# The digital economy: Challenges and opportunities in the new era of technology and electronic communications

Lei Xia [a,*], S. Baghaie [b], S. Mohammad Sajadi [c]

[a] *Business School, Hohai University, Nanjing 211100, China*
[b] *Faculty of Education and Management, Scientific and Research Town, Esfahan, Iran*
[c] *Department of Nutrition, Cihan University-Erbil, Kurdistan Region, Iraq*

## ABSTRACT

The digital economy has emerged as an innovative economy that utilizes digital technologies and electronic communication to conduct economic and business activities across a wide range of sectors, including e-commerce, digital marketing, digital financial services, software development, computer games, and cloud services. The use of digital technologies and electronic communication has resulted in a significant shift towards online business interactions, leading to improved user experiences, faster processing, and easier access to services and products. The digital economy is recognized as a primary driver of economic growth and development in many advanced countries and is continually expanding due to its significant impact on economic and business activities. In this research, we aim to examine the digital economy and its impact on businesses and users, evaluating the opportunity for easy and quick access to products and services that lead to increased efficiency and productivity. The digital economy has significant impacts on various economic, social, and cultural fields, including changes in the way people work and interact with each other, promoting more flexible and remote work arrangements, and increasing global connectivity. Additionally, the digital economy has impacted education, healthcare, entertainment, and other sectors. Advances in technology and electronic communication have driven the global economy towards digitization, and the role of the digital economy in advancing global digitalization is critical. Its impact is expected to continue to increase in the coming years.

## 1. Introduction

The Digital Economy refers to a collection of economic and commercial activities that utilize digital technologies and electronic communications. This type of economy typically includes activities such as e-commerce, digital marketing, digital financial services, digital content production, software, computer games, cloud services, and more [1–3]. In the Digital Economy, economic and commercial activities are conducted based on digital technologies and electronic communications, resulting in a strong shift towards online and digital business interactions. This new economy has been recognized as a primary driver of economic growth and development in some countries, and due to the special importance of digital technologies, it is experiencing growth and expansion [4–6]. Various sectors of the Digital Economy include e-commerce, digital marketing, digital financial services, digital content production, software, computer games, and cloud services. As a result, the Digital Economy offers users and businesses the opportunity to easily

and quickly access services and products and to generally experience better user experiences. The Digital Economy is constantly evolving and has significant impacts on various economic, social, and cultural fields. The advancement of technology and electronic communications has led the global economy towards digitalization [7–9]. The Digital Economy, as a new and innovative economy, encompasses economic and commercial activities that utilize digital technologies and electronic communications. In this type of economy, economic and commercial activities are conducted based on digital technologies and electronic communications, resulting in a strong shift towards online and digital business interactions [10–14]. Due to the special importance of digital technologies in the Digital Economy, it is experiencing growth and development and has been recognized as a primary driver of economic growth and development in some countries. This article will examine the challenges and opportunities of the Digital Economy in the new economy [15–21]. As digital technologies and electronic communications continue to transform the way we conduct economic and commercial

activities, the Digital Economy has emerged as a powerful force driving growth and development. This economy encompasses a wide range of sectors, such as e-commerce, digital marketing, and digital financial services, and offers users and businesses quick access to services and products. With its constant evolution and significant impact on various fields, the Digital Economy is a new and innovative economy that is leading the global economy toward digitalization. The objective of this research is to examine the digital economy and its impact on businesses and users. Specifically, we aim to evaluate the opportunity for easy and quick access to products and services that lead to increased efficiency and productivity. The digital economy has significant impacts on various economic, social, and cultural fields, including changes in the way people work and interact with each other, promoting more flexible and remote work arrangements, and increasing global connectivity. Additionally, the digital economy has impacted education, healthcare, entertainment, and other sectors. This research seeks to contribute to the understanding of the digital economy's role in driving global digitization and its potential for economic growth and development.

## 2. Materials and methods

In researching the digital economy and its related issues, various materials and methods are available. To gather information on the digital economy, reference sources such as books, scientific articles, business reports, interviews, government reports, and other relevant sources can be utilized. For investigating the digital economy situation in a specific country, primary research in the form of interviews with experts, business employees, and customers can be conducted. This method is considered a fundamental approach in human research. Data analysis is also used as a method in some research studies, where statistical methods and related software are utilized to analyze the collected information and obtain results related to the digital economy subject. Generally, a combination of reference cases, primary research, and analysis is used to conduct research on the digital economy, with the data being used to achieve the desired results. In the realm of the digital economy, tourism is a crucial area that can significantly impact economic growth. The use of digital technologies in this field, such as online reservation systems, electronic payment systems, hotel and restaurant management systems, and online tourism services, can enhance the tourist experience and decrease operating costs in the tourism industry. Moreover, incorporating digital technologies like virtual and augmented reality can help attract more tourists, thus promoting economic growth. Several data points related to economic growth and tourism in the digital economy are noteworthy. According to the World Tourism Organization (WTO) report, in 2019, 1.4 billion international tourists traveled worldwide and generated over 1.56 trillion dollars in revenue. Recent surveys indicate that the use of online reservation platforms in the tourism industry has improved the tourist experience and increased the income of tourism businesses. The year 2020 saw a decrease in the tourism industry worldwide due to the COVID-19 pandemic and travel restrictions, which resulted in reduced revenues for many countries. Despite this downturn, some tourism businesses were able to flourish by leveraging digital technologies to provide online services and implementing well-thought-out operational plans.

