INNOVATION AND APPLICATIONS IN SUSTAINABLE TOURISM

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Abstract. *Scientific, technical and socio-economic progress has led to accelerated development of tourism. As a result, serious problems in the areas of ecology, culture and social development have arisen in regions where tourism infrastructure is actively developing. Uncontrolled growth of tourism, caused by the desire to quickly make a profit, often leads to negative consequences – damage to the environment and local communities. This forces humanity to take care of preserving natural, historical and cultural values. Thus, the issue of sustainable tourism development is very relevant today. The article discusses innovations that have a significant impact on the development of the sustainable tourism industry. Modern technologies, digitalization, artificial intelligence change approaches to the organization of tourism, improving customer experience, increasing the efficiency of business processes and thereby contributing to sustainable tourism development. The article examines possible prospects for the development of sustainable tourism in Azerbaijan based on the application of innovative achievements.*

Keywords: *Innovation, Digitalization, Sustainable Tourism, Ecological transformation, Tourism industry.*

1. Introduction

Tourism, as one of the most dynamically developing sectors of the economy, is at the intersection of many factors, including economic, social and technological changes. In recent decades, tourism has undergone significant changes due to the introduction of innovative technologies.

In the era of digitalization and ecological transformation of industry and society, the ability to develop and use innovations is crucial to an organization's, sector's, and the economy's overall success. Increasing the competitiveness and efficiency of the tourism industry in the first place, the sector later on, and the economy overall depends on the adoption of innovations. Developing tourism flows and producing experiences and products that meet and anticipate individual demand as much as possible are the goals of innovation. This calls for familiarity with the primary areas where the tourism organization focuses its innovation efforts, such as the introduction of new products and the use of new technologies in manufacturing (Ilieva, Petrova, & Todorova, 2023).

Technologies not only help improve the quality of service, but also open up new horizons for travelers, creating unique experiences and optimizing processes. Innovations in tourism have

become an important factor that forms new trends, changes the requirements for infrastructure and customer service, and opens up opportunities for sustainable development of the industry.

The tourism industry is very sensitive to various environmental, economic and political changes. Therefore, the COVID-19 challenge has changed business models around the world, including in the tourism industry. The global impact of the COVID-19 pandemic has resulted in disruptions in logistics, travel, transit, accommodation, hospitality and trade. Digitalization is seen as a potential opportunity to reinvent the sector. In this process, the COVID-19 epidemic, which has deeply affected tourism, has accelerated digitalization and the use of technological innovations in the tourism business. New procedures in transportation, mobile applications in hotels and automatic travel insurance are some of the key factors in the future of tourism (Eşitti, 2023). These changes have highlighted the growing role of innovation in promoting sustainable tourism development.

After COVID-19, the issue of sustainable tourism development has become even more urgent and vital. Tourism is one of the largest and most thriving industries in the world, providing significant benefits to the host economy. Not only does it create jobs, but it is also one of the most significant sources of foreign exchange for any economy and is usually a significant contributor to the host country's GDP growth. But actively developing tourism in pursuit of profit, tourist-oriented countries do not take into account environmental degradation. Therefore, at present it is necessary to adhere to the principles of sustainable tourism and the growth of environmental legislation throughout the world, become more environmentally tactful and choose environmentally friendly and sustainable substitutes.

This article analyzes the process of the influence of innovations on the development of sustainable tourism and examines the problems that still hinder this process. In article analysis is also being conducted of the development of tourism in Azerbaijan and how the transition to a green, sustainable development model is being carried out.

2. Literature review

2.1. Understanding innovation in tourism

Over the past few decades, as global trade, capital, and labor have expanded, high-income economies' competitiveness and prosperity have become increasingly dependent on their ability to innovate. We commonly associate innovation with breakthrough inventions, but it can also refer to organizational changes and technology spread (Chandra et al., 2009). As defined by the Organisation for Economic Co-operation and Development (OECD), innovation refers to a new or enhanced product or process that significantly differs from what the unit previously offered and has been made accessible to potential users or put into practice. Innovation at the societal level aims to meet current and future human needs, both individually and collectively. Firms are motivated to innovate when they hope to enhance their market share, sales, or profits (OECD/Eurostat, 2018). In the face of changing global market conditions, innovation is critical to maintaining an organization's competitive advantage. It includes not only the development of new products or services, but also the implementation of innovative strategies within the organization's culture, operations, and business models. Effectively managed innovation enables firms to adapt to changing market environments, improve operational efficiency, and provide more value to customers (Hapsari et al., 2024).

Technology is crucial to the tourism industry because it helps businesses run their day-to-day operations, enhances the customer experience, and increases the appeal of a place to prospective

tourists. Furthermore, achieving sustainable tourism is a dynamic, ongoing process that necessitates ongoing effect monitoring, the implementation of suitable preventive measures when necessary, and the use of the right technological tools to promote tourism activities and guarantee that visitors are getting the greatest experiences. This is why it's critical for hotels, restaurants, airlines, and other businesses to stay abreast of technological advancements.

