The Role of Artificial Intelligence in Supporting and Enhancing the Tourism Sector in Algeria (2017-2023)

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Abstract:
With the proliferation of information and communication technologies, artificial intelligence (AI) has become one of the key pillars across various sectors, especially in service industries, as its use is now synonymous with success due to its numerous advantages. The tourism sector is one of the most significantly benefitted industries globally from the implementation of AI. In the context of economic diversification, Algeria aims to develop its tourism sector by leveraging the latest AI-based information and communication technologies. These technologies can provide precise, rapid, and flexible information, enhance the quality of tourism services, stimulate tourism demand, and elevate service quality. This study aims to shed light on the role and importance of applying AI in supporting and revitalizing the tourism sector and to examine the current state of its usage in the Algerian tourism industry. The study found that AI applications in the tourism sector are lagging according to global indicators, despite government efforts to establish appropriate legal frameworks and strategies to meet international requirements.

Keywords: Artificial Intelligence, Tourism Sector, Information and Communication Technology, Travel and Tourism Competitiveness Index.

Introduction: Information and communication technology (ICT) has become the backbone of economic sectors, especially in services, with the tourism sector standing out for its vitality and high flexibility. It is essential to adopt innovative solutions to improve operational mechanisms, enhance service quality, boost tourism activity, and elevate this sector. As one of the modern forms of technology, artificial intelligence (AI) has driven many global IT companies to develop AI-based applications due to its ability to analyze vast amounts of data and solve problems in a way that mimics human thinking. This capability allows tourism companies to better understand customer behaviors and predict their needs through intelligent booking systems and automated chatbots.

The application of AI improves process management, increases efficiency, reduces the costs of tourism services, develops tourism products, and attracts the largest possible number of tourists, thus boosting investment opportunities and the competitiveness of tourism institutions. This ultimately enhances their market position, increases the sector's added value to the national economy, and improves its overall performance, contributing to the revival of the national economy and the promotion of economic development.

Research Problem: Artificial intelligence is seen as a dynamic tool for enhancing innovation and growth, with the potential to revolutionize many sectors that contribute to development and increase competitiveness by improving productivity. Given that the tourism sector heavily relies on ICT, the following research problem is posed:

- To what extent does artificial intelligence contribute to supporting the tourism sector in Algeria?
  In light of this main question, several sub-questions are raised to address the study's key points:
- What is meant by artificial intelligence, and what are its applications?
- What is the importance of artificial intelligence in the tourism sector?
- What is the current state of AI application in Algeria's tourism industry?
- What are the requirements for the successful use of AI in stimulating the tourism sector?

Significance of the Study: The significance of this study lies in addressing a contemporary and important topic, as artificial intelligence has become a key factor in the development of the tourism sector. It serves as a crucial tool for providing information and delivering tourism services efficiently and flexibly, enhancing customer experience, increasing efficiency and productivity, reducing costs, and playing a vital role in achieving sustainable development goals.

Objectives of the Study: The study aims to highlight the role of artificial intelligence in supporting and activating the tourism sector by covering the following aspects:

- Fundamentals of artificial intelligence and the tourism sector.
- Demonstrating the extent to which AI contributes to the development of the tourism sector in Algeria.
- Emphasizing the role AI plays in stimulating the tourism industry.

Research Hypotheses:

- The use of AI applications leads to the creation of innovative new products and the enhancement of tourism service quality.
- The success of AI in stimulating and developing the tourism sector depends on the presence of strong ICT infrastructure.

Research Methodology: Given the nature of the topic and the study's objectives, the descriptive and analytical methods were adopted. These methods help in covering the theoretical aspects of the study and analyzing data related to the Travel and Tourism Competitiveness Index and the Government AI Readiness Index.

Study Structure: To address the research problem, the study is divided into the following sections:

1. Basics of Artificial Intelligence.
2. General Concepts of the Tourism Sector.
3. The Role of Artificial Intelligence in Supporting and Activating the Tourism Sector.

Section One: Fundamentals of Artificial Intelligence

Artificial intelligence (AI) is one of the sciences that emerged from the contemporary technological revolution. It serves as the core of digital development and is a driving force behind the profound and transformative shift in the economic system.

1. Definition of Artificial Intelligence (AI):

Artificial intelligence (AI) has been defined by numerous researchers and specialists in the field, as well as by various scholars and enthusiasts of this science. The term "artificial intelligence" is used in English and is often referred to as "machine intelligence," abbreviated as AI. The term consists of two components:

- **Intelligence**: Refers to the ability to understand and think.
- **Artificial**: Means something that is made or non-natural [1].

    AI is based on the idea of creating something that replicates the cognitive abilities of the human mind. AI applications and programs are designed by studying how the human brain thinks, learns, makes decisions, and solves problems.
- AI can be described as a set of computer programs that solve problems by mimicking human thought processes. Most of these programs are built on a set of rules similar to logical reasoning, enabling computers to think, see, speak, hear, and move [2].
- According to John McCarthy (who formally introduced the term at the Dartmouth Workshop in 1955), AI is "the science and engineering of making intelligent machines."[3]
- According to the Encyclopaedia Britannica, AI is "the capability of digital computers or computer-controlled robots to solve problems typically associated with human intellectual processes."[4]
- The term AI is applied to the kind of intelligence that can be acquired by a machine through the integration of algorithms and programs, making the machine seem as if it possesses a mind that mimics various human cognitive abilities, allowing it to behave like a rational or discerning human [5].
- AI is intelligence that humans create and then bestow upon machines or computers, essentially enabling them to act intelligently [6].
- AI is the computer's ability to think like a human, utilizing artificial neural networks—a type of information processing system with specific performance features that mimic biological neural networks. Neural networks have been developed as mathematical models based on human thought processes and how nerves handle information. AI is a branch of computer science and one of the fundamental pillars of technological industries.

- AI also represents a scientific and technological field that includes theories, methodologies, and techniques aimed at creating machines capable of simulating intelligence (7).
- AI is one of the most significant modern sciences due to its intersection between technological advancements in systems science, computing, automation, logic, mathematics, linguistics, and psychology. It aims to understand the nature of intelligence by developing computer programs that can solve problems or make decisions in specific situations (8).

2. Origins of Artificial Intelligence:

The roots of AI can be traced back to philosophical and psychological ideas on how the human mind functions, as seen in the works of the philosopher Ibn Sina (Avicenna) and Greek philosophers.