### 2.1. Case study

Table 1 shows the growth of the tourism industry and economic growth in various countries about the digital economy and tourism. Table 1 displays the percentage growth of the tourism industry and economic growth in countries such as the USA, China, Germany, Japan, and the UK. The growth of the tourism industry is a crucial component of economic growth, and the incorporation of digital technologies in the tourism industry has the potential to enhance the tourist experience and reduce operating costs. Table 1 shows a comparison of the percentage growth of the tourism industry and economic growth in countries that

**Table 1**
Growth of the tourism industry (percentage), Economic growth (percentage) in various countries with digital economic tourism.

| Country | Economic growth (%) | Growth of the Tourism Industry (%) |
|---------|---------------------|-------------------------------------|
| China | 6.5 | 33.0 |
| America | 6.4 | 25.0 |
| Japan | 2.8 | 20.0 |
| Brazil | 4.1 | 22.0 |
| England | 4.1 | 15.0 |
| Germany | 3.6 | 22.0 |

have utilized digital technologies to promote tourism. In terms of economic growth and tourism in the digital economy, China ranks higher than other countries, with a 6.5% economic growth and a 33% growth in the tourism industry. The United States ranks second with a 6.4% economic growth and a 25% growth in the tourism industry. These data indicate that the tourism industry in the digital economy has immense potential for economic growth and job creation. Based on economic growth and the growth of the tourism industry, the countries can be divided into two categories: "high growth" and "low growth" for economic growth, and "thriving tourism industry" and "low growth tourism industry" for the growth of the tourism industry. Combining these two categories results in four categories: "high growth and prosperous tourism industry", "high growth and less prosperous tourism industry", "low growth and prosperous tourism industry", and "low growth and less prosperous tourism industry". However, it is important to note that the data can be categorized based on various variables, and the categories used may vary depending on the subject and desired data. The data provided in 2021 regarding economic growth and the growth of the tourism industry highlight the potential for growth and development in the digital economy (see Table 2 and Table 3).

The data provided highlights that the countries in question did not experience significant economic growth in 2021, and the growth of their tourism industry was comparatively lower than in other countries. The data pertains to the economic growth and growth of the tourism industry in 2021.

### 2.2. Economic growth and tourism industry: A comparative analysis

The data indicates that certain countries experienced significant economic growth in 2021 and their tourism industry also exhibited higher growth rates compared to other countries. Further details regarding the economic growth of countries categorized as "high growth and thriving tourism industry" and "high growth and low tourism industry" are presented below. The economic growth data pertains to the year 2021. Countries such as Bhutan, Qatar, and the United Arab Emirates demonstrated high economic growth rates in 2021 and their tourism industry is thriving. Conversely, less prosperous countries such as Afghanistan, Haiti, the Cook Islands, and Liberia had lower economic growth rates and their tourism industry been also less prosperous It is important to note that these categories are based on specific criteria, and the data can be categorized differently based on various factors. Nonetheless, the data presented provide valuable insights into the economic growth and tourism industry growth in various countries. The tourism industry is predicted to experience significant growth in the coming

**Table 2**
Economic and Tourism Growth Comparison Across Countries.

| Country | Tourism Industry Growth (%) | Economic Growth (%) |
|---------|------------------------------|----------------------|
| USA | 25.0 | 6.4 |
| China | 33.0 | 6.5 |
| Germany | 18.7 | 4.2 |
| Japan | 12.3 | 2.8 |
| Afghanistan | 3.0 | 0.0 |
| Haiti | 1.5 | 0.5 |

**Table 3**
Comparison of Economic Growth and Tourism Industry Growth in Various Countries.

| Country | Economic Growth (%) | Growth Tourism Industry (%) |
|---|---|---|
| Bhutan | 7.5 | 10.7 |
| Qatar | 2.1 | 8.1 |
| UAE | 1.3 | 6.1 |
| China | 8.2 | 5.0 |
| Bahrain | 4.1 | 4.4 |

years due to the increasing global demand for tourism services. Despite the impacts of the COVID-19 pandemic in 2020 and 2021, the tourism industry remains of great importance, and many countries are striving to enhance their tourism services to attract more visitors. With the previous complexities of pre-COVID-19 life, many individuals are seeking outdoor tourism activities and have a desire to travel both domestically and in groups. Providing the highest level of safety for travelers has become a priority for hotels, entertainment centers, and other tourism-related industries, leading to the adoption of new technologies and innovations to improve their facilities. Additionally, the tourism industry is expected to embrace the digital world and offer tourism services online, such as virtual tours and online tourist guides. The tourism industry's growth is expected to be driven by the increasing demand for travel and sightseeing, the provision of new and diverse tourism services, and a focus on improving facilities and services. However, as with all economic sectors, domestic and international political and economic changes may also affect the tourism industry's growth process.

## 3. The role of new technologies in enhancing the tourist experience

New technologies are playing an increasingly significant role in enhancing the tourist experience, and many tourism industries are adopting these technologies to improve travel experiences for tourists. Four such technologies include virtual and augmented reality, the Internet of Things (IoTs), robotics and artificial intelligence (AI), and electronic payment systems. Virtual and augmented reality offer tourists the opportunity to experience tourist destinations through images and videos before traveling to their destination. Augmented reality can also be used to provide tourists with information about the space and facilities around them. The IoTs can be used to manage and control facilities in hotels and tourist centers, while robotics and AI can be utilized for services such as greeting guests, cleaning rooms, and guiding tourists. Electronic payment systems are another beneficial technology for tourists as they eliminate the need to carry cash and enable the easy use of various services. Virtual and augmented reality, in particular, have become increasingly popular in the tourism industry. Virtual reality allows users to experience a completely virtual 3D environment through virtual reality glasses, while augmented reality enhances the reality around users by revealing virtual information on real images that users can access through their mobile devices. The use of virtual and augmented reality allows tourists to explore and learn about tourist destinations before traveling and make informed decisions about their trip. The IoTs, on the other hand, connects different objects to the internet and to each other to collect and exchange data and information. In the tourism industry, the IoTs can be used to enhance the services and experience of tourists.

