportation systems, energy waste, and environmental deterioration can result from reactive rather than proactive management (Vijayan *et al*., 2020). IoT can be seen as a proactive methodology because it provides real-time information to support decision-making. The intended outcomes of this integration are threefold: to increase visitor satisfaction with the service, to increase the service's operational efficiency by automating and optimizing processes, and to work towards achieving sustainability goals through continuous monitoring of environmental impact and resource consumption (Shah, 2016).

The importance of IoT lies in its ability to transform outdated, inefficient technological systems into flexible, intelligent ones (Mishra & Singh, 2023). This implies avoiding queues, customizable navigation, and heightened safety for visitors. It provides cost savings and resource optimization, enabling predictive analytics for the operators. It ensures environmental stewardship and long-term environmental resilience for communities (Maksimovic, 2018a). As tourism grows and competition intensifies, destinations that adopt IoT will be better positioned to offer individuals high-quality experiences while safeguarding the cultural, social, and environmental resources of future generations.

This chapter examines the role of the Internet of Things (IoT) in smart destination management and explores how IoT-enabled technologies improve operational efficiency, visitor experiences, and sustainability outcomes. The chapter also highlights key applications, challenges, and future opportunities associated with IoT adoption in tourism destinations, providing insights for researchers, practitioners, and policymakers.

Chapters' Objectives

The objectives of the chapter are as follows:

- To improve visitor experience: To provide a smooth, personalized, and enhanced experience, starting with no queue to smart navigation and customized directions.
- To increase operational efficiency: Minimize resource consumption and waste, and allow proactive maintenance and crowd control.
- To support environmental sustainability: Track real-time consumption to

maximize the use of energy, water, and transport, harmonizing tourism and sustainable development.

THEORETICAL OVERVIEW

IoT: As a Boost to Smart Destination Management

IoT is a disruptive technology to simplify the management of tourism destinations, in which it is possible to retrieve data in real time, process it, and make decisions automatically (Muthuramalingam *et al*., 2019). IoT enables destinations to act dynamically in response to current realities by integrating physical infrastructure, visitor devices, and management platforms. This technological trend is in line with other rising needs in a smart, convenient, personalized, and sustainable tourism environment. The theoretical basis of IoT in destination management is systems theory, in which functioning units are interdependent and collaborate to promote best practices, reduce inefficiencies, and satisfy stakeholders in both system operations and the overall experience (Atlam & Wills, 2020).

Enhancing Visitor Experience through IoT Integration

Visitor satisfaction is a key indicator of tourism success, and IoT provides a means to take experiences beyond classical service models (Nematpour *et al*., 2025a). The experience economy theory provides a theoretical foundation in this regard and suggests that outstanding personalized interactions will lead to repeat consumption and positive word-of-mouth. Such customization is made possible by IoT through connected systems comprising mobile applications using GPS to guide visitors, digital signage connected to crowd-monitoring sensors, and automated ticketing that eliminates the need to wait in line (Daily & Peterson, 2017). IoT enables queue-free entry, where gates at the entrances connect to ticketing databases, and real-time entry approvals can be granted immediately (Joo & Wong, 2008). Likewise, location-based beacons can send personalized suggestions, such as recommendations for nearby restaurants, upcoming events, or areas with fewer crowds, directly to visitors' phones. This not only enhances a sense of control but also offers the traveller comfort through easier navigation, information, and services (Riva Sanseverino *et al*., 2017). From a service design perspective, IoT data can provide destination managers with real-time, actionable insights to support decision-making (Sirivadhanawaravachara, 2025). For example, when crowd density is higher at a particular location, management can implement dynamic pricing or redirect visitors *via* in-app alerts (Tehseen *et al*., 2024).