- In the 1940s, the programmable digital computer was invented, based on the core principles of logical mathematical reasoning. This innovation prompted a group of scientists to seriously explore the possibility of building an electronic brain, including the British scientist Alan Turing, who began developing the concept of a thinking machine that could simulate human thought. Despite its rudimentary nature, the machine was capable of executing complex algorithms and was used during World War II to decipher German communications for the benefit of the British forces and their allies.
- In 1950, Alan Turing created a test known as the Turing Test, involving three participants and a series of questions. Two participants were a human and a machine, while the third participant acted as a judge. The task of the participants was to answer the questions displayed on a screen. If the judge could not distinguish between the answers given by the human and the machine, the machine could be considered intelligent (9).
- In 1956, the Dartmouth Conference was held, bringing together scientists like John McCarthy and Norbert Wiener. The conference set future goals and plans for developing AI, marking the official beginning of AI as a field of study.
- In the 1980s, expert systems were developed to assist in decision-making, leading to increased support and interest in the field of artificial intelligence.
- By the late 1990s, the first speech recognition system emerged, marking a new leap in the field of artificial intelligence.
- At the start of the 21st century, AI witnessed significant advancements in computing technologies, enabling the processing of vast amounts of data and the development of learning techniques based on artificial neural networks.
- By 2018, AI had found applications in various fields, including healthcare, finance, transportation, and recreational tourism.

3. The Importance of Artificial Intelligence:

Artificial intelligence holds significant importance due to several factors (10):

- AI enables humans to interact with machines using natural language rather than programming languages, making the use of machines accessible to all societal segments, not just specialists.
- AI enhances productivity and efficiency by providing services faster and more effectively than humans.
- It reduces costs and provides high-quality transportation and communication services at lower prices.
- AI alleviates many risks and psychological pressures on humans, allowing them to focus on more important and humane tasks.
- It contributes to achieving high rates of sustainable economic and social development.

4. Features of Artificial Intelligence:

AI has many characteristics and features, including (11):

- The ability to process vast amounts of data simultaneously.
- The capability to think, perceive, acquire knowledge, and apply it.
- The capacity to learn from past experiences and apply this knowledge in new situations.
- The ability to plan and solve problems using logical reasoning.
- Recognition of voices and speech and the ability to move objects.
- Creativity and visualization capabilities.
- The ability to detect errors and correct them quickly.
- Responsiveness to changes, with flexibility and quick reactions in various situations.

5. Types of Artificial Intelligence:

There are three types of artificial intelligence (12):

1. **Strong or General AI**: This type can gather and analyze information, accumulate experiences from acquired situations, and make independent, autonomous decisions.
2. **Weak or Narrow AI**: The simplest form of AI, programmed to perform specific functions within a defined environment.
3. **Superintelligent AI**: Also known as "super AI," this type is still in the experimental phase. It refers to machines equipped with cognitive abilities that surpass human intelligence, possessing a degree of self-awareness and the capability to predict and respond to others' emotions and behaviors.

6. Fields of Artificial Intelligence:

AI is a modern science that has spread across many fields (13):

1. **AI in Science**: Found in communications, medicine (e.g., analyzing large patient datasets for diagnosis), chemistry, education, climate studies, and entertainment and gaming.
2. **AI in Infrastructure**: Applied in transportation, agriculture, engineering, and energy sectors.
3. **AI in Applied Fields**: Includes natural language processing, speech and voice recognition technologies, and smart education, where AI acts as a tutor and provides educational consulting.
4. **AI in Automotive Industry**: Robots operate on assembly lines, and self-driving cars and drones have emerged (14).
5. **AI in Manufacturing**: Monitors production processes and replaces human labor in harsh environmental conditions.
6. **AI in Commerce**: Analyzes market conditions, predicts trends, and studies pricing.

7. Applications of Artificial Intelligence:

There are numerous AI-based applications, and as research in this field advances, the usage of AI applications continues to expand in various areas. Many applications are used daily; for example, facial recognition technology is used to unlock phones, and voice commands are used for making calls. Google search engines are utilized for finding information, products, or locations with the help of AI technology. Additionally, navigation devices and digital maps are examples of AI applications.

AI applications can be broadly categorized into three main areas (15):

1. Intelligent Natural Interface Applications:

These include:

- **Natural languages**.
- **Speech and handwriting recognition**.
- **Multisensory interfaces**.
- **Virtual reality**.

2. Smart Machine Applications:

These include:

- **Visual perception**.
- **Sense of touch**.
- **Mobility and movement**.

3. Cognitive Science Applications:

These include:

- **Expert systems**.
- **Learning systems**.
- **Fuzzy logic**.
- **Genetic algorithms**.

Section Two: General Concepts of the Tourism Sector

Tourism holds a prominent place in the priorities of most countries worldwide, both in the public and private sectors. This is due to its vital role in the economies of nations, as tourism is a multifaceted phenomenon that invests in the natural, cultural, and social aspects of different societies. Tourism reflects the level of civilizational progress, social development, and scientific advancement of peoples. It is characterized by being a dynamic, human phenomenon, closely linked to economic, cultural, political, and social factors, making it an essential element in facilitating communication between countries and local communities.

Thus, it can be said that the tourism sector is of significant importance, intersecting with various fields that impact individuals within the society in one way or another.

1. Concept of Tourism:

To understand the concept of tourism, it is essential to start with the linguistic and terminological definitions of the word.

- **Linguistic definition**: The term "tourism" or "siyāḥa" in Arabic derives from the word "sāḥ," meaning to wander or travel across the land.
- **Terminological definition**: It refers to the movement of people from one place to another for the purpose of exploration or leisure, temporarily and for a limited period, far from their usual place of residence. The primary goal is mental or physical relaxation (16).

1.1 Definition of Tourism:

Tourism is defined as a set of activities undertaken by individuals when traveling to destinations outside their place of residence for the purpose of leisure, learning, or exploration. These activities may include visiting tourist attractions, experiencing different cultures, and participating in social events (17).

There are also several other definitions related to the concept of tourism, often linked to the notion of traveling or journeying across the land, as expressed in the Quran: {Say, "Travel through the earth and observe how He began creation. Then Allah will produce the final creation. Indeed, Allah is over all things competent."}

{قل سيروا في الأرض فانظروا كيف بدأ الخلق ثم الله ينشئ النشأة الآخرة إن الله على كل شيء قدير}.(18)

- **Definition by the International Academy of Tourism**: Tourism is defined as a term used to refer to recreational trips and includes a range of human activities dedicated to achieving such trips. Tourism is considered a comprehensive industry aimed at meeting the needs of tourists.
- **Definition by the World Tourism Organization (UNWTO)**: Tourism is defined as the activities undertaken by individuals during their travel and stay in places outside their usual environment, for consecutive periods not exceeding one year, for the purposes of leisure, business, or other reasons.
- It is also described as a socio-economic phenomenon involving the movement of individuals from their permanent residence to other regions outside their country or area, for a period not less than 24 hours and not exceeding one year, for any of the known tourism purposes (19).
- **Definition by EGUYE FREULER**: In its modern concept, tourism is a natural phenomenon reflecting the advancements of the contemporary era. The foundation of this phenomenon is the growing need for relaxation and a change of environment, alongside an increasing cultural awareness that encourages appreciation of the beauty of natural landscapes. Tourism also reflects the desire of individuals to explore new cultures and enjoy diverse experiences (20).

2. Definition of a Tourist:

A tourist is any person who travels from their place of residence to another location for a period of not less than 24 hours and not exceeding four months, for purposes such as leisure, healthcare, business trips, studies, and other similar activities.