Fig. 1 illustrates the various technologies that are transforming the tourism industry and enhancing the overall tourist experience. Virtual and augmented reality technologies provide tourists with the opportunity to experience tourist destinations through images and videos before traveling to their destination. Virtual reality allows users to experience a completely virtual 3D environment through virtual reality glasses, while augmented reality enhances the reality around users by revealing virtual information on real images that users can access through their mobile
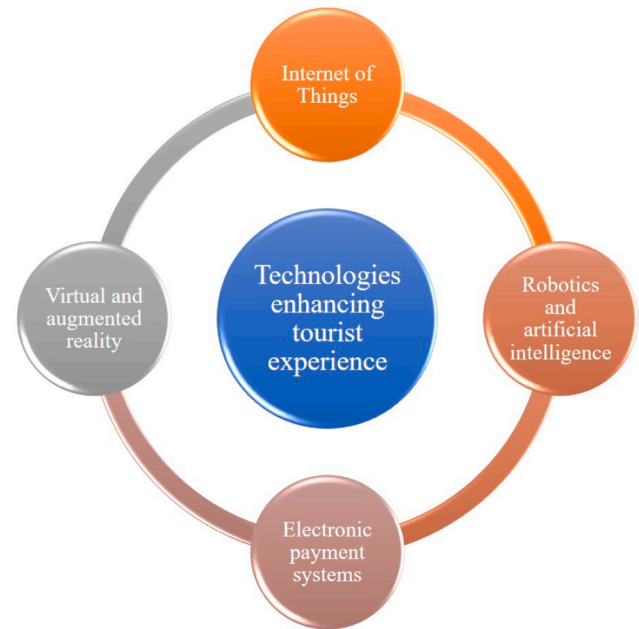


**Fig. 1.** Technologies enhancing the tourist experience.

devices. These technologies allow tourists to explore and learn about tourist destinations before their trip, making informed decisions about their travel plans.

Fig. 2 provides an overview of the various applications of technology in the tourism industry. These technologies are revolutionizing the way tourism services are provided and experienced by tourists. Virtual and augmented reality technologies are being used in the tourism industry to provide tourists with a realistic preview of tourist destinations before their trip. This technology enables tourists to explore and learn about tourist destinations before traveling, making informed decisions about their travel plans. Tourists can use virtual and augmented reality technologies to view images and videos of tourist sites and obtain information about tourist facilities [22,23] (see Fig. 3).

## 4. The role of IoT, AI, and AR in enhancing the tourist experience and systems

The IoT can be utilized in hotels to better control and manage facilities, whereby smart systems can remotely adjust the temperature of the room, turn lights on and off automatically, and even control electronic devices. The use of IoT in the tourism industry can reduce costs
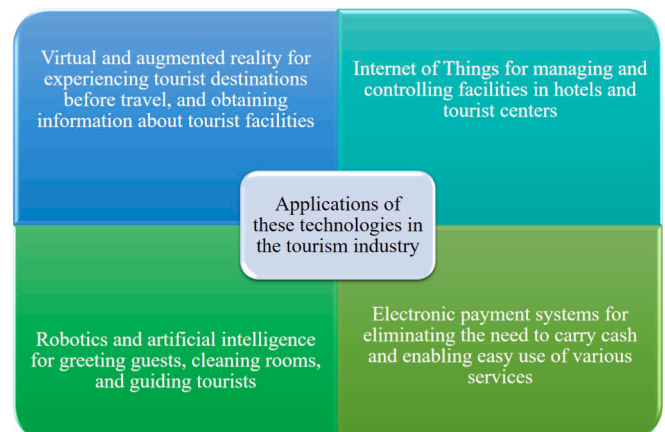


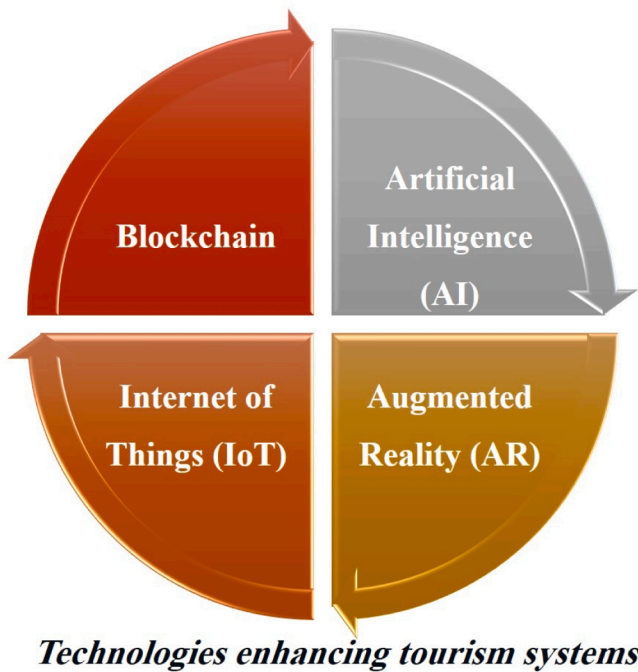**Fig. 2.** Applications of these technologies in the tourism industry.

**Fig. 3.** Schematic of technologies enhancing tourism systems.



**Fig. 4.** Benefits of Augmented Reality in the Tourism Industry.

and improve the quality of service, as well as enable the intelligent utilization of available facilities and resources to enhance the tourist experience [4,5,24–26]. AI is another technology that can improve the tourist experience and enhance the performance of tourism systems. AI systems can learn from data and provide intelligent answers to user questions and needs. AI can be used in hotel reservation sites to automatically answer user questions or allocate tours to customers in tour reservation systems. The use of AI can improve the efficiency and productivity of tourism systems by intelligently utilizing available resources and facilities. Augmented reality (AR) is a technology that creates interactive experiences between the real world and the virtual world using electronic devices.

In the tourism industry, AR can enhance the tourist experience and increase the attractiveness of tourist destinations. In museums and historical places, visitors can scan AR tags with their smartphones to access detailed information and live images of historical sites [4,5,8,26,27]. These technologies have immense potential to improve the tourist experience and enhance the performance of tourism systems. They can help reduce costs, increase efficiency and productivity, and intelligently utilize available resources and facilities to provide high-quality services to tourists.