CHAPTER 7

Global Success Stories of AI and IoT in Tourism

Abstract: Artificial Intelligence (AI) and the Internet of Things (IoT) can transform global tourism by moving beyond experimental applications of technology towards effective, large-scale implementation. This chapter analyzes destination and business cases of the successful application of AI and IoT to enhance visitor experiences, improve operations, and make sustainable tourism work. Practical applications, including AI-based recommendation systems, IoT-enabled smart cities, connected hotels, and predictive analytics in transportation, demonstrate how technological innovation has enhanced operational efficiency, personalization, and safety in tourism. These examples not only highlight technological innovations but also emphasize the importance of strategic collaboration among governments, technology operators, and technology providers. The chapter concludes with a summary and recommendations for future implementation, highlighting how AI and IoT can play a transformative role in developing resilient tourism systems and inclusive, competitive ecosystems.

Keywords: Artificial intelligence, Case studies, Internet of things, Innovation, Smart tourism.

INTRODUCTION

The global tourism industry has entered a new era of transformation, in which AI and IoT are no longer emerging technologies with merely theoretical potential but practical tools delivering tangible results (Jain & Mitra, 2025). Governments, individual businesses, and technology providers worldwide are collaborating to implement solutions that address longstanding challenges, including overtourism, operational inefficiency, safety concerns, and the need to provide more personalized travel experiences.

Tourism is a highly dynamic industry involving myriad interactions among services, people, and places (Sankaran, 2019). Traditional management tactics are prone to failure in monitoring visitor flows, service provision, and sustainability. The use of AI and IoT as facilitators enables real-time data collection, predictive analytics, and automated responses, thereby transforming destination and operator decision-making (Badruddoza *et al*., 2024). For example, European heritage sites are considering how IoT-connected sensors can be used to track visitor numbers

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and environmental impacts, whereas Asian megacities are adopting AI-based mobility systems that can reduce congestion and make travelling more comfortable.

The element of personalization is also crucial. The industry moved towards the use of such technologies even sooner due to the pandemic and shifted its focus to contactless check-ins, AI-based health monitoring, and the use of IoT to implement sanitation processes (Hoang, 2024). What began as a crisis response is now better characterized as a global adoption trend that has fostered a strong and adaptive tourism ecosystem (Krittayaruangroj *et al*., 2023).

This chapter presents success stories from around the world in which AI and IoT have been utilized and highlights their usefulness and challenges. These real-life examples demonstrate that technology alone cannot guarantee success and must be implemented alongside effective governance, ethical frameworks, and cultural adaptability. Overall, these cases illustrate how innovation can contribute to customer satisfaction, operational efficiency, and sustainability, providing a pathway for the global tourism industry to remain competitive while embracing innovation (Dhama & Anil, 2025).

Chapter's Objectives

The objectives of this chapter are as follows:

- Display Global Applications: Existing applications of AI and IoT in tourism.
- Identify Strategic Benefits: Demonstrate how technology improves individualization, efficacy, and safety.
- Lessons Learned: Demonstrate lessons learned from destination-wide innovation initiatives.

THEORETICAL OVERVIEW

AI and IoT as Tourism Innovation Fuel

AI functions as an analytical tool for processing large volumes of traveler data, while IoT enables real-time communication among devices, spaces, and services. Together, they create a seamless digital ecosystem in which visitor needs can be anticipated and addressed proactively. This synergy has transformed destination management and tourism service delivery, enabling smart systems to predict demand, manage visitor flows, and personalize experiences (Gochhait *et al*., 2020). The combination of IoT-induced real-time data with AI-driven algorithms will help destinations predict demand peaks, optimize energy consumption in hotels, and improve the safety of travelers due to predictive monitoring. For

example, AI is used to manage queues at airports, and luggage is monitored with IoT sensors to make the travel process easier. This combination of smart devices and smart analytics makes tourism more proactive rather than reactive management (Dimitrovski *et al*., 2012).