2. Characteristics of Tourism

Based on the previous definitions, which indicate that tourism encompasses all activities related to providing a variety of services directly or indirectly to tourists, the following key characteristics of tourism can be highlighted:

- **Diversity**: Tourism includes a wide range of activities and services, such as transportation, accommodation, food, and recreational activities, providing tourists with multiple options.
- **Mobility**: Tourism involves the movement of individuals from one place to another, reflecting the social and economic nature of this phenomenon.
- **Cultural Interaction**: Tourism enhances communication between different cultures, giving tourists the opportunity to learn about the customs and traditions of local communities.
- **Dynamism**: Tourism is influenced by economic, social, and political factors, making it a dynamic phenomenon that is constantly changing.
- **Economic Impact**: Tourism significantly contributes to the local economy by creating job opportunities and increasing revenue.
- **Sustainability**: Modern tourism emphasizes the importance of sustainability, which means preserving natural and cultural resources to meet the needs of future generations.

Through these characteristics, tourism can be understood as a comprehensive phenomenon that reflects societal and economic changes and contributes to promoting sustainable development.

3. Types of Tourism

The tourism sector is one of the most important sectors for many countries due to its economic significance and the revenues it generates. Tourism varies from region to region, depending on the unique features of each area. Therefore, there are several types of tourism, classified according to different criteria.

Table 1: Tourism Types

Classification	Type
Location & Boundaries	International Tourism - Domestic Tourism
Tourist Attractions	Cultural Tourism - Natural Tourism - Social Tourism
Purpose	Recreational Tourism - Cultural Tourism - Medical Tourism - Religious Tourism - Sports Tourism
Organization	Family Tourism - Individual Tourism - Group Tourism
Age Groups	Children's Tourism - Youth Tourism - Adult Tourism - Senior Tourism
Duration of Stay	Permanent Tourism - Seasonal Tourism

Source: Farid Bakhti, Reda Behyani, "Desert Tourism as a Method to Promote Domestic Tourism in Algeria: A Case Study of Tamanrasset," Journal of Advanced Economic Research, University of El-Oued, University of Algiers, Vol. 05, Issue 02, 2020, p. 160.

4. Importance of the Tourism and Travel Sector in Economic Development

The tourism and travel sector is a fundamental driver of economic development, contributing significantly to national income, particularly in developing countries with diverse natural resources. This sector serves as a strategic alternative to other sectors where these countries may lack competitive advantages, thus enhancing opportunities for economic growth and development. Tourism creates job opportunities, stimulates investment, and improves living standards, thereby promoting sustainable development in local communities. The economic importance of tourism can be highlighted through the following points (21):

- **Job Creation**: Tourism provides numerous job opportunities across various sectors, such as hotels, restaurants, and travel agencies, helping reduce unemployment rates.
- **Increase in National Income**: Tourism is an important source of national revenue, contributing to increased income through tourism fees and local sales.
- **Investment Stimulation**: Tourism attracts local and foreign investments in infrastructure and tourism projects, helping to develop the economy.
- **Development of Related Sectors**: Tourism fosters the growth of other sectors, such as transportation, agriculture, and handicrafts, contributing to economic diversification.
- **Promotion of Sustainable Development**: Sustainable tourism helps preserve natural and cultural resources, ensuring long-term development.
- **Increase in Exports**: Tourists are a significant source of revenue through their spending on local products and services, helping to improve the balance of payments.
- **Infrastructure Development**: The growing demand for tourism services leads to improvements and developments in infrastructure, such as roads, airports, and public facilities.

Section Three: Contribution of Artificial Intelligence in Supporting and Activating the Tourism Sector

Artificial intelligence (AI) has started to revolutionize the tourism sector, leveraging its substantial capabilities to enhance operational efficiency, improve customer service, gain a competitive edge, and increase profitability.

1. Importance of Using Artificial Intelligence Technology

At the start of the 21st century, the tourism sector experienced significant technological advancements that brought about a radical shift in its operational dynamics. AI, as a form of modern technology, plays a crucial role:

- The importance of AI lies in improving productivity and efficiency by completing routine tasks faster and better than humans.
- AI is capable of understanding vast amounts of data, especially in today's data-rich world (22).
- **Cost Reduction**: AI helps reduce costs for tourism companies, airlines, and hotels, allowing them to offer more competitive services at lower prices.
- **Enhanced Customer Interaction**: AI can aggregate diverse ideas, respond to customer inquiries simultaneously, and provide information to tour operators and companies.

- **Instant Responses**: AI provides immediate responses during increased demand for tourism services.
- **Labor Cost Reduction**: The use of robots, chatbots, and self-service kiosks operates 24/7 without the need for financial support, providing customer service more efficiently than human employees, leading to increased sales volume.
- **Efficient Handling of Customer Needs**: AI delivers timely information in the form of interactive messages through chatbots, facial recognition, and self-service technology.
- **24/7 Customer Support**: Chatbots support customer service continuously at airlines, hotels, airports, and travel agencies.
- **Real-Time Traffic Updates**: Google Maps provides drivers with real-time traffic updates and suggests alternative routes to avoid congestion.
- **Product and Service Promotion**: AI helps tourism companies offer and promote products and services at lower costs and with high quality, assisting in revenue improvement strategies and forecasting financial challenges and opportunities.
- **Personalized Customer Experience**: AI analyzes data to offer customized experiences, recommending travel destinations and providing suggestions for flights and hotels.
- **Understanding Customer Preferences**: AI helps service providers understand tourists' needs, behaviors, budget preferences, and travel choices, offering tailored services and products.
- **Administrative Task Automation**: Automating administrative tasks helps travel companies save time and money.
- **Fraud Prevention**: AI detects suspicious activities, reduces fraud, and ensures the safety of travelers.
- **Enhanced Flight Safety**: AI improves flight safety by providing detailed data on aircraft performance and alerting pilots to potential issues.
- **Predictive Analytics for Delays**: AI uses predictive analytics to alert airlines and airports about potential delays, enabling them to take necessary precautions.
- **Automated Check-in and Baggage Handling**: Airlines like British Airways and EasyJet use AI to predict passengers' needs for beverages and meals on board, reducing inventory costs.
  Regarding to AI applications in airports have increased security, improved service quality, sped up security checks, reduced service costs, and minimized human errors, leading to higher passenger satisfaction.
- **Convenient Check-in Options**: Travelers can check in through the web, mobile apps, or self-service kiosks at terminals.
- **Mobile Boarding Passes**: Boarding passes are accessed via smartphones or through self-scanning devices at the boarding gates.
- **Lost Baggage Tracking**: Travelers can track their lost luggage using their smartphones.
- **AI in Hotel Management**: AI enhances hotel services through facial recognition technology, chatbots, robots, virtual assistants, in-room service robots, and self-service kiosks for check-in. These innovations have led to the emergence of smart hotels.
- **Impact on Restaurants**: AI has significantly influenced the restaurant industry through chatbots and digital voice assistants.
- **Tablet Ordering Systems**: Meals and drinks can be ordered using tablets placed on tables.
- **Virtual Reality in Marketing**: VR is used to showcase and market meals and dining areas within restaurants, enabling customers to order food or reserve tables (23).
- **Improved Business Operations**: AI enhances the daily operations of tourism companies.
- **High-Quality Service**: AI ensures the delivery of high-quality services to tourists.
- **Speed and Ease of Bookings**: Faster and more convenient reservation processes.
- **Increased Efficiency and Productivity**: Enhanced operational efficiency and output.
- **Cost Savings**: Reduced costs in service delivery.
- **Enhanced Customer Experience**: Improved overall customer satisfaction.
- **Effective Tourist Facilities**: Tourists receive better and more efficient services.
- **Interactive Tourist Facilities**: Greater interaction between tourist facilities and visitors.
- **Innovative Services**: Introduction of new and creative tourism services.
- **Improved Competitiveness**: Increased competitiveness of tourism companies.
- **Higher Supplier Revenues**: Boosted revenues for tourism service providers.