Fig. 4 highlights the various benefits of using augmented reality (AR) in the tourism industry. AR is a technology that creates interactive experiences between the real world and the virtual world using electronic devices, such as smartphones or tablets. In addition, AR can provide benefits to tourism businesses. By using AR, tourism businesses can differentiate themselves from competitors and offer unique experiences to tourists. This can help to increase customer satisfaction and loyalty, leading to repeat business and positive word-of-mouth marketing.

## 5. Potential of digital technologies in enhancing the tourist experience

Augmented reality can also be utilized in the hotel industry to provide attractive experiences to customers. Customers can use electronic devices to view hotel rooms in augmented reality and enhance their experience in these rooms. The use of augmented reality in the tourism industry can improve the tourist experience, increase the attractiveness
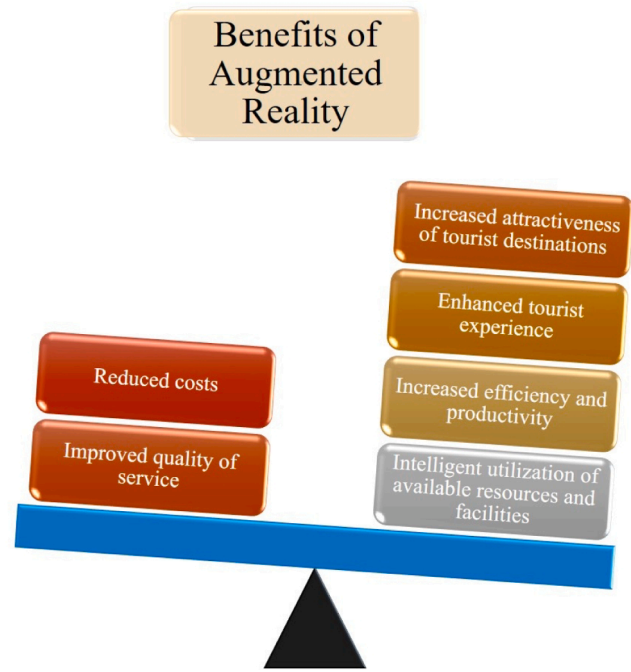
of tourist destinations, and intelligently utilize available resources and facilities to improve the efficiency and productivity of tourism systems. The various technologies used in the tourism industry have unique capabilities that can enhance the tourist experience and improve the performance of tourism systems. AI can help manage complex data and improve the performance of tourism systems, while augmented reality can create interactive experiences and increase the attractiveness of tourist destinations. Fig. 5 showcases the various applications of digital technologies in the tourism industry, specifically Augmented Reality (AR), Artificial Intelligence (AI), Internet of Things (IoT), and Blockchain. These technologies have the potential to significantly transform the tourism industry and improve the tourist experience.

The IoTs can intelligently manage information and resources, and blockchain technology can provide security and transparency in transactions, preventing fraud and misuse of information. The digital economy refers to the use of digital technologies in economic activities, and the tourism industry is one of the sectors that can benefit from digital technologies. AR technology can be used in the tourism industry to enhance the tourist experience by providing interactive and engaging experiences. Hotels can use AR to provide customers with a realistic preview of hotel rooms, allowing them to explore and customize their rooms before booking. This can increase customer satisfaction and loyalty, leading to repeat business and positive word-of-mouth marketing. The use of blockchain in the tourism industry can improve the economy and economic growth by creating transparency in transactions, preventing fraud and misuse of information, improving the quality and speed of transactions, and reducing transaction costs. Similarly, the use of digital technologies such as augmented reality and AI can improve the tourist experience, increase the attractiveness of tourist destinations, and enhance the performance of tourism systems, ultimately contributing to the growth of the tourism industry and improving the economy of countries. Therefore, the use of digital technologies, particularly blockchain, in the tourism industry has the potential to improve the economy and economic growth of countries.
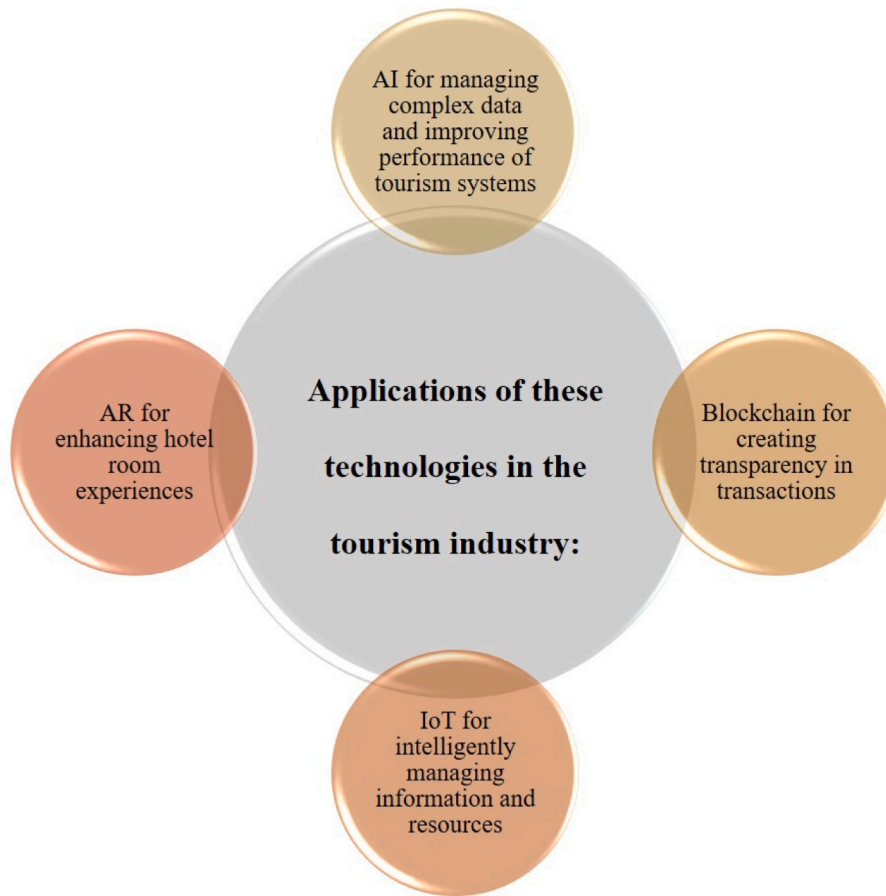
**Fig. 5.** Applications of AR, AI, IoT, and Blockchain (for creating transparency in transactions, preventing fraud and misuse of information) technologies in the tourism industry.