Global Adoption Trends

Locations around the world are starting to position AI and IoT as pillars of competitiveness. Among the most prominent are smart airports, connected hotels, and AI-intelligent cultural heritage interpretation, which offer a blueprint to other models. These applications show how technology promotes inclusivity, sustainability, and resilience in tourist systems. Singapore Changi Airport is a location in Asia where operations are supported by IoT technologies and AI-based predictive maintenance, and in Europe, Amsterdam uses smart sensors to guide visitors to the various districts, spreading tourist traffic. Hotel chains in North America combine AI concierges with IoT-enabled room controls to deliver hyper-personalized hospitality. The emerging economies use IoT to monitor the environment and support sustainable tourism. All these adoption trends point to a convergence to smart tourism ecosystems (Talukder *et al*., 2024).

A Visual Representation of Global Adoption Trends

Fig. (**1**) illustrates global adoption trends in tourism as an orchestrated, multilayered process. At the highest level, overarching strategies guide the implementation of these trends. The main areas include smart infrastructure, connected services, and global data adoption. Each area involves several stages, including technology implementation, system integration, operational optimization, and service personalization. The next level encompasses monitoring, analytical forecasting, and real-time adjustments to improve operational efficiency, visitor experiences, and sustainability. The final stages focus on improving decision-making, enhancing safety, and optimizing resource management. Collectively, these processes contribute to a resilient, inclusive, and competitive tourism ecosystem driven by AI and IoT technologies.

LITERATURE REVIEW: GLOBAL SUCCESS PERSPECTIVES

Across continents, studies and practical experience demonstrate that the implementation of AI and IoT can deliver measurable benefits, including increased customer engagement, reduced operating costs, and improved resource management. Tourism boards, global hotel chains, and transport operators report improvements in operational efficiency and visitor satisfaction. Nevertheless, these experiences highlight the importance of effective governance, data privacy, and cross-sector collaboration in supporting sustainable scaling (Liu, 2003).

CHAPTER 8

AI and IoT-Driven Startups: Transforming Innovation and Competitiveness in Smart Tourism

Abstract: This chapter explores how Artificial Intelligence (AI) and Internet of Things (IoT) enabled startups are driving smart tourism ecosystems. Inspired by the theories on entrepreneurship, disruptive innovation, and integrated IoT architectures, the chapter discusses the development of solutions that are innovative and bring changes to the traditional business model of the tourism sector and increase the competitiveness of the sector. AI tools such as automation systems, predictive analytics, and intelligent decision-making systems, along with IoT sensors and real-time monitoring tools, contribute to operational efficiency, resource optimization, and sustainable tourism practices. In addition, these technologies will allow visitors to have a highly personalized, context-aware experience, create new visitor value propositions, and enable service providers. The chapter also explores the obstacles to the development and scaling of AI and IoT-powered tourism startups. Some of the challenges are regulatory restrictions, privacy issues, cybersecurity, market uncertainty, and competition from existing tourism bodies. Yet despite these hurdles, the results indicate that technological capability is not enough to be successful in the long term. For scaling to occur, there must be an enabling innovation ecosystem, cross-sector collaboration, stakeholder engagement, and consumer trust. The chapter concludes that AI- and IoT-based startups hold great promise for advancing smart tourism development, provided there is a balance among technological innovation, sustainability, governance, and responsible business practices.

Keywords: Artificial intelligence, Automation, Entrepreneurship, Innovation, Smart tourism, Sustainability, Tourism ecosystem.

INTRODUCTION

This chapter discusses how entrepreneurial dynamism, novel business forms, and new disruptive applications of Artificial Intelligence (AI) and the Internet of Things (IoT) are redefining the digital travel and hospitality sectors worldwide. There is a technological revolution in the tourism industry, which has relied on physical service delivery and traditional marketing systems. Startups that lack legacy systems and are meant to experiment are leading this paradigm shift. They offer hyper-personalization, predictive analytics, and automation through the implementation of AI. IoT technologies enable real-world and virtual-world

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connectivity, real-time tracking, flexible service delivery, and seamless interaction between devices and destinations with service providers. Collectively, these technologies are not only streamlining tourism operations but also redefining how tourism products are envisaged, marketed, and consumed. Such changes are significant because tourism contributes substantially to global GDP and employment, while smart tourism is one of the fastest-growing market niches. The effects extend beyond the economic sphere to influence environmental strategies, digital inclusivity, and the cultural experiences of visitors and local communities (Novera *et al*., 2022).