- **Increased Tourist Satisfaction and Loyalty**: Enhanced satisfaction and loyalty among tourists.
- **Improved Airport and Airline Services**: Enhanced safety and service quality in airports and airlines.
- **Customized Hotel Design**: Hotels are designed to meet the specific needs and expectations of tourists.
- **Rise of Virtual Tourism**: Virtual tourism has become a significant AI application, especially after the COVID-19 pandemic, due to the partial or full closure of many tourist facilities (24).

2. AI Applications in the Tourism Sector

There are numerous AI applications in the tourism industry:

1. **Virtual Reality (VR)**:
o VR is a 3D simulation technology that allows users to explore and interact with virtual environments as if they were real. VR hotel tours offer 3D video displays of hotel surroundings and facilities (e.g., virtual visits to hotels and their locations). Examples include virtual Hajj and Umrah tours, and visits to religious sites, helping tourists access the information they need. Airlines also use VR to market their services interactively, allowing customers to view their seats, first-class cabins, business class seating, meals, and entertainment options (25).

2. **Augmented Reality (AR)**:
o AR differs from VR as it integrates the real world with virtual elements, unlike VR, which simulates a fully digital environment. AR applications are user-friendly and connected to mobile devices with integrated cameras and GPS. Users can point their phone cameras at any object and view 3D videos (26).

3. **Chatbots**:
o There are two types of chatbots: text-based chatbots and voice-based chatbots. These programs facilitate communication through auditory and visual means. Chatbots are used 24/7 to respond to tourists' inquiries instantly, offer recommendations and deals, handle booking requests, and provide updates on traffic and weather conditions. This aims to enhance customer service, reduce response times, and increase customer loyalty and satisfaction.

Additionally, this type of AI is used in airports to inform travelers about gate changes, departure information, driving directions, and details on the cheapest flights and destinations. It also functions as an automated tour guide, offering features that human tour guides may not have, such as recognizing multiple languages.

4. Robots:

Robots, as a form of AI technology, have established a strong presence in the tourism sector and are now widely used in various capacities, including:

- **In Hotels**: Robots control room lights, turn off the TV, adjust lighting, curtains, music, and air conditioning. They can activate the air conditioning before the guest's arrival or dim the lights when the guest leaves the room. Robots also serve as hotel concierges, such as *Connie*, launched by Hilton Worldwide in 2016.
- **In Restaurants**: Robots perform tasks such as cooking, taking customer orders, serving and packaging food, collecting dishes from tables, cleaning them, and washing floors and restrooms.
- **In Airports**: Robots guide passengers during check-in, direct them to gates, handle and inspect luggage, print baggage tags, verify boarding passes, respond to traveler inquiries, and entertain them by playing music and taking photos. For instance, *Josie Pepper* at Munich Airport in Germany welcomes passengers and answers their questions about shops, restaurants, and gates. Robots also enhance safety during emergencies by sending alerts and detailed incident data to the contact center in real time to ensure passenger safety (27).
- **During Hajj Season (COVID-19 Pandemic)**: Robots were used to ensure physical distancing, clean and disinfect buildings, assist with room service, carry luggage, guide guests to their rooms, serve food, answer inquiries, provide guidance for pilgrims, measure body temperature, offer sanitization, and monitor compliance with mask-wearing rules (28).

Applications like *Smart Travel* and *SITA* make it easier to book tickets and board flights, providing services like onboard Wi-Fi and online meal ordering.

5. Facial Recognition:

Facial recognition technology helps tourists travel through airports and board planes without physical travel documents. It automatically verifies passports through facial recognition and is also used in hotels for identifying guests during check-in.

6. Smart Parking Systems:

Smart parking systems use advanced technologies like sensors and navigation algorithms to help drivers find the optimal route to a parking spot. They guide users based on their car's license plate number and provide directions via a map, showing the current location of the vehicle.

7. Smartphone Applications:

Various AI-powered smartphone apps enhance tourism experiences, making them more enjoyable and cost-effective. Examples include GPS navigation, email, social media, and web browsing. In South Korea, halal tourism apps help Muslim tourists find restaurants and shopping locations.

8. Google Maps:

Google Maps uses GPS technology to help tourists locate themselves and find shops, malls, hotels, restaurants, and entertainment venues.

9. Translation Apps:

Translation apps like *Google Translate* offer voice translation services, translating text, voice messages, and even images containing text. Users can point their cameras at signs or store names to receive instant translations on the screen.

10. Dynamic Pricing Applications:

These apps use data related to pricing, room types, and user booking patterns. For example, Starwood Hotels use dynamic pricing apps (29).

11. Search Optimization Applications:

Travel agencies and hotels use these applications to enable search engines to retrieve accurate information.

12. Social Media:

Social media is one of the best AI applications. It analyzes tourist feedback on social media, interpreting expressions like "thank you" or "dissatisfied," using AI to derive insights and solutions.

13. TripAdvisor:

TripAdvisor uses AI technology and is crucial for tourists, specializing in helping them plan trips based on recommendations from millions of travelers who have previously visited the destination (30).

14. WT2 Earbuds:

A recent AI innovation in tourism, WT2 earbuds allow tourists to converse with anyone in a foreign language, offering a unique travel experience without the need for a translator or guide.

15. AI Check-In at Hotels:

Many hotels now use AI for the check-in process, which takes only 30 seconds in three steps: first, scanning the customer's ID using a special device; second, confirming the check-in; and third, issuing the room key automatically.

16. Smartphone Check-In and Check-Out:

Apps like Hilton's allow customers to prepare for their hotel stay online, tracking their reservation from booking until check-in. When the booking is confirmed through the dedicated app, hotel chains receive the room number before the guest's arrival, eliminating the need to visit the front desk for a key, using a near-field communication (NFC) feature instead (31).

17. Booking.com:

The Booking.com app offers a wide variety of hotel and accommodation options, with around 28 million alternatives available in 43 different languages.