## 6. Tourism industry through digital technologies and blockchain

Blockchain technology can enhance the tourism industry by creating transparency in transactions, preventing fraud and misuse of information, improving transaction quality and speed, and reducing transaction costs. Additionally, the use of digital technologies such as AI, augmented reality, the IoTs, electronic payment systems, and data analysis in the tourism industry can improve tourism systems' performance and productivity and enhance the tourist experience. These technologies can provide attractive and interactive experiences for tourists, improve tourism system planning, and develop the best strategies for attracting tourists. In our country, the use of digital technologies in the tourism industry is increasing, and it has the potential to improve tourism systems' performance and productivity and enhance the tourist experience. Electronic payment systems, online reservation systems, tourist information systems, and social networks are some digital technologies currently used in the tourism industry. As digital technologies continue to grow, it is expected that their use in the tourism industry will play a crucial role in the industry's development. Social networks are recognized as effective marketing tools in the tourism industry in our country. As most people use social networks today, they can be an effective communication and marketing tool for tourism companies and organizations to reach their target audience and attract visitors to their destinations using engaging content and images. Many tourism companies in our country use social networks for advertising and marketing, providing practical information, discounts, and special offers to their target audience to create effective marketing for themselves. Social networks can also serve as a communication tool between tourists and tourism companies, improving the provision of better services to

tourists. Tourism companies in our country use paid advertising on social networks to target specific audiences, displaying ads to users who are more likely to use their services with accurate targeting and getting more efficiency from their ads as a result. Social media advertising can significantly increase sales and reservations and boost the revenue of tourism companies. As social media advertising is less expensive than traditional media, many tourism companies in our country use this method for marketing and advertising. Social media advertising is particularly effective for small businesses, providing a cheap and efficient solution for marketing and advertising their services in the digital world. By using social media advertising, small businesses can easily expand their market and attract new customers, providing useful information about their services and products through appropriate and attractive content. Social media advertising can also help small companies compete with larger companies in the tourism market by reaching a larger audience with a lower budget and experiencing greater advertising efficiency. Digitization, the digital economy, and innovation are interconnected in various economic sectors, including the tourism industry. By using digital technologies, tourism companies can communicate easily with their target audience, provide useful information, and offer their services and products to customers online. The integration of digital technologies and the tourism industry provides numerous opportunities but also poses several challenges, such as security concerns and the need for digital literacy among tourists and industry professionals.

Table 4 shows the impact of various digital technologies on the tourism industry, including social media, AI, augmented reality, the IoTs, and blockchain. These technologies offer a range of benefits, such as increased marketing reach, improved customer service, enhanced tourist experiences, efficient resource usage, and secure transactions.

**Table 4**
The impact of digital technologies on the tourism industry.

| Digital Technology | Impact on Tourism Industry |
|---|---|
| Social media | Increased marketing reach |
| AI | Improved customer service |
| Augmented reality | Enhanced tourist experience |
| Augmented reality | Enhanced tourist experience |
| IoTs | Efficient resource usage |
| Blockchain | Secure transactions |

The digital economy refers to the utilization of digital technologies and electronic communications in economic processes. These technologies include the Internet, cloud computing, blockchain, AI, the IoTs, and big data. By incorporating these technologies, economic processes can be improved, efficiency and productivity can be increased, and information access can be enhanced. In the tourism sector, the use of digital technologies can enhance the performance and quality of tourism-related services. Tourism websites and applications, electronic reservation and payment systems, and the provision of accurate and up-to-date information to travelers can improve the performance and quality of services. Additionally, tourism can contribute to the economic growth and development of countries by generating significant revenue through the attraction of tourists.

Fig. 6 shows a comparison of the general economic situation and the economy of the tourism industry of six developed countries in the field of digital economy. Fig. 6 reflects the growth rates of the tourism industry and the corresponding economic growth rates for each country. According to the data, China experienced the highest growth rate in the tourism industry with 33%, accompanied by a relatively high economic growth rate of 6.5%. The United States also demonstrated a significant growth rate in the tourism industry with 25%, accompanied by an economic growth rate of 6.4%. Meanwhile, Japan, Brazil, and Germany experienced growth rates of 20%, 22%, and 22%, respectively, in their tourism industry, with corresponding economic growth rates of 2.8%, 4.1%, and 3.6% respectively. Finally, England had the lowest growth rate in the tourism industry with 15%, accompanied by an economic growth rate of 4.1%.

This revenue can be utilized for further economic development and the improvement of living conditions. Furthermore, as the tourism industry is indirectly related to other industries, its development can create job opportunities and foster the growth of various industries, leading to additional economic benefits. In summary, the integration of digital technologies and the tourism industry offers numerous opportunities for improving economic processes, enhancing the quality of tourism-related services, and contributing to the economic growth and development of countries.

## 7. Effect of digital economy

The digital economy involves the utilization of digital technologies and electronic communications in economic processes, which can improve the performance and quality of services across various economic sectors. In the tourism industry, the use of digital technologies can enhance the performance and quality of tourism-related services, such as tourist websites and applications, electronic reservation and payment systems, and the provision of accurate and up-to-date information to travelers.