The relevance of this research topic is evident in industry, academia, and policymaking discourse. In the transport and accommodation sectors, AI-driven analytics enable dynamic pricing, predictive maintenance, service personalization through sentiment analysis, and real-time disruption management. IoT systems allow hotels and attractions to facilitate smart ticketing, location-based crowd control, and automated energy and resource management. On an international level, such competencies are in line with the strategic objectives of sustainability, competitiveness, and digital governance. Nevertheless, they also cause issues, such as privacy concerns, algorithmic discrimination, and job loss in fields that traditionally relied on face-to-face interaction. Another element of this shifting terrain is startups: they are touted as rapid, innovative, and agile, but their success rates are low, they have limited access to capital, and they become more vulnerable to market dynamics and regulatory shifts. The field of academic research on AI and IoT in the tourism industry has grown considerably in recent years, yet most studies focus on either large corporations or a generalized smart destination (Suneel *et al*., 2022). The potential of startups, particularly in integrating AI and IoT into feasible and scalable solutions, has not been fully realized. This chapter fills this gap by assessing critiques of innovations initiated by startups, based on conceptual models, practical examples, and future trends in the field.

This chapter is organized into four interrelated dimensions. To begin with, it examines how AI- and IoT-based startups conceptualize and implement business models tailored to the smart tourism market (Filipiak *et al*., 2023). They are wearable-operated recommendation engines that dynamically provide itineraries, AI-driven demand forecasting systems that enable small travel agencies to optimize resource assignments, and interactive city guide platforms that are based on making destinations more interactive. Second, it assesses their quantitative impacts on the sustainability of the activities.

They range from AI-powered food waste minimization programs in hotel restaurants to IoT-enabled building management systems that reduce energy

consumption without compromising guest comfort. Third, it briefly examines some of the most relevant challenges, including fragmented rules, heterogeneous digital infrastructure, security issues, and the inability to build consumer trust in data-intensive services, which may affect the feasibility of scaling and implementing startup-driven innovations. Fourth, it describes the future prospects of fields such as startup-based digital twin applications in destination management, AI-based analytics for tourism development in less-served regions, and IoT-based integrated solutions to increase accessibility for people with diverse needs (Gabor *et al*., 2023).

Finally, the chapter introduces startups as key players that will shape what the digital future of tourism is going to be like. Through lean development, rapid expansion capabilities, and the ability to exploit network effects, such ventures develop technology solutions that reinvent competitive advantage in the field. Their innovations relate to the broader social agenda of reducing the environmental impact of tourism, promoting inclusivity, and strengthening destination resilience to economic, environmental, and geopolitical shocks (Hassebo & Tealab, 2023).

Chapters' Objectives

The objectives of the chapter are as follows:

- To examine startups using AI and the Internet of Things and establish the course of a smart tourism ecosystem.
- To analyze trends in business models by startups in improving travel and hospitality services.
- To assess the revolutionary role of the technological innovations driven by startups and their effect on the tourism sector.

THEORETICAL OVERVIEW

This section explains some of the leading theoretical frameworks that underpin the dynamic interactions among startups, AI, IoT, and smart tourism innovation. It provides a critical view of the role of new ventures in transformational change by covering key concepts in entrepreneurship, technology adoption, and ecosystem theories. The chosen frameworks can show how startups can use advanced technologies to develop novel business models, diffuse disruptive innovations, and reconstruct tourism experiences. These theoretical indications provide the necessary academic basis for investigating innovations driven by startups and their effects through a macro lens of smart tourism.