- Innovative tourism helps to create new jobs and to provide opportunities for the development of small and medium-sized tourism companies.
- Innovative tourism projects require specialists in various fields, including IT, marketing, design and hospitality, which contributes to the development of an innovative ecosystem and the expansion of the labor market.
- Innovative tourism attracts investment and contributes to the development of infrastructure. Investors see potential in innovative tourism projects, such as the development of ecotourism, the creation of tourist attractions using new technologies or the reconstruction and modernization of historical sites. This not only contributes to the growth of tourist flow, but also to the development of the construction industry, transport and other related sectors of the economy.
- Innovative torurism improves the competitiveness of a tourist destination.

The COVID-19 pandemic has accelerated the need for innovation in tourism and has led to a fundamental transformation in service delivery. In order to achieve prosperity and sustainable development goals for tourism firms during the pandemic, it is essential to incorporate and properly use technological advances in the business. Technological developments affecting tourism can be broadly divided into the following key dimensions:

•ICT
•Social Media
•Internet and Websites
•Mobile and Smart Phones
•Other Technological Advances (Giotis & Papadionysiou, 2022).

The spread of technology in the tourism industry is primarily due to the growing consumer demand. Planning a tourist trip involves the preliminary preparation of a number of details, from the choice of destination, to the selection of means of transport, accommodation and local attractions and monuments. Until recently, the customer preferred to save his valuable time and have all these details arranged by the nearest travel agency, while now there is an increase in the number of users who organize their own trip, because everything is just a click away. With the availability of a smart device and a wi-fi connection, the customer can book a ticket to the chosen destination by the chosen mode of transport, book a stay in a suitable hotel and find the best restaurants and bars nearby in a few clicks. Examples of beneficial applications for both industry and tourism include the following technological advancements:

1.Smart Travel Initiatives: This concept revolves around the integration of various service systems, allowing travelers to purchase tickets and check in online, access boarding passes via their smartphones, and enjoy a fully automated check-in process.

2.Smart Destinations: These locations adopt a comprehensive strategy to enhance the entire tourist experience, engaging visitors before, during, and after their stay. Such destinations aim to promote sustainable management of local tourism resources and proactively address potential challenges to ensure a seamless customer experience.

3.The introduction of the "digital tour guide" service. This application utilizes the location data from users' smartphones or tablets to assist them in navigating to their chosen sites, while also offering an audio guide for local attractions.

4.Online booking and accommodation options. Many processes, such as receiving and registering passenger boarding passes, have been streamlined and can now be accessed remotely just hours before departure.

5.Online communities: When searching for hotels or restaurants at our desired destinations, tourists can quickly check reviews to determine their worthiness. These communities function like modern tour guides, collaboratively suggesting top spots in and around the destination, significantly affecting customer choices and decisions.

6.Travel safety guidelines. These regulations are continually evolving in response to the changing situation. To keep everyone informed, governments offer digital platforms that supply real-time updates on local rules and regulations, including alert levels for terrorism risks and environmental hazards such as floods or wildfires (Ilieva, Petrova, & Todorova, 2023).

2.2. Apply of innovations for supporting sustainable tourism development: experience of countries specializing in tourism business.

As noted above, the use of innovations in tourism creates new opportunities for the effective development of tourism, including the development of new tourist destinations, the use of technological innovations in the hotel business, in transport, in the work of travel agencies, as well as the entire infrastructure necessary for the development of tourism. In addition, the use of innovation in maintaining the sustainability of tourism is a very important factor.

Economic, socio-economic and scientific-technical progress has led to excessively rapid development of tourism. Because of this, serious problems in the field of ecology, culture and social development have appeared in places of mass tourist visitation, in connection with the problem of protecting the territory from the impact of tourism.

The principles of protecting the biosphere on a global scale were enshrined in 1992 by the UN Conference on Environment and Development in Rio de Janeiro, which was attended by delegations of governments of 179 countries of the world, numerous international and non-governmental organizations.