### 7.1. Tourism industry

Tourism refers to the act of traveling to different regions of the world for recreational purposes, visiting tourist attractions, and experiencing the culture and lifestyle of local people. Tourism can contribute to the economic improvement and development of countries by generating significant revenue through the attraction of tourists. This revenue can be utilized for further economic development and enhancing the living conditions of local people. Additionally, as the tourism industry is indirectly related to other industries, its development can create job opportunities and foster the growth of various economic sectors.

### 7.2. Economic improvement

Economic improvement refers to the increase in income and development, which can enhance the living conditions and quality of life of individuals. The development of various industries, job creation, increased production and trade, growth of economic sectors, and attraction of new investments are among the factors that can contribute to economic improvement. In the tourism sector, attracting tourists and creating job opportunities can also contribute to economic improvement.

### 7.3. Opportunities and challenges of the digital economy and blockchain

The utilization of digital technologies in tourism processes can enhance the quality and efficiency of these processes, including reservation systems, electronic payments, provision of accurate and up-to-date information to travelers, tourist websites and applications, service delivery systems, and other tourism-related processes. Digital technologies can also improve marketing and advertising efforts, attracting more tourists and providing precise information and updates about tourist attractions and related services through websites,
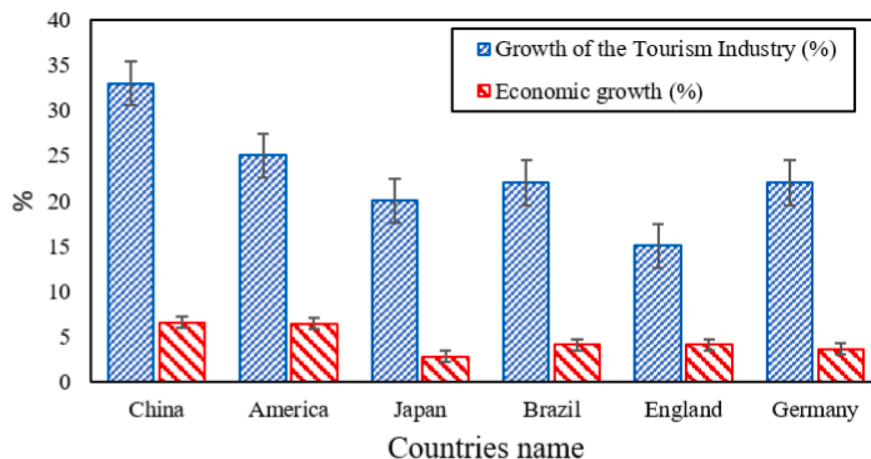


**Fig. 6.** Comparison of the general economic situation and the economy of the tourism industry of developed countries in the field of digital economy.

applications, social media, online advertising, and other related activities. Analyzing tourism-related data can also enhance the performance and quality of tourism-related services by examining tourists' behavior, forecasting demand, and optimizing tourist plans. Digital technologies can also enhance the quality of the tourism experience, including the use of virtual and augmented reality, online tourism experiences, and providing up-to-date information about tourist attractions. The integration of these technologies in the tourism industry can improve the quality and efficiency of tourism-related services, increase the number of tourists, and contribute to the economic development of countries. In this regard, the digital economy is considered a novel approach in the tourism industry, offering a superior alternative to traditional methods. Blockchain technology is another new technology introduced in the field of tourism and the digital economy. By employing blockchain, tourism companies can securely and transparently provide their customers with their information, thereby building trust and confidence among customers. The integration of blockchain technology in the tourism industry can also enhance the security and transparency of transactions, prevent fraud and misuse of information, and reduce transaction costs. The utilization of digital technologies, including blockchain, has significant potential to improve the performance and quality of tourism-related services and enhance the tourism industry's economic impact.

### 7.4. Role of the digital economy, innovation, and blockchain on the growth of the tourism industry

Tourism encompasses a wide range of activities, such as leisure trips, family vacations, historical and cultural trips, and business trips. The concept of economy involves the production, distribution, and consumption of goods and services, both domestically and internationally, as well as investment, taxation, and budgeting. Blockchain is a secure technology for storing and managing information, which can also be utilized for money transfer, supply chain management, and information security. Innovation refers to the introduction of new ideas, technologies, processes, and changes in products and services that bring about improvement and transformation in the economy and industry. In the tourism industry, digital technologies, the digital economy, and innovation, including blockchain, play a crucial role in enhancing performance and growth. As digitization, the digital economy, and innovation are interconnected in various economic sectors, including tourism, companies can utilize digital technologies to easily communicate with their target audience, provide useful information, and offer their services and products online. The digital economy is also considered a new approach in the tourism industry, offering superior performance over traditional methods [4,5,25,26]. Blockchain technology can enhance the security and transparency of transactions, improve information management, and foster trust and confidence among customers. Digital technologies, the digital economy, and innovation, including blockchain, are essential for improving the performance and growth of the tourism industry.

### 7.5. Impact of digital technologies on the global tourism industry

According to statistics from the WTO, the number of global travelers visiting tourist destinations in 2019 reached 1.4 billion, which represents a 4.4% increase from the previous year. Furthermore, the same organization reported that 75% of hotel reservations worldwide were made online in 2019. In Iran, the number of domestic and foreign tourists reached around 8,444,144 in 2019, and the number of foreign tourists visiting Iran has increased in recent years. In the digital era, various technologies, such as augmented reality, AI, and blockchain, are being increasingly utilized in the tourism industry. Some hotels use augmented reality to provide an immersive experience for travelers, whereas some airlines adopt AI to enhance performance and deliver superior services to passengers. The impact of digital technologies on the tourism industry is not limited to Iran, as the digital economy and

related technologies have become essential factors in the global transformation of the tourism industry. More than 80% of hotel reservations in the United States are made online through various websites and applications. In China, blockchain is used as a strategic technology in the tourism industry one of China's largest tourism companies, using blockchain to manage and secure traveler information. In Europe, innovative technologies such as augmented reality and AI are also being utilized in the tourism industry, with some hotels offering augmented reality experiences and some airlines using AI to improve performance and service quality.