CHAPTER 9

Sustainable Tourism through AI and IoT

Abstract: This chapter discusses how Artificial Intelligence (AI) and the Internet of Things (IoT) can be used to enable sustainable tourism. As the environmental impact of the tourism sector has become a more pressing concern, AI and IoT can enable more resource-efficient systems, minimize carbon footprints, and support eco-friendly travel. The chapter mentions the application of AI to use energy more efficiently, predict maintenance needs, and offer personalized travel recommendations, while IoT can enable real-time tracking of environmental conditions and resources. With the combination of these technologies, the tourism sector can be more sustainable, less wasteful, and also efficient in its operations. The theoretical frameworks, including the Smart Sustainability Framework, the Green Technology Adoption Model, and the Digital-Environmental Synergy Theory, provide insights into how AI and IoT can complement each other to promote sustainable tourism. These frameworks highlight the need to address several barriers, including limited access to financial incentives for Small and Medium-sized Enterprises (SMEs), data privacy concerns, and insufficient intersectoral cooperation to develop standardized systems. Lastly, AI and IoT have the potential to transform the tourism industry and promote more eco-friendly solutions, providing travelers with choices that are less harmful to the environment.

Keywords: Artificial intelligence, Eco-friendly, Green technology, Sustainability, Sustainable tourism, The Internet of Things, Tourism.

INTRODUCTION

Sustainability is required in the tourism industry. As more people become concerned about climate change and environmental degradation, it is important that the tourism industry also embraces sustainable practices. This chapter explains the contributions of Artificial Intelligence (AI) and the Internet of Things (IoT) to sustainable tourism development. These technologies help to minimize the environmental footprint of tourism and help to optimize resources and create more environmentally friendly mechanisms of traveling (ŞiMşek, 2024). Tourism is an economic powerhouse worldwide, but it is also a significant contributor to environmental issues. It accounts for about 8 percent of global gas emissions, which is mainly from transport and accommodation. This presents a paradox. On the one hand, tourism generates significant income for many countries and provides millions of people with employment.

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On the other hand, it consumes vast amounts of supplies and generates vast amounts of waste. Sustainable tourism is intended to reduce tourism's negative environmental impact while also boosting local economies and communities. As environmental awareness grows, demand for green tourism decisions is rising. People are becoming conscious of the impact of what they are doing to the planet and are seeking alternative ways that are greener. This has compelled the tourism industry to be creative and incorporate new technologies to make tourism more sustainable (Font & McCabe, 2017). AI and IoT are the keys to this change. AI is the application of machines to analyze massive amounts of data and make decisions without human intervention. AI can also be utilized in tourism to optimize energy use, forecast maintenance needs, and enhance the travel experience. It can assist a business in making smarter and more data-driven decisions that lead to waste and energy savings. IoT-linked devices and systems gather and exchange real-time data. IoT is applied to regulate energy use, garbage collection, and transport networks in the tourism industry. AI and IoT, combined, promote resource management, thereby reducing the environmental footprint of tourism (Nitti *et al*., 2017). Sustainable tourism is not only a matter of environmental consideration but also a necessity for the increasing number of travelers. Research has revealed that 87 percent of international travelers choose sustainable travel options, and 69 percent are more inclined to stay at places that promote green behavior. This clearly shows that sustainability is now a significant consideration in the decision-making process when traveling.

Travelers are now seeking destinations, accommodations, and services that align with their green ethics. Greener tourism choices are on the increase, and technology plays a central role in meeting these requirements. Although AI and IoT have become increasingly popular and promising, there are obstacles to their widespread adoption. The initial expenses of adopting such technologies can be a challenge to many tourism businesses, especially Small and Medium-sized Enterprises (SMEs). Moreover, privacy and data security issues exist; IoT devices capture large volumes of data. In addition, implementing AI and IoT into established tourism systems can be complicated, and the infrastructure is not available to many individual businesses. Such challenges are important, but they must not overwhelm the benefits of AI and IoT in bringing positive change in tourism (Angelkova *et al*., 2012). They can also help companies reduce waste, manage resources, and provide green alternatives for passengers. Nonetheless, to ensure that such technologies have the desired effect, additional research is required to understand the long-term impacts of their use and to overcome the challenges that may impede their acceptance. The chapter will contribute to the body of knowledge and provide a comprehensive overview of how AI and IoT will transform sustainable tourism in the future (Kannammal & Chandia, 2023; Ambraziejus, 2025; Chakraborty, 2024).