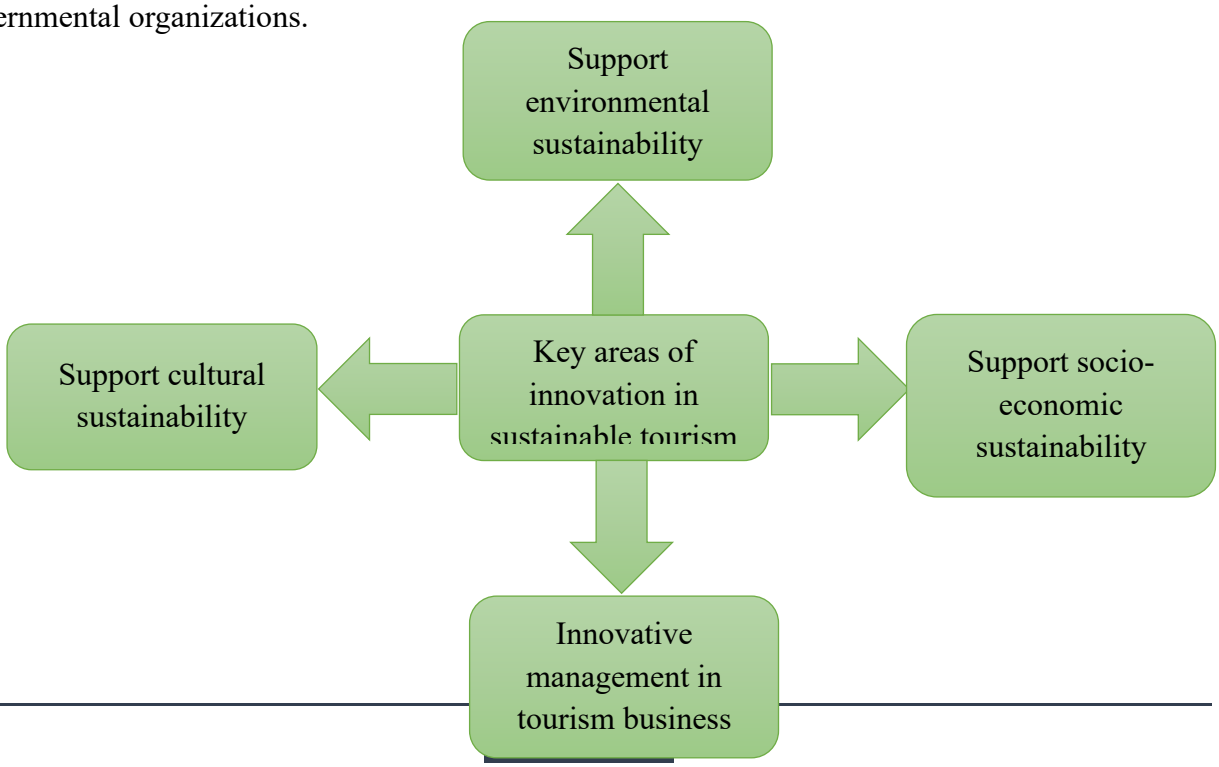

Figure 1. Key areas of innovation in sustainable tourism

What are the main objectives of innovations in sustainable tourism development?

First, it is balanced and efficient to use resources to reduce the processes of environmental degradation.

Secondly, optimization of business processes, management and increasing the efficiency of resource use.

Thirdly, creation of new jobs and thereby maintaining the socio-economic sustainability of the country.

New tourism projects and innovations require specialists in various fields, including IT, marketing, design and hospitality, which contributes to the development of an innovative ecosystem and the expansion of the labor market. Innovative tourism attracts investment and contributes to the development of infrastructure. Investors see potential in innovative tourism projects, such as the development of ecotourism, the creation of tourist attractions using new technologies or the reconstruction and modernization of historical sites. This not only contributes to the growth of tourist flow, but also to the development of the construction industry, transport and other related sectors of the economy. The use of innovations also improves the competitiveness of a tourist destination.

The performance of important industries, particularly tourism, is correlated with economic growth in every part of the world. Through export earnings that include both passenger transportation and international tourism receipts, international tourism supports local economies. Tourism-related income is a significant source of foreign money and a key element of export diversification for many locations. In the years leading up to 2019, tourism experienced significant growth and diversification, establishing itself as one of the largest and quickest-expanding economic sectors globally. However, from 2020 to 2022, the industry faced a substantial drop in international arrivals as a result of the COVID-19 pandemic. Arrivals of foreign visitors fell 72% from roughly 1.5 billion in 2019 to 400 million in 2020. With the introduction of the coronavirus vaccine and the relaxation of entrance restrictions in several countries, international travel began to recover in the second half of 2021 (World Tourism Organization, 2024). In 2024, foreign visitor arrivals entirely recovered from the 1.465 billion arrivals in 2019, returning to pre-pandemic levels. More than 300 million tourists traveled abroad in the first quarter of 2025, which is around 14 million higher than during the same period in 2024 (UNWTO, 2025) (see **Figure 2**).