18. Smart Hajj Bracelet:

First introduced in 2021 in Saudi Arabia, the Smart Hajj Bracelet gathers information about the pilgrim's health status by measuring blood oxygen levels and pulse. It also provides medical assistance alerts and sends awareness messages.

Current Use of AI Applications in Algeria's Tourism Sector:

1. Tourism Sector Assets in Algeria: Natural, Historical, and Cultural Qualifications

Algeria boasts significant tourism assets, positioning it strategically on a global scale. The country's natural attractions include a Mediterranean coastline stretching over 1,200 km, acting as a gateway to Africa and a bridge between Africa and Europe. Additionally, the vast Sahara Desert, covering over two million square kilometers, offers unique tourism products with its oases, sand dunes, rocky plateaus, and archaeological landmarks like polished stones and cultural heritage sites. Algeria's heritage includes Roman ruins in Timgad, rock art in Tassili, and seven UNESCO World Heritage Sites such as the Casbah and the M'Zab Valley. The country also has

numerous mineral hot springs suitable for treating various ailments, along with diverse climates from north to south, making it a strong contender in the tourism industry.

These natural and cultural assets are supported by physical infrastructure like hotels, roads, airports, ports, and communication networks. However, these assets alone do not guarantee a successful tourism industry. In recent years, Algeria has focused on diversifying its revenue sources beyond the oil sector by implementing development strategies to boost the tourism sector.

2. Policies and Strategies Adopted in Algeria's Tourism Sector:

- The issuance of several laws and plans aimed at promoting the tourism sector, along with the establishment of various institutions dedicated to organizing and managing this sector (32).
- Legislation related to tourism expansion zones and tourist sites.
- The creation of the Ministry of Tourism and Handicrafts in 2003 and the establishment of the National Institute for Tourism Studies.
- The formation of the National Committee to Facilitate Tourism Activities, alongside the implementation of various economic and financial measures, such as the Master Plan for Tourism Development.
- The **2025 Tourism Development Master Plan (SDAT)**, through which the state aims to boost the tourism sector by implementing developmental programs and policies (33).
- The **2030 Tourism Development Master Plan (SDAT)**, which serves as a reference for a new policy adopted by the Algerian state to make tourism a contributing sector to economic development, as an alternative to the oil sector.

3. Evaluation of the Tourism Sector's Performance in Algeria

3.1 Based on Local Resources and Policies:

Despite Algeria's natural, cultural, and historical assets and its available human resources—which could serve as strong drivers for developing the tourism sector—and despite the legal and structural framework established for tourism, the sector has not yet reached a level sufficient to achieve its developmental goals. This is primarily due to the limited use of artificial intelligence (AI) applications in the tourism sector, which remains in its early stages and is confined to (34):

- Some mobile applications and weak websites lacking proper search engines and strong content, such as the website of the National Tourism Office, which is the official promoter of Algerian tourism, and the Ministry of Tourism and Handicrafts website.
- The absence of modern technologies (especially AI) in digital tourism promotion for Algerian tourist destinations on these websites.
- A limited number of five-star hotels, with only about six such establishments.
- Slow progress in the completion of tourism projects, which negatively affects the volume and quality of tourism services provided.

Algeria has begun laying the groundwork to advance in this field by implementing several strategies, including:

- Establishing the **Center for Advanced Technology Development** in 2003, tasked with conducting scientific research, technological innovation, robotics, laser applications, software engineering, and AI.
- Launching the gradual strategy known as "e-Algérie 2013" in 2008, aimed at expanding internet access, digitizing public services, and adapting the legal framework accordingly.
- Developing the **Algeria Vision 2035 Strategy** by the Ministry of Finance, which emphasizes digitalization and the use of modern technologies as key factors for success in developing and diversifying the national economy (35).
- Introducing a **National AI Strategy (2020–2030)**, which includes the establishment of a national university to train top-performing high school students as engineers and the creation of a technology city to serve as a foundation for an AI-driven and technologically advanced industry and economy (36).

3.2 Based on Global Indicators:

We will attempt to evaluate the performance of Algeria's tourism sector according to global indicators, particularly regarding the use of information and communication technology (ICT) and the adoption of advanced technologies (AI):

3.2.1 Algeria's Position in the World Economic Forum's Travel & Tourism Competitiveness Index (2017, 2019, 2024):

The World Economic Forum in Davos publishes a biennial report on the Travel & Tourism Competitiveness Index (TTCI) at the international level since 2007. This report contains detailed data assessing countries' global rankings by evaluating and analyzing their tourism performance. The objective is to identify strengths and weaknesses by measuring a set of factors and policies that enable countries to achieve sustainable tourism and travel development and enhance their competitiveness. The index is scored between 1 (worst) and 7 (best) and measures all factors and policies contributing to the development of this sector and the achievement of sustainable growth.

Figure 1: Travel & Tourism Competitiveness Indicators from the World Economic Forum (Davos Report), 2019
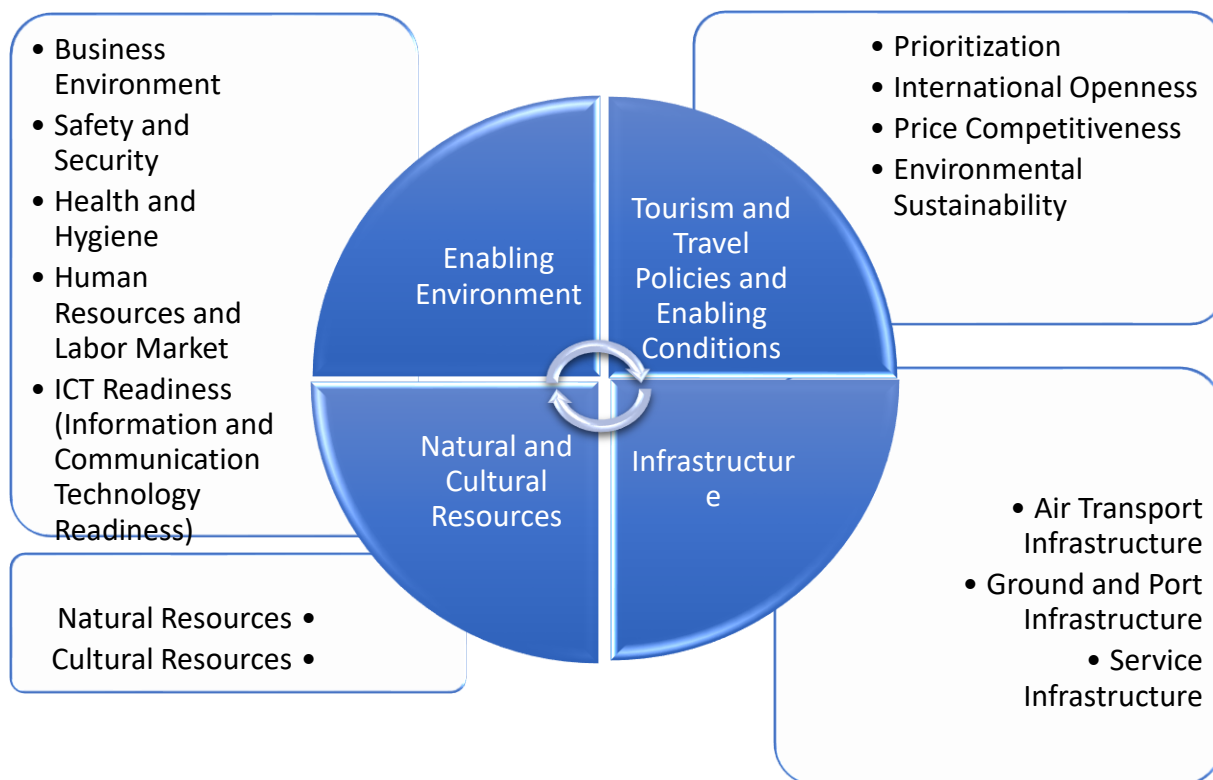
Source: *The Travel and Tourism Competitiveness Index, Report 2019, World Economic Forum, Geneva, Switzerland, p. 10.*