Chapter's Objectives

The objectives of the chapter are as follows:

- To explore the possibility of AI and IoT in maximizing resource management in the tourism industry.
- To examine how AI and IoT technologies can be used to reduce the carbon footprint and environmental impact of tourism activities.
- To analyze how AI and IoT can be used to enhance environmentally friendly tourism projects, as well as provide consumers with a travel solution that is environmentally friendly.

THEORETICAL OVERVIEW

Theoretical Foundations for Integrating AI and IoT in Sustainable Tourism

These theories provide a clearer understanding of how technologies can optimize resource use, minimize environmental impacts, and promote sustainable tourism practices. These theoretical perspectives provide the foundation for an in-depth discussion of AI and IoT applications in the tourism industry. In contemporary tourism, the intersection of technology and sustainability is guided by several key principles and observations, as summarized below (Talukder, 2024).

Integrating AI and IoT in Sustainable Tourism

Fig. (**1**) presents a conceptual framework linking smart sustainability practices with sustainable tourism development. Data-driven decision-making, energy management, water conservation, waste management, resource allocation, and environmental monitoring contribute to smart sustainability and digital-environmental synergy, which together support sustainable tourism outcomes. The framework further explains that the adoption of green technologies is influenced by factors such as consumer demand, regulatory pressures, cost-saving potential, implementation costs, and the availability of technical expertise.

The Smart Sustainability Framework: Integrating AI and IoT for Ecological Balance

The Smart Sustainability Framework describes how AI and IoT can be integrated into tourism to optimize resource use, reduce waste, and promote ecological balance. This framework emphasizes the importance of evidence-based decision-making in achieving sustainable tourism goals. AI-driven predictive capabilities can help tourism operators manage energy, water, and waste more efficiently. By implication, AI algorithms can give estimates of the amount of energy consumed

CHAPTER 10

The Future of Smart Tourism

Abstract: Technological and tourism integration is occurring at a high rate that is transforming destination management and experience while introducing the concept behind smart tourism. This chapter explains how smart tourism is expected to evolve by covering its technological background, sustainability, ethics, and applications. The findings indicate that along with the tremendous opportunities that smart tourism is set to deliver, *i.e.*, hyper-personalization, predictive analytics, and collaboration on a global scale, there are also a number of challenges. These include data privacy, surveillance, financial constraints in developing countries, and the threat of overtourism, all of which must be addressed. The gaps in the research identified in the chapter included the lack of evidence on the long-term socio-cultural sustainability of smart tourism, the underrepresentation of developing economies in the current literature, and the emergence of new technological frontiers in smart tourism, including 6G and quantum computing. The chapter emphasizes the significance of hybrid models, which can be implemented to strike a balance among innovation and human touch, effective governance systems, and non-discriminatory policies that can empower local communities through strategic suggestions. Lastly, smart tourism is not concerned with technology but with a sustainable, fair, and humanistic global tourism system.

Keywords: Intelligent tourism technology, Innovation in travel, The direction of travel, The Internet of Things in travel, The trends of digital tourism.

INTRODUCTION

The tourism business is on the brink of a technological revolution, as the intersection of innovation and the travel industry is redefining how we navigate the world. Smart tourism is a paradigm that has defined the future of world tourism, as it has embraced new technologies to maximize traveler satisfaction, improve resource efficiency, and sustain the tourism industry. The second issue is not the adoption of technology but the development of an equal-footing model in which innovation, human relations, and sustainability can support one another. This chapter examines emerging trends in smart tourism, focusing on how new technologies can make travel experiences more engaging, efficient, and sustainable, as well as the challenges associated with this digital transformation.