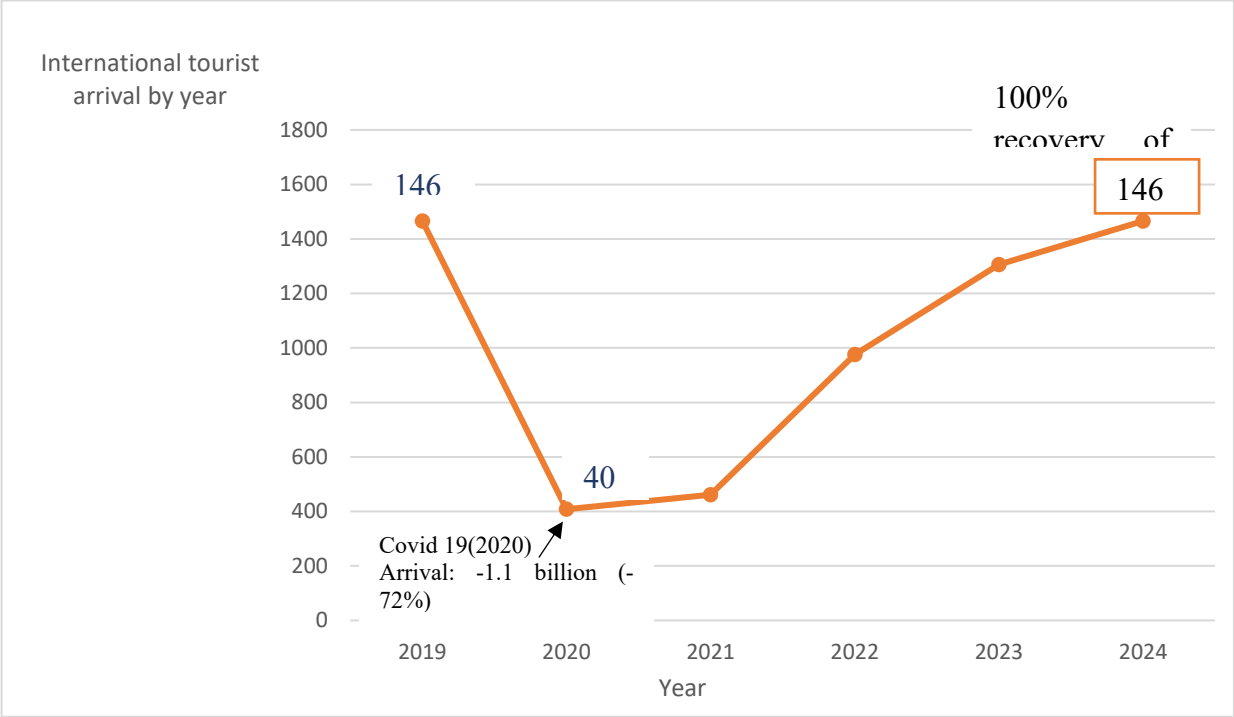

Figure 2: International tourist arrival (billion.person)

Source: World Tourism Organization (2025). World Tourism Barometer, Volume 23, Issue 2, May 2025. UN Tourism, Madrid.

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With the rapid rebound in international tourist arrivals in recent years, the demand for safer, smarter, and more sustainable travel experiences has significantly increased. This growth in tourism activity has pushed destinations and service providers to adopt innovative solutions in order to meet changing traveler expectations, manage larger visitor volumes efficiently, and minimize negative environmental and social impacts. For instance, when guests enter Singapore's Marina Bay Sands hotel, they can use their mobile devices to pre-register wherever they are, check in, and finish the necessary verifications. Additionally, hotel allow visitors order in-room meals and use their smartphones as digital keycards to access their rooms and hotel elevators to enhance the visitor experience and streamline hotel operations (Marina Bay Sands, 2023). Significant advancements in transportation for tourism encompass high-speed trains, contemporary airports, electric vehicles, e-bikes, and smart cards for public transit. These developments enhance both efficiency and convenience in the tourism sector. In Norway, the electrification of road vehicles is a major technological advancement that supports sustainable tourism. Essential drivetrain technologies include battery electric vehicles, plug-in hybrid electric vehicles, hybrid electric vehicles, and hydrogen fuel-cell electric vehicles, all aimed at minimizing environmental impact and fostering low-emission travel for tourists (van Wee, Annema, & Köhler, 2022). For example, the Netherlands has successfully implemented this approach. It has developed the concept of “green routes” and promoted the use of bicycles and electric cars to transport tourists. This not only reduces the negative impact on the environment but also creates new opportunities for the development of infrastructure and service enterprises related to environmentally friendly tourism.

3. Development tourism in Azerbaijan in the prism of innovation concept

Azerbaijan, with its capital Baku, is located at the crossroads of East and West, with both modern infrastructure and regions full of rich historical sites, stunning nature and national parks. This unique position attracts the majority of international tourists. In recent years, Azerbaijan has been actively working to ensure compliance with technological innovations and tools and make the best of them for the effective development of the tourism (Center for Analysis of Economic Reforms and Communication, 2017). According to the State Statistical Committee of the Republic of Azerbaijan, in 2024, the Republic of Azerbaijan received 2,626.7 thousand foreign and stateless visitors, indicating a 25.9% increase compared to 2023. These visitors came from 196 different countries, indicating a rising interest in Azerbaijan as a travel destination. The rise in the number of visitors also shows that international tourism in Azerbaijan continues to recover after the sharp decline caused by the COVID-19 pandemic. A comparison with previous years clearly illustrates the impact of the pandemic on inbound tourism. In 2019, foreign arrivals reached a high of 3,170 thousand, but this number plummeted to 795.7 thousand in 2020 and 791.8 thousand in 2021 due to global travel restrictions, border closures, and health concerns. Since 2022, the tourism sector has been gradually recovering, and by 2024, the number of visitors exceeded the 2023 figure of 2,085.8 thousand, reinforcing a consistent upward trend. In 2024, the majority of visitors came from the Russian Federation (27.8%), followed by Türkiye (16.2%), India (9.3%), Iran (8.0%), and Georgia (4.2%). This growth is in line with the country's planned investments in digital platforms, smart tourist programs, and building infrastructure that will last (State Statistical Committee of Republic of Azerbaijan, 2024) (see **Figure 3**).