Figure 2: The Five Dimensions of the Travel and Tourism Development Index 2024

Sustainability of Tourism and Travel	Tourism and Travel Resources	Infrastructure and Services	Tourism and Travel Policies and Enabling Conditions	Enabling Environment
• Environmental Sustainability • Economic and Social Impact of Travel and Tourism • Demand for Tourism and Travel	• Natural Resources • Cultural Resources • Non-Leisure Resources	• Air Transport Infrastructure • Ground and Port Infrastructure • Tourist Service Infrastructure	Tourism and Travel Prioritization International Openness Price Competitiveness	• Business Environment • Safety and Security • Health and Hygiene • Human Resources and Labor Market • ICT Readiness

Source: *The Travel and Tourism Development Index, Report 2024, World Economic Forum, Geneva, Switzerland, p. 8.*

Changes and Adjustments to the Main Indicators of Travel and Tourism:

The Travel and Tourism Competitiveness Indicators have undergone several changes and adjustments as follows (37):

- **From 2007 to 2013**: The index included three main indicators: Regulatory and Legal Framework, Business Environment and Infrastructure, and Human, Natural, and Cultural Resources.
- **From 2015 to 2019**: The report featured four main indicators and 14 sub-indicators, as illustrated in Figure 1.
- **From 2021 to 2024**: The report included five main indicators. The fourth sub-indicator, Environmental Sustainability, which was part of the second main indicator (Travel and Tourism Policies and Enabling Conditions), was elevated to become the fifth main indicator. It now includes three sub-indicators: Environmental Sustainability, Economic and Social Impact of Travel and Tourism, and Demand Sustainability for Travel and Tourism.

Additionally, a new sub-indicator, Non-Leisure Resources, was added to the fourth main indicator, Natural and Cultural Resources, as explained below:

1. **Main Indicator 1: Enabling Environment**
   This indicator covers the general conditions necessary for the tourism sector's operations and includes five sub-indicators:
o **Business Environment**: Measures the presence of policies that encourage investment in the tourism sector.
o **Safety and Security**: Assesses risks faced by local residents and inbound tourists.
o **Health and Hygiene**: Evaluates the availability of health and hygiene standards and tourists' access to medical assistance.
o **Human Resources and Labor Market**: Measures skills and efficiency in the labor market.
o **ICT Readiness**: Assesses the readiness of a country's economy in terms of information and communication technology infrastructure.
2. **Main Indicator 2: Travel and Tourism Policies and Enabling Conditions**
   This indicator examines strategic policies affecting the tourism and travel sector and includes four sub-indicators:
o **Prioritization of Travel and Tourism**
o **International Openness**

o   **Price Competitiveness**
3. **Main Indicator 3: Infrastructure and Services**
    This indicator measures the availability and quality of infrastructure in the tourism and travel sector and includes three sub-indicators:
o   **Air Transport Infrastructure**
o   **Ground and Port Infrastructure**
o   **Tourist Service Infrastructure**
4. **Main Indicator 4: Natural and Cultural Resources**
    This indicator evaluates aspects related to natural and cultural resources and includes three sub-indicators:
o   **Natural Resources**
o   **Cultural Resources**
o   **Non-Leisure Resources**
5. **Main Indicator 5: Sustainability of Travel and Tourism**
    This indicator addresses current and future challenges facing the tourism and travel sector, including three sub-indicators:
o   **Environmental Sustainability**: Measures the sustainability of energy use in the sector and the overall sustainability of the natural environment, including the protection of natural resources.
o   **Economic and Social Impact of Travel and Tourism**: Contributes to creating well-paying jobs and achieving gender equality in the workforce.
o   **Demand Sustainability for Travel and Tourism**: Assesses factors that may indicate fluctuations in demand or unsustainable demand trends.

3.2.1.1 Performance of Algeria's Tourism Sector According to the Overall Travel and Tourism Competitiveness Index (2017–2024):

The following table shows Algeria's ranking based on the overall Travel and Tourism Competitiveness Index, as issued by the World Economic Forum from 2017 to 2024.

Table 2: Global and Arab Ranking of Algeria According to the Overall Travel and Tourism Competitiveness Index (2017–2024)

Country	Report 2017	Report 2019	Report 2024
	Global (136 countries)	Score (1–7)	Arab (12 countries)
Algeria	118	3.07	12
United Arab Emirates	29	4.49	1
Qatar	47	4.8	2
Bahrain	60	3.89	3
Morocco	65	3.81	5
Saudi Arabia	63	3.82	4
Oman	66	3.78	6
Jordan	75	3.63	8
Tunisia	87	3.5	9
Egypt	74	3.64	7
Lebanon	96	3.37	10
Kuwait	100	3.33	11

Source: Compiled by the researcher based on:

- *The Travel and Tourism Competitiveness Report 2017, World Economic Forum, Geneva, Switzerland, p. 9.*
- *The Travel and Tourism Competitiveness Report 2019, World Economic Forum, Geneva, Switzerland, p. 44.*
- *The Travel and Tourism Development Index, Report 2024, World Economic Forum, Geneva, Switzerland, p. 11.*
  The table above presents Algeria's international and regional ranking according to the Travel and Tourism Competitiveness Index published by the World Economic Forum for the years 2017, 2019, and 2024. The year 2022 is excluded as Algeria was not listed in the report due to its non-participation.
  Based on the data in the table, Algeria ranked 118th globally out of 136 countries in the 2017 report, with a score of 3.07 out of 7, which is below average. Regionally, it ranked 12th out of 12 Arab countries. In the 2019 report,

Algeria improved slightly to 116th globally out of 140 countries, with a score of 3.1 out of 7, again ranking 12th regionally. By 2024, Algeria's position improved to 98th globally out of 119 countries, with a score of 4.42 out of 7 (above average), but it remained 12th regionally. Despite the overall improvement in its score and a significant jump of 16 positions globally from 2019 to 2024, Algeria's regional position did not change, reflecting the continued poor performance of its tourism sector.