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At the core of smart tourism, technologies such as AI, IoT, Augmented Reality (AR), Virtual Reality (VR), big data, and blockchain are used to create a more interconnected and intelligent tourism ecosystem (Bhuiyan *et al*., 2022). These innovations would also help destinations accommodate personal preferences on broader issues, such as overtourism, environmental degradation, and accessibility. One such example is AI-controlled chatbots. These may provide real-time assistance for travelers, offering recommendations based on desired types, preferences, and past actions, and delivering real-time information. Similarly, IoT can be used in smart devices within hotels or transportation systems to automate processes and enable automated check-ins and real-time traffic updates, augmenting convenience and efficiency. Meanwhile, AR and VR are changing the tourist experience of the destination by allowing visitors to experience it virtually, immerse themselves in history, or take a virtual tour around attractions in the form of a museum or historical site. As global travel is increasing every single day, so is the environmental footprint. Smart technologies can be used to reduce this impact, such as AI-based analytics to optimize energy use in tourist facilities and IoT systems that monitor and manage crowds to prevent congestion at tourist spots. Blockchain technology also promotes trust and transparency by enabling secure booking systems and loyalty programs while helping reduce fraud.

These innovations not only enhance the traveler experience but also make destinations sustainable for future generations (Rosário & Dias, 2024). To ensure that smart tourism does not strip local communities and traditions, it will be essential to find a balance between technological innovation and local culture. This chapter aims to address the main aspects of smart tourism, such as AI, IoTAR/VR, big data, and blockchain, and to emphasize their implementation through real-world examples. Singapore's plans to become a smart city and Dubai's plans to introduce futuristic transport options are just two examples that show how technology can reshape tourism. The emergence of 6G networks and advanced robotics is another trend examined in this chapter, along with their potential impact on the tourism industry over the next decade (Bibri & Jagatheesaperumal, 2023). By addressing the opportunities and challenges, this chapter should provide a complete picture of how smart tourism can make the travel environment more connected, sustainable, and personalized, and it beckons stakeholders to embrace innovation responsibly.

Chapter’s Objectives

The objectives of the chapter are as follows:

- To investigate the new technological solutions influencing the future of smart tourism, such as AI, IoT, big data, blockchain, immersive technologies

(VR/AR), and the Metaverse.
- To examine the challenges and risks associated with the further development of smart tourism, it is better to focus on data privacy, the digital divide, sustainability, and stakeholder adoption.
- To present strategic implications and the way forward for sustainable and inclusive development of smart tourism, identifying the best practices, policy frameworks, and implications for the global hospitality and tourism sector.

THEORETICAL OVERVIEW

Adoption Model in Smart Tourism

The rapid adoption of technologies in the tourism industry, including AI, IoT, AR/VR, and blockchain, is consistent with the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use are the determinants of technology adoption. AI in smart tourism personalizes travel through recommendations, and studies predict the market will grow to $2.26 billion by 2032, driven by improved user experiences. Smart cities are easily connected through IoT and enable real-time data exchange, which can be used to navigate effectively and manage resources. AR/VR would change how people interact by providing interactive cultural experiences, whereas blockchain would ensure the security of transactions. According to this framework, traveler acceptance is dependent on perceptive interfaces and practical advantages, including customized itineraries or simple bookings. For example, AI chatbots offer real-time assistance, which makes traveling less annoying, and VR previews help with decision-making. The model focuses on constant innovation to ensure user trust and engagement.

Sustainability Transition Framework

The Sustainability Transition Framework highlights the importance of smart tourism in solving environmental issues, which is in line with the global demands of using environmentally friendly measures in the face of climate demands in 2025. This framework incorporates socio-technical systems theory, in which technology contributes to sustainable change in tourism ecosystems (Hebinck *et al*., 2022). AI and IoT will play a central role in addressing overtourism, as smart sensors will track visitor volumes at places such as Machu Picchu, easing pressure on the environment. Intelligent analytics reduce the carbon footprint in smart hotels by leveraging big data to optimize energy consumption. The model assumes that sustainable tourism requires a multi-level approach: micro (personal traveler preferences), meso (destination management), and macro (global policy alignment). Examples are smart destinations with IoT-based waste management, which have environmental effects, and AI-based forecasting models, which

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