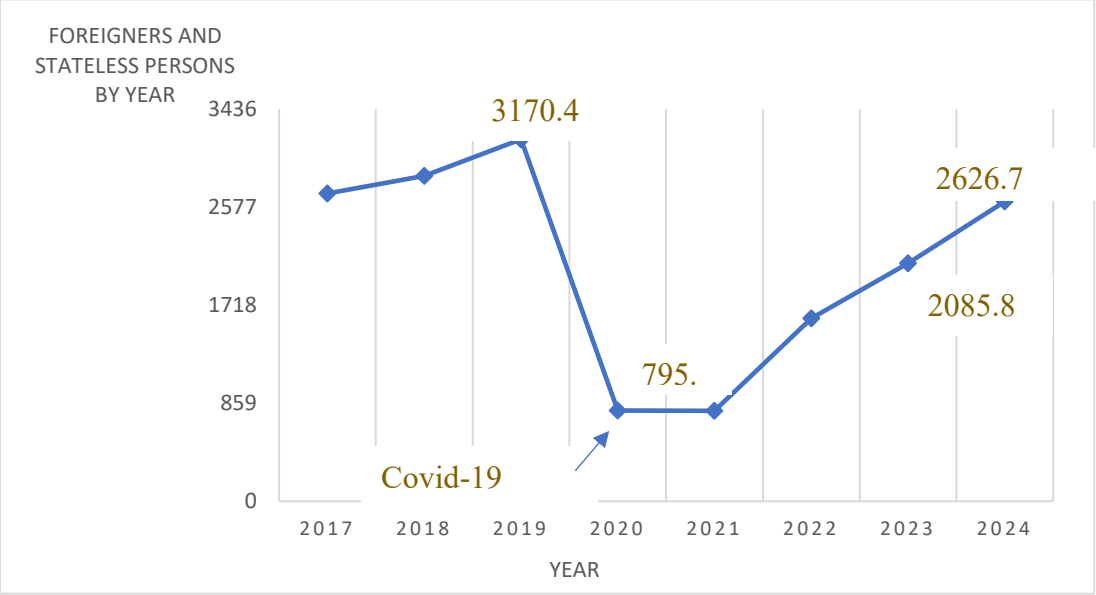

Figure 3. Foreigners and stateless persons arrieved to Azerbaijan-total (thsd.person)
Source: State Statistical Committee of the Republic of Azerbaijan, 2024
https://www.azstat.gov.az/portal/tblInfo/TblInfoList.do

The figure provides a chronological overview of key technological and sustainability-oriented advancements in Azerbaijan's tourism sector from 2015 to 2025. These developments signal the country's strategic commitment to modernizing tourism services while strengthening environmental responsibility and regional inclusiveness.

Azerbaijan's national strategies, such as the "Strategic Roadmap for the Development of Specialized Tourism Industry in Azerbaijan" prioritize high-quality and competitive tourism services in global and local markets, tourism practices aligned with national values, new investment projects based on cutting-edge ideas and innovations, and effective collaboration among tourism sector stakeholders (Center for Analysis of Economic Reforms and Communication, 2017). People can now apply for and receive a visa to enter Azerbaijan with great ease and convenience thanks to the introduction of the Azerbaijan electronic visa, which marked a significant digital revolution. There are no formalities because the application process is completed entirely online and the candidate does not need to physically visit the Azerbaijani embassy or consulate (ASAN Visa, n.d.). Smart technologies began to play a more visible role with the introduction of the GoMap mobile application. With this mobile application, tourists can find objects, obtain in-depth information about them, plan their routes, and hit the road (GoMap, n.d). In parallel Azerbaijan has significantly enhanced its tourism infrastructure through the expansion of public Wi-Fi networks. The deployment of public Wi-Fi in prominent urban and tourist locations has substantially increased digital accessibility for visitors (Electronic Government Portal of the Republic of Azerbaijan, 2023).

During the Covid 19 pandemic, a significant decrease in the number of tourists visiting the Republic of Azerbaijan led to serious structural and technological changes in the tourism sector of Azerbaijan. Along with the emphasis on the development of domestic and ecological tourism, digital solutions such as virtual excursions, online platforms and mobile applications have begun to be widely used. At the same time, the application of digitalization such as use of QR codes, mobile applications, the application of new technologies and the organization of online excursions on social networks was one of the main tools for modernizing the sector and ensuring its sustainable development (Hajiyeva, 2021). Measures taken in recent years have created a foundation for the transition to a more digital and environmentally conscious tourism sector in Azerbaijan after the pandemic period.

