

Chapter 1

AI–Driven Sustainable Guest Experience in Intelligent Hospitality Ecosystems: Frameworks, Applications, and Future Pathways

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ABSTRACT

has emerged as a transformative force in the hospitality industry, especially in the creation of intelligent ecosystems that enhance sustainability and guest experience. This academic update examines recent advancements in AI applications within sustainable hospitality environments, emphasizing intelligent service delivery, operational efficiency, personalization, and eco-responsibility. The paper reviews contemporary frameworks such as smart hospitality ecosystems, AI-enabled circular economy models, digital twins, and sustainable experience design. It explores how AI technologies—such as predictive analytics, natural language processing, computer vision, and autonomous service robots—optimize resource consumption, reduce waste, and enhance energy management while delivering hyper-personalized guest services. Applications include AI-powered concierge systems, smart rooms,

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dynamic pricing engines for green service offerings, and emotion-aware guest interaction tools. Additionally, the study highlights ethical AI practices, data privacy, responsible automation.

INTRODUCTION

The worldwide hospitality sector is going through a big change because of new technologies, a greater awareness of the environment, and changing visitor expectations. Artificial Intelligence (AI) has become a key part of this change, giving hospitality businesses new ways to improve guest experiences, make operations more efficient, and support sustainability across the industry. Travelers are asking for more personalized, seamless, and eco-friendly services. To meet these needs, hospitality providers are using smart technologies like AI-powered chatbots, smart rooms, robotic concierges, emotion detection systems, digital twins, and predictive analytics to offer unique value propositions. This change marks the move away from traditional hospitality models that focus on service to data-driven, smart, and sustainable ecosystems that follow the UN's Sustainable Development Goals (SDGs), especially SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

In the past, the hospitality business was known for its high-touch, labor-intensive services that concentrated on human relationships, cultural exchange, and experiencing value. But the post-pandemic age has forced hospitality businesses to change how they do business because of problems like limited resources, more consumers being conscious of sustainability, health and safety issues, and competition from around the world. AI technologies have become important instruments to deal with these problems by making it possible to personalize at scale, optimize resource use, automate repetitive operations, and get insights for making decisions based on data. AI is especially important for sustainability because hotels are one of the most resource-intensive types of commercial buildings, using a lot of energy, water, and materials. Smart thermostats, AI-based energy management systems, and predictive maintenance tools are examples of intelligent systems that can cut down on carbon emissions, waste, and the life of assets.

Also, the modern hospitality industry shows a change in what guests anticipate. Modern visitors want more than just comfort and luxury. They also want experiences that are meaningful, real, and good for the environment. More than 70% of travelers around the world now prefer eco-friendly places to stay, and more than 60% are prepared to pay more for services that are good for the environment (World Travel & Tourism Council, 2024). AI-driven personalization lets hotels meet these needs

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