3.2.1.2 Performance of Algeria's Tourism Sector According to Main and Sub-Indicators (2017–2024):

The table below shows Algeria's ranking based on the main and sub-indicators of the Travel and Tourism Competitiveness Index from the World Economic Forum for the period 2017–2024.

Table 3: Algeria's Ranking by Main and Sub-Indicators of Travel and Tourism Competitiveness (2017–2024)

Dimension	Indicator	2017 Rank	2019 Rank	2024 Rank	Score (1–7)
Enabling Environment	Business Environment	110	118	N/A	3.24 (Below Average)
	Safety and Security	81	53	N/A	5.58 (Good)
	Health and Hygiene	89	76	N/A	4.35 (Above Average)
	Human Resources and Labor Market	112	102	N/A	3.03 (Below Average)
	ICT Readiness	96	89	N/A	4.41 (Above Average)
Tourism Policies and Conditions	Government Prioritization of Tourism	131	132	N/A	3.69 (Above Average)
	International Openness	134	139	N/A	2.49 (Weak)
	Price Competitiveness	4	8	N/A	6.03 (Excellent)
Infrastructure and Services	Air Transport Infrastructure	100	99	N/A	2.66 (Weak)
	Ground and Port Infrastructure	105	90	N/A	2.80 (Weak)
	Tourist Service Infrastructure	131	136	N/A	2.61 (Weak)
Natural and Cultural Resources	Natural Resources	124	126	N/A	2.47 (Weak)
	Cultural Resources	53	51	N/A	2.20 (Weak)
	Non-Leisure Resources	N/A	N/A	N/A	1.94 (Very Weak)
Sustainability of Tourism	Environmental Sustainability	106	133	N/A	3.42 (Below Average)
	Economic and Social Impact	N/A	N/A	N/A	4.47 (Acceptable)
	Demand Sustainability	N/A	N/A	N/A	2.82 (Weak)

Source: Adapted from:
- *The Travel and Tourism Competitiveness Report 2017, World Economic Forum, Geneva, Switzerland, p. 81.*
- *The Travel and Tourism Competitiveness Report 2019, World Economic Forum, Geneva, Switzerland, pp. 65–83.*
- *The Travel and Tourism Development Index Report 2024, World Economic Forum, Geneva, Switzerland, p. 39.*

Analysis:
- **Enabling Environment**: Algeria's ranking in Business Environment declined from 110th in 2017 to 118th in 2019 due to an unfavorable business climate. However, its Safety and Security indicator improved significantly from 81st to 53rd, reflecting political and social stability. Health and Hygiene also showed progress, but there are still issues with the quality of healthcare services for foreign tourists. The ICT Readiness indicator improved slightly, but Algeria still faces challenges with internet infrastructure.
- **Tourism Policies and Enabling Conditions**: Despite several strategic plans to boost tourism, Algeria's rankings in Government Prioritization of Tourism and International Openness declined. However, Algeria scored highly in
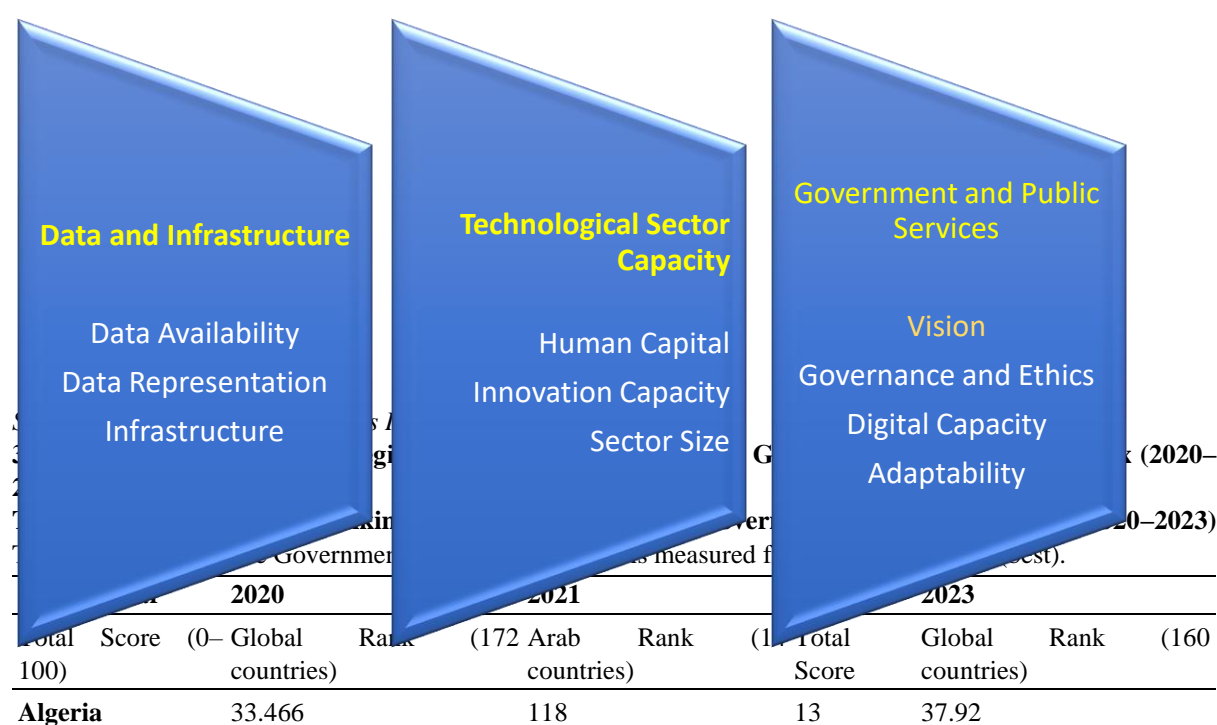
Price Competitiveness, ranking 4th globally in 2017, due to low national currency value and reduced purchasing power.

- **Infrastructure and Services**: Algeria showed slight improvements in Air Transport Infrastructure and Ground and Port Infrastructure rankings, but the overall infrastructure remains underdeveloped. The ranking for Tourist Service Infrastructure fell, indicating a lack of hotel rooms, public facilities, and car rental services.
- **Natural and Cultural Resources**: Algeria's ranking in Natural Resources declined, suggesting underutilization of natural assets and poor conservation efforts. Cultural Resources improved slightly, but the promotion of Algeria's rich historical heritage remains inadequate.
- **Sustainability of Tourism**: The Environmental Sustainability indicator dropped significantly, reflecting poor maintenance of historical sites and lack of regular upkeep. The Economic and Social Impact and Demand Sustainability indicators were introduced in 2024, but data is not available for analysis.

3.2.2 Algeria's Position in the Government AI Readiness Index (2020–2023):

The Government AI Readiness Index, published by Oxford Insights, measures the preparedness of countries to adopt AI technologies in the public sector and assess their use in public services. It evaluates 39 sub-indicators across 10 key dimensions based on three main pillars: Government and Public Services, Technological Sector Capacity, and Data and Infrastructure, as illustrated in the figure below.