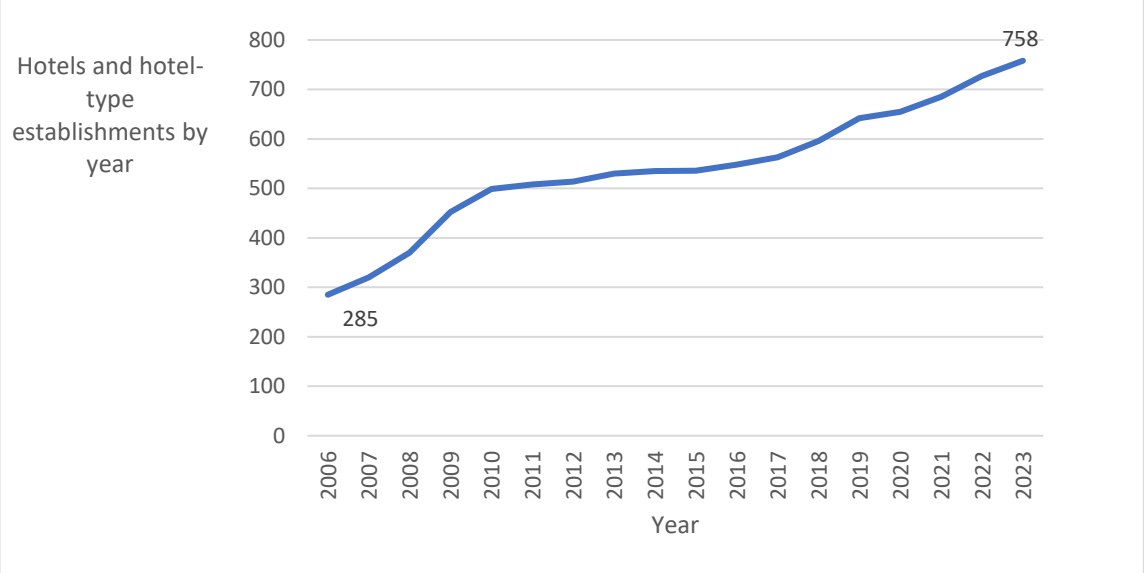

Figure 4: Total number of hotels and hotel-type establishments, unit
Source: State Statistical Committee of the Republic of Azerbaijan. (2024). Tourism statistics. https://www.stat.gov.az/source/tourism/?lang=en

Over the previous 20 years, Azerbaijan's hotel industry has grown steadily. There were 285 hotels and similar facilities nationwide in 2006. This number has more than doubled by 2023,

reaching 758 (see **Figure 4**). In addition to the rise in hotel establishments, the nation's hotel capacity has expanded dramatically. Hotel capacity increased from over 24,700 units in 2006 to nearly 59,400 units in 2023, reflecting the total amount of lodging that is available. Azerbaijan has increased the number of hotels it has built as well as the size and scope of its current infrastructure in order to better serve tourists. Baku, the country's capital, has dominant position on both the total number of hotels and their capacity. Baku's hotel capacity was approximately 6,900 units in 2006 and increased to almost 26,000 units by 2023. Additionally, hotel capacity is rising in other economic zones of the nation. In recent years, the tourist infrastructure in the Guba-Khachmaz and Shaki-Zagatala economic regions has grown. In 2023, capacities of hotel and hotel-type establishments in Guba-Khachmaz and Shaki-Zagatala economic regions reached to 11274 and 5090, respectively. Along with expanding hotel capacity in these areas, tourism is becoming more evenly distributed geographically, and regional tourist development is encouraged nationwide (State Statistical Committee of the Republic of Azerbaijan, 2024) (see **Figure 5**)

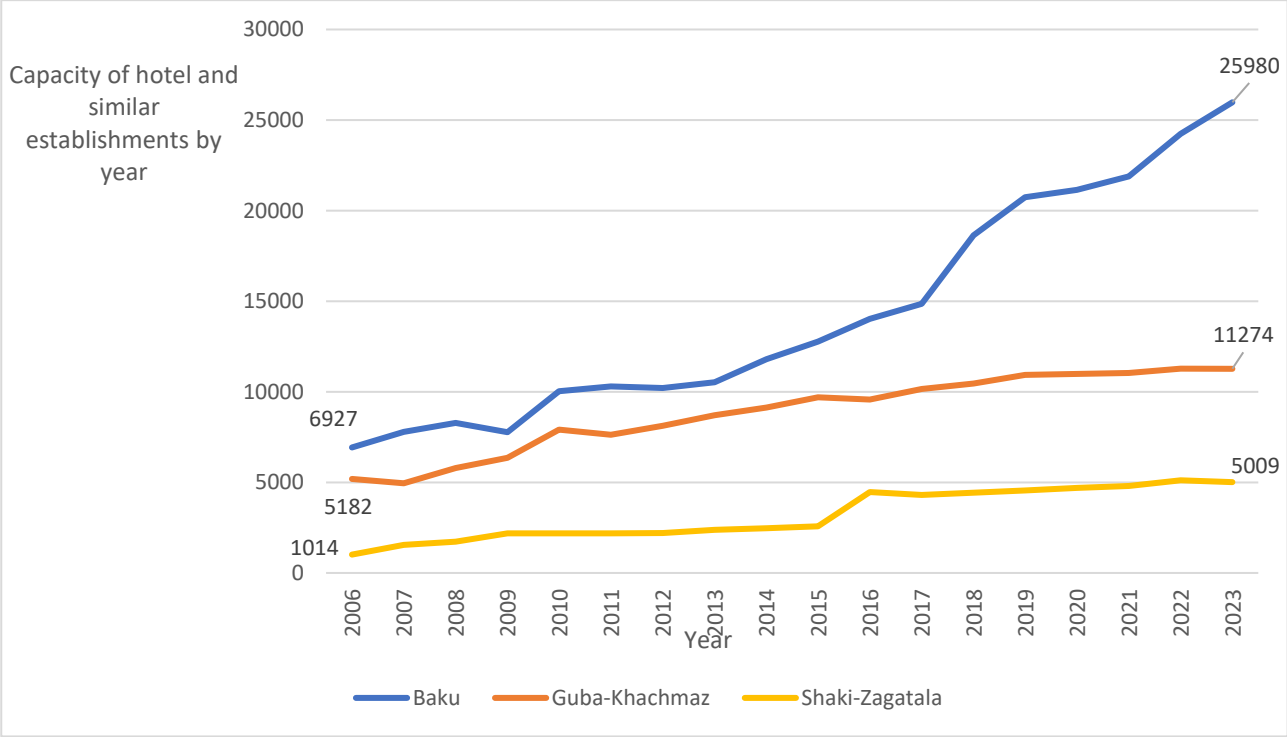

Figure 5: Capacity of hotels and similar establishments (bed places)