### 7.6. Growing role of digital technologies and blockchain in the African and global economies

In African countries, various technologies such as mobile payment and online reservation systems are rapidly growing and developing. Jumia Travel, one of the largest tourism companies in Africa, offers hotel and flight reservation services online. The digital economy includes various technologies such as the Internet, social networks, applications, and websites, which are used for managing and transferring information and services. Blockchain technology is another technology that has found many uses in various economic fields in recent years, such as managing international money transfers, supply chains, information security, and creating digital currencies [9–12]. Additionally, blockchain can be used as a suitable solution for managing insurance and payment of damages, improving the quality of insurance services, and reducing costs associated with this industry. By utilizing blockchain's transparency and security features, it can be a significant technology in the economic field, particularly for digital currencies and international money transfers, and can be utilized to decrease payment and money transfer costs. Moreover, blockchain technology is a suitable solution for supply chain management, enhancing product quality, and reducing production costs. Yi et al. [28] have stated that the global economy has been significantly affected by the recent progress made towards reaching carbon emission peaks and achieving carbon neutrality. They suggest that the utilization of digital technologies and the implementation of a structural upgrade in energy systems can provide benefits to enterprises, which in turn are expected to enhance the overall societal efforts towards reducing carbon emissions in various industries. Additionally, Manda et al. [29] contend that the emergence of the fourth industrial revolution poses considerable opportunities and challenges to society, necessitating suitable responses from governments to facilitate this transformation.

This technology enables all information related to the supply chain to be transparent and accessible. Furthermore, blockchain is a safe and transparent technology that can be utilized to maintain information security in the economy, including managing banking services, medical data, and personal information. In conclusion, blockchain technology can be utilized as an effective solution for managing insurance claims and payments, improving the quality of insurance services, and reducing costs in the industry. However, this is only one of many applications of blockchain in the economic field, and there are still other applications that can be developed. Blockchain can be utilized for managing investments in the stock market and financial markets, as well as for tax management and international taxes, where blockchain's transparency and accuracy can improve the quality of tax management and reduce related costs. Additionally, blockchain can be a suitable solution for managing and predicting risks related to international trade, which can improve the quality of international trade and reduce the costs of risk management. Blockchain technology is a significant technology in the economic field, and it can be used for financial management, banking service management, supply chain management, insurance management, compensation, and many other applications in this field. The economy encompasses various economic concepts, such as the production, distribution, and consumption of goods and services, economic growth, inflation, and unemployment. The researchers address various

topics in the IoT field, including the design of low noise amplifiers for IoT sensors, the comparison of low and high resolution infrared cameras for IoT smart city applications, the development of a smart hydroponic and aeroponic system for indoor greenhouse cultivation, the review of enabling technologies for the Internet of Medical Things (IoMT) ecosystem, the presentation of a smart application for house condition survey, and the discussion of the challenges and opportunities of Industry 4.0 in the construction industry [30–36].

## 8. Conclusion

Blockchain technology is a powerful tool in various economic industries, including financial management, banking services, supply chain management, insurance, and compensation. With the continuous development of blockchain technology, newer and more creative applications are emerging, particularly in the tourism and digital economy sectors. In the tourism industry, blockchain can be used for reservation management, payment, and travel expenses to improve service quality, reduce costs, and increase security and privacy. Blockchain technology can also be effective in reducing fraud in the tourism industry, which can lead to increased trust among travelers. By using digital signatures and the trust network of blockchain, tourism transactions and information can be safely and reliably registered and managed. The digital economy, as a new and innovative economy, uses digital technologies and electronic communications to conduct economic and business activities. This type of economy usually includes a wide range of sectors, such as e-commerce, digital marketing, digital financial services, software development, computer games, and cloud services, among others. The use of digital technologies and electronic communications in these sectors has led to a significant shift towards online business interactions, faster processing, and digitalization, which has improved user experiences and made access to services and products easier. The digital economy is recognized as the main driver of economic growth and development in many advanced countries and continues to develop continuously due to the special importance of digital technologies and their impact on economic and business activities. Therefore, in this descriptive research, we focus on examining the digital economy and its impact on businesses and users, as well as evaluating the opportunities for easy and fast access to products and services that can lead to increased efficiency and productivity. In addition, the digital economy has significant impacts on various economic, social, and cultural areas, such as changing the way people work and interact with each other, promoting more flexible and remote working arrangements, and increasing global connectivity. Furthermore, the digital economy has also had an impact on education, healthcare, and entertainment, among other sectors. The advancement of technology and electronic communications has pushed the global economy towards digitalization. The role of the digital economy in promoting global digitalization is crucial, and it is expected that its impact will continue to increase in the future.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

[1] Tu Y, Liu R, Li H. The Development of Digital Economy and the Future of the Trade Union Law of the People's Republic of China. Journal of Chinese Human Resources Management 2022;13(2):76–85.

[2] Hu F, Qiu L, Xi X, Zhou H, Hu T, Su N, et al. Has COVID-19 Changed China's Digital Trade?—Implications for Health Economics. Frontiers in public health 2022. https://doi.org/10.3389/fpubh.2022.831549.

[3] Guo B, Wang Y, Zhang H, Liang C, Feng Y, Hu F. Impact of the digital economy on high-quality urban economic development: Evidence from Chinese cities. Economic Modelling 2023;120:106194.

[4] Zheng Z, Xie S, Dai H, Chen X, Wang H. An overview of blockchain technology: Architecture, consensus, and future trends. IEEE Int Congress Big Data 2017: 557–64.