Figure 3: Dimensions of the Government AI Readiness Index and Its Main Pillars

Data and Infrastructure

Data Availability
Data Representation
Infrastructure

Technological Sector Capacity

Human Capital
Innovation Capacity
Sector Size

Government and Public Services

Vision
Governance and Ethics
Digital Capacity
Adaptability

	2020			2021			2023		
	Total Score (0–100)	Global Rank (172 countries)		Arab Rank (1.		Total Score	Global Score	Rank (160 countries)	
Algeria	33.466	118		13			37.92		

Source: Adapted by the researcher based on:

- *Government AI Readiness Index, Report 2020, Oxford Insights, pp. 128–133.*
- *Government AI Readiness Index, Report 2021, Oxford Insights, pp. 61–71.*
- *Government AI Readiness Index, Report 2022, Oxford Insights, pp. 53–58.*
- *Government AI Readiness Index, Report 2023, Oxford Insights, pp. 47–52.*

According to the table above, Algeria ranked 118th globally out of 172 countries in the 2020 report, with a total score of 33.466 points, placing it 13th regionally out of 14 Arab countries. In the 2021 report, Algeria improved to 99th globally out of 160 countries with a score of 37.92, ranking 12th regionally. In 2022, Algeria fell to 111th globally out of 181 countries and maintained the 12th place regionally, with a score of 35.33. In 2023, it ranked 120th globally out of 193 countries, still in 12th place regionally, with a score of 35.99. Comparing the values from the four reports, Algeria made significant progress in 2021 (up 19 ranks compared to 2020), but then fell 12

ranks in 2022 and 9 ranks in 2023. Regionally, it improved by one rank in 2021 but remained at the 12th position in both 2022 and 2023.

3.2.2.2 Algeria's Global and Regional Position by Main Pillars of the Government AI Readiness Index (2020–2023)

Table 5: Algeria's Global and Regional Rankings by Main Pillars of the Government AI Readiness Index (2020–2023)

Country	Year	Total Score Index	Government and Public Services	Technological Sector	Data and Infrastructure
Algeria	2020	33.466	N/A	N/A	N/A
	2021	37.92	32.96	29.57	51.24
	2022	35.33	30.17	29.93	45.88
	2023	35.99	30.10	30.56	47.30

Source: Adapted by the researcher based on:

- *Government AI Readiness Index, Report 2020, Oxford Insights, pp. 128–133.*
- *Government AI Readiness Index, Report 2021, Oxford Insights, pp. 61–71.*
- *Government AI Readiness Index, Report 2022, Oxford Insights, pp. 53–58.*
- *Government AI Readiness Index, Report 2023, Oxford Insights, pp. 47–52.*

Note: The 2020 Government AI Readiness Index report only provided the overall index score without detailed values for the main pillars.

From the data above, Algeria ranked 99th globally in the 2021 index with a score of 37.92, scoring 32.96 in Government and Public Services, 29.57 in the Technological Sector, and 51.24 in Data and Infrastructure. In 2022, it scored 35.33 overall, with 30.17 in Government and Public Services, 29.93 in the Technological Sector, and 45.88 in Data and Infrastructure. In 2023, Algeria scored 35.99 overall, with 30.10 in Government and Public Services, 30.56 in the Technological Sector, and 47.30 in Data and Infrastructure.

Comparing the three main pillars over the study period, there was a decline in the Government and Public Services pillar, while the Technological Sector showed notable improvement, reflecting Algeria's focus on technology and limited infrastructure development in ICT and digital services. The Data and Infrastructure pillar showed a decline in 2022 but a significant improvement in 2023.

Algeria's low rankings, both regionally and globally, indicate a general weakness in its performance across most dimensions of the Government AI Readiness Index, despite some improvements in key pillars.

4. Challenges of Using AI Applications in Algeria's Tourism Sector:

Several challenges hinder the use of AI applications in the tourism sector in Algeria:

- High initial costs of implementing AI applications.
- Lack of specialized national companies for the production and maintenance of AI applications.
- Insufficient funding for AI projects.
- Long-term return on investment for AI applications.
- Weak ICT infrastructure.
- Lack of skilled personnel to manage this type of technology.

Conclusion:

In light of technological advancements, the use of AI applications has become essential and a fundamental pillar for the development and success of the tourism sector. AI offers significant advantages that cater to modern requirements, such as speed and flexibility in service delivery. However, Algeria's tourism sector remains underutilized compared to its vast resources, capabilities, financial means, and available opportunities that could make it a prime tourist destination. Despite strategic efforts to boost this sector, Algeria still ranks low according to global indicators, even though some sub-indicators have shown improvement. The overall Travel and Tourism Competitiveness Index has advanced slightly, indicating slow progress due to the absence of a genuine strategy.

Algeria lags significantly in adopting digital tools in the tourism sector, despite notable progress in information and communication technology (ICT), though at a slow pace. Nonetheless, the country continues to make efforts in this field. ICT has become the cornerstone of tourism development, making it an imperative rather than an option for stakeholders. Therefore, modernizing and updating the mechanisms to support this sector is an urgent necessity.

Answers to Research Hypotheses:

- The first hypothesis, stating that the use of AI applications leads to the creation of innovative new products and improves the quality of tourism services, is **confirmed**. This research has shown that countries adopting AI applications have experienced significant growth in the competitiveness of their tourism sectors, marking a major leap in this evolving industry.

- The second hypothesis, suggesting that the success of AI in stimulating and developing the tourism sector relies on a robust ICT infrastructure, is also **confirmed**. ICT has seen substantial growth in recent years and is the foundational element of tourism development. It is not merely a strategic choice but a necessity imposed by the current economic conditions to enhance and grow Algeria's tourism sector.

Findings:

- ICT applications have a significant impact on driving the growth of the tourism sector.
- There is insufficient investment in ICT infrastructure.
- AI is a vital strategic tool for supporting and enhancing the tourism sector.
- The hotel infrastructure does not meet international standards.
- There are issues with internet speed and connectivity.

Recommendations:

1. Algeria should leverage AI technologies to boost the tourism sector, as well as the economic and social sectors, to achieve comprehensive development.
2. Investing in digital technology is crucial to creating an environment conducive to innovation and leadership in the tourism industry.
3. Establish an appropriate environment for AI applications by ensuring reliable internet connectivity.
4. Implement the outlined AI strategies effectively.
5. Develop specialized curricula and offer AI courses in schools and universities to train a new generation of AI experts.
6. Strengthen ICT infrastructure and enhance the communication system to support AI-related projects.
7. Learn from the expertise of leading countries in AI.
8. Provide incentives to the Algerian diaspora specializing in AI to benefit from their expertise in this field.
9. Establish legal and regulatory frameworks to ensure data security and privacy in AI applications.
10. With the continued advancement of AI technologies, new opportunities for innovation in tourism are expected. Therefore, tourism companies should stay updated on the latest trends and developments to ensure sustainable benefits.

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