Source: State Statistical Committee of the Republic of Azerbaijan. (2024). Tourism statistics. https://www.stat.gov.az/source/tourism/?lang=en

Following global practices in sustainable tourism, several hotels in Azerbaijan have started to adopt green management approaches aimed at reducing their environmental footprint. In this regard, the receipt of the "Green Key" eco-certification of the hotels JW Marriott Absheron Baku, The Ritz-Carlton Baku, Baku Marriott Hotel Boulevard, Courtyard Marriott, The Merchant, and Sheraton Intourist Hotel can be cited as an important example. Hotels that fulfill stringent requirements for eco-friendly initiatives, such as mitigating the effects of climate change, are granted the prestigious Green Key eco-label. This standard was developed and is maintained by the Foundation for Environmental Education (FEE), which promotes excellence in the field of

sustainable tourism. By maintaining sustainability and ethical tourism practices, Green Key accredited hotels are not only benefiting the environment but also attracting environmentally conscious travelers who value green efforts (SGS, 2024).

According to the Republic of Azerbaijan's State Statistics Committee, the number of travel companies and tour operators doing business in Azerbaijan grew steadily between 2006 and 2019. This number increased by about 4.5 times from 2006, when it was only 96, to 432 in 2019. Increased investments in the nation's tourism infrastructure, service sector liberalization, and the encouragement of foreign visitor flows are the primary causes of this increase. However, the COVID-19 pandemic has caused a significant decline in the number of agencies since 2020. This number dropped to 300 in 2020 and to 150 in 2021. The industry made a partial recovery in the ensuing years, reaching 300 units in 2023. Prior to the pandemic, Azerbaijan's travel agency industry grew steadily before going through another stage of development (State Statistical Committee of the Republic of Azerbaijan, 2024) (**see Figure 6**)

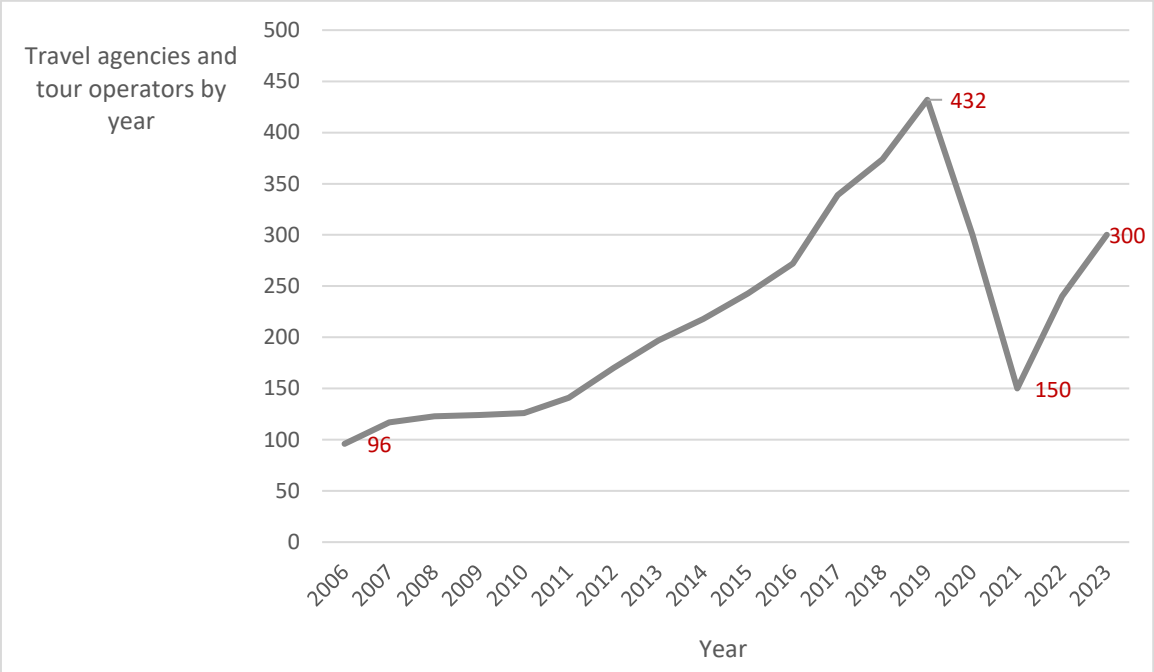

Figure 6: Number of travel agencies and tour operators, unit

Source: State Statistical Committee of the Republic of Azerbaijan. (2024). Tourism statistics. https://www.stat.gov.az/source/tourism/?lang=en

Azerbaijani travel agencies are also integrating innovations into their activities. Large agencies have switched to online platforms for booking tours, hotels, tickets and other services, which makes the travel planning process more convenient and accessible. Travel agencies are developing mobile applications for tourists that provide complete information about the country's attractions, transport infrastructure, etc. Based on special technology, travel agencies create virtual tours of the country's historical sites and also offer virtual gastronomic tours. All this has a positive effect on attracting tourists to Azerbaijan.