[5] Zhang Y, Wen Y, Huang J. Blockchain technology application in tourism industry: A systematic review. J Hosp Tour Technol 2019;10(4):572–99.

[6] Buhalis D, Neuhofer B. COVID-19 and tourism: Impacts and implications for advancing and resetting industry and research. J Travel Res 2020. 0047287520965199.

[7] Yao Y, Shu F, Li Z, Cheng X, Wu L. Secure Transmission Scheme Based on Joint Radar and Communication in Mobile Vehicular Networks. IEEE Transactions on Intelligent Transportation Systems 2023. https://doi.org/10.1109/TITS.2023.3271452.

[8] Yan L, Shi Y, Wei M, Wu Y. Multi-feature fusing local directional ternary pattern for facial expressions signal recognition based on video communication system. Alexandria Engineering Journal 2023;63:307–20.

[9] Xu M, Liang X. Blockchain as a service: A framework for cloud-based blockchain infrastructure. In: Proceedings of the IEEE International Conference on Web Services; 2017, 936-943.

[10] Chen J, Xu LD, Zhou L, Wu Z. Towards blockchain-based intelligent transportation systems: A survey. IEEE Trans Intell Transp Syst 2019;20(11):3830–44.

[11] Yuan Y, Bi J, Zhang L. Blockchain-based decentralized trust management in vehicular networks. IEEE Trans Veh Technol 2019;68(5):4245–59.

[12] Chung JY, Cho JH, Kim KJ. A blockchain-based smart grid: Towards sustainable local energy markets. Sustainability 2019;11(7):2018.

[13] Xu LD, Xu EL, Li L. Industry 4.0: state of the art and future trends. Int J Prod Res 2018;56(8):2941–62.

[14] Iansiti M, Lakhani KR. The truth about blockchain. Harv Bus Rev 2017;95(1): 118–27.

[15] Zohar A. Bitcoin: under the hood. Commun ACM 2015;58(9):104–13.

[16] Peters GW, Panayi E. Understanding modern banking ledgers through blockchain technologies: Future of transaction processing and smart contracts on the internet of money. In: Banking Beyond Banks and Money. Cham: Springer; 2015. p. 239–78.

[17] Swan M. Blockchain thinking: The brain as a decentralized autonomous corporation. IEEE Technol Soc Mag 2017;36(2):41–52.

[18] Li Z, Yang X, Li J. Blockchain-based food traceability: A review of implementation strategies and challenges. IEEE Trans Ind Inf 2019;15(8):4623–30.

[19] Liang X, Shetty S, Tosh D, Kamhoua C, Kwiat K. ProvChain: A blockchain-based data provenance architecture in cloud environment with enhanced privacy and availability. J Cloud Comput 2018;7(1):1–16.

[20] Panarello A, Tapas N, Merlino G, Longo F, Puliafito A. Blockchain and iot integration: A systematic review. Sensors 2018;18(8):2575.

[21] Böhme R, Christin N, Edelman B, Moore T. Bitcoin: economics, technology, and governance. J Econ Perspect 2015;29(2):213–38.

[22] Gao F, Liu X. Blockchain-based sharing services: What blockchain technology can contribute to smart cities. Financ Innov 2018;4(1):1–10.

[23] Xu R, David K, Ramachandran M. Blockchain for IoT security and privacy: The case study of a smart home. IEEE Internet Things J 2019;7(3):2047–56.

[24] Mousannif H, Al Moatassime H, Khaloufi H. Blockchain technology for IoT security: A systematic literature review. IEEE Access 2019;7:46121–34.

[25] Ali MR, Khan MA, AlZain MA. Blockchain based secure and sustainable supply chain: A systematic review. J Clean Prod 2019;242:118469.

[26] Pilkington M. Blockchain technology: Principles and applications. Research Handbook on Digital Transformations 2016; 225-253.

[27] Zhang X, Wen J, Yang Y. Blockchain for trust management: Opportunities and challenges. Futur Gener Comput Syst 2019;97:557–78.

[28] Yi M, Liu Y, Sheng MS, Wen L. Effects of digital economy on carbon emission reduction: New evidence from China. Energy Policy 2022;171:113271.

[29] Manda MI, Ben Dhaou S. Responding to the challenges and opportunities in the 4th Industrial revolution in developing countries. In: Proceedings of the 12th international conference on theory and practice of electronic governance; 2019, April pp. 244-253.

[30] Bhuiyan MAS, Hossain MR, Hemel MSK, Reaz MBI, Nisa'Minhad K, Ding TJ, et al. CMOS low noise amplifier design trends towards millimeter-wave IoT sensors. Ain Shams Eng J 2023:102368.

[31] Al-Habaibeh A, Yaseen S, Nweke B. A comparative study of low and high resolution infrared cameras for IoT smart city applications. Ain Shams Eng J 2023;14(6): 102108.

[32] Sadek N, Shehata D. Internet of Things based smart automated indoor hydroponics and aeroponics greenhouse in Egypt. Ain Shams Eng J 2023:102341.

[33] Slama SB. Prosumer in smart grids based on intelligent edge computing: A review on Artificial Intelligence Scheduling Techniques. Ain Shams Eng J 2022;13(1): 101504.

[34] Ashfaq Z, Rafay A, Mumtaz R, Zaidi SMH, Saleem H, Zaidi SAR, et al. A review of enabling technologies for Internet of Medical Things (IoMT) Ecosystem. Ain Shams Eng J 2022;13(4):101660.

[35] Chohan AH, Awad J, Jung C, Ani AIC. Development of smart application for house condition survey. Ain Shams Eng J 2022;13(3):101628.

[36] Alaloul WS, Liew MS, Zawawi NAWA, Kennedy IB. Industrial Revolution 4.0 in the construction industry: Challenges and opportunities for stakeholders. Ain Shams Eng J 2020;11(1):225–30.