Large cities are not the only places in Azerbaijan where the tourism industry is developing technologically and sustainably. This strategy is also readily apparent in Karabakh's liberated areas. Because of its geography and abundant natural recreational resources, the Karabakh region has enormous potential for the tourism industry. Following the occupation, Karabakh is undergoing repair and reconstruction on the president's orders. The building of the "Victory Road" was one of

the initiatives carried out in Karabakh. In addition to being a sign of victory, this route makes it easier for visitors to get from Fuzuli airport to Shusha. Another initiative was the "Smart Village," which is being put into practice in the Zangilan district's Agali village. High levels of creativity and intelligent technology were employed in the design of the eco-friendly project. The city of Shusha which known for its water resources, including Turshsu and Isabulagi is also implementing projects to increase tourism. The hotels "Xari Bülbül" and "Karabakh" have been refurbished and are now operational. The development of Karabakh's tourism sector is based on technological innovations and ecologically conscious planning. Developing Karabakh, which has rich tourism potential, is economically important for Azerbaijan. However, restoration and reconstruction projects are costly and challenging (Yusifov, 2023).

The "Azerbaijan Tourism Strategy 2023–2026," which specifically names "digitalization, technology, and innovation" as one of its nine strategic pillars, as another essential component of technological development. Tourism in the 21st century demands the employment of cutting-edge techniques for effective destination creation, management, and marketing. Consequently, STA and ATB have invested in electronic tools to fully leverage technological advancements. The azerbaijan.travel website has been launched, and all material websites have experienced SEO optimization. Additionally, a visitor telephone hotline, a tourism information system, a monitoring system, an e-learning program for travel professionals, and the regional innovation startup program have been implemented. This strategy further develops Azerbaijan as an accessible, sustainable, and "quality tourism" destination that offers unique experiences to both domestic and international tourists (Azerbaijan Tourism Board, 2023).

In 2024, Azerbaijan hosted the 29th session of the United Nations Climate Change Conference (COP29), strengthening the country's standing in global environmental governance. COP29 Azerbaijan Operating Company, AZERSUN Holding, and COP29's Sustainable Growth Partner, co-organized a session titled "Advancing Sustainable Tourism with Local Agriproducts" as part of the Green Zone program. Experts, sustainability researchers, business leaders, and tourism professionals from various countries met to discuss how prioritizing local produce and supporting sustainable agriculture can reduce tourism's carbon footprint, enhance the travel experience, and foster a greener, more sustainable future (COP29, 2024). Additionally, on November 20, 2024, the United Nations World Tourism Organization (UNWTO) conducted a dedicated Thematic Day on Tourism in Baku as part of the UN Climate Change COP29 Action. The event brought together key stakeholders from both the government and the corporate sector to discuss how to integrate tourism development with climate objectives. The summit provides an opportunity for the tourism industry to highlight its vital role and progress in combating climate change, recognizing both its vulnerability to climate consequences and its potential to contribute to solutions. A high-level expert group also convened researchers and policymakers to discuss new and realistic options for improving climate action in the tourism industry. Discussions centered on how to go from commitments to tangible results, emphasizing the importance of cross-sector collaboration, scaling up green finance, and applying regenerative practices at a larger scale. The workshop offered a clear roadmap for transitioning to low-carbon and climate-resilient tourism systems, outlining tangible methods that may be implemented internationally (UNWTO, 2024).

Conclusion

According to the article, it should be noted that, the role of innovative technologies in the world is constantly increasing, and this trend also directly affects the tourism sector. Especially in a

modern society where digitalization is rapidly spreading, the application of innovations has become a necessity. Digital tools, artificial intelligence, mobile applications and environmentally friendly technologies contribute to the tourism's progression in a sustainable manner, increase the quality of service and enrich the tourist experience. This article considered the role of innovations in the development of sustainable tourism, as well as analyzed the experiences of various countries in this field and the situation in Azerbaijan. As a result of the research, it became clear that the application of innovative approaches has already begun in our country.

Projects such as electronic visas, mobile applications, smart tourism infrastructure, "Green Key" certified hotels and the "smart village" in the Karabakh region are important steps in this area. However, despite all these successes, some structural and technological problems, as well as uneven development of infrastructure across regions, still exist. The tourism sector remains one of the most promising areas for Azerbaijan. For the further development of this field, it is important to apply innovative technologies on a large scale and systematically. In the future, strengthening public-private sector cooperation in this direction, ensuring environmental sustainability and deepening digital transformation should be one of the important priorities. Thus, thanks to innovative approaches based on technologies, Azerbaijan can get closer to building a sustainable and competitive tourism model.

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