Journal of Information Systems Engineering and Management
2024, 9(4), 30348
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Evaluation of Blockchain Technology in the Context of Tourism Sector within the Framework of Diffusion of Innovation Theory: Challenges and Opportunities

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Citation: BEŞTAŞ, M. (2024). Evaluation of Blockchain Technology in the Context of Tourism Sector within the Framework of Diffusion of Innovation Theory: Challenges and Opportunities. *Journal of Information Systems Engineering and Management*, 9(4), 30348. https://doi.org/10.55267/iadt.07.15197

ARTICLE INFO

Received: 16 Aug 2024
Accepted: 05 Sep 2024

ABSTRACT

Blockchain technology is one of the technologies emphasized both academically and practically due to the possibility of application integration in different fields. The tourism sector has an interest in blockchain technology due to its early and rapid adoption of technology. Today, blockchain technology is mainly used in finance. However, it is also preferred in tourism due to the opportunities it provides in data management, payment systems, identity management and loyalty programs. In this study, a literature review was first conducted to examine the use of blockchain technology in the tourism sector. Then, the first pioneer companies that emerged in the field of tourism were classified. The relationship between blockchain and tourism is evaluated within the scope of institutional analysis. Then, an analysis was carried out within the framework of the diffusion of innovation theory. As a result, it has been determined that blockchain technology is still developing. However, the promising and growing number of the first sectoral solutions increases the likelihood of acceptance. There is a lack of knowledge about blockchain among industry players and consumers. Integration of blockchain technology with tourism applications is ongoing, but no generally accepted standard has emerged. It has been determined that there are deficiencies regarding local and global legal regulations.

Keywords: Tourism Industry, Blockchain, Diffusion of Innovation.

INTRODUCTION

The potential impact of blockchain technology on today's business methods is known to be a pressure factor for the renewal of industries, a serious change in economic activities and the potential to lead a global digital transformation in the coming years (Iansiti & Lakhani, 2017). When considered together with today's technologies such as artificial intelligence, 5G mobile opportunities and the Internet of Things, it is believed that blockchain can help many businesses in the context of management and planning of processes (Kewell & Michael Ward, 2017). The impact of blockchain can be positive on businesses and the social life of individuals. The positive impact may realization of commercial and social change and can trigger the emergence of new and innovative businesses that did not exist before (S. Singh & Singh, 2016). The emergence of innovative businesses is expected to increase the speed of the adoption of blockchain technology (Manski, 2017).

When the use and acceptance of digital technologies in the context of the service sector is evaluated, it is known that the maturity of the sector to accept and use technology is high (Law, Leung, & Buhalis, 2009; Chen,

Chan, Mehraliyev, Law, & Choi, 2021). The use of technology in the service sector plays a major role in providing existing services, meeting the existing demand, collecting service fees and collecting feedback for businesses. Thus, it has become a facilitating factor in the realization of operational activities carried out in tourism and hotel management, as well as an essential element in increasing efficiency. The tourism sector, which develops with the support of technology, has created the sub-concepts of smart tourism and smart accommodation. The importance of technology within the requirements of a sustainable tourism business is increasing (Gössling, 2021; Pencarelli, 2020).

Although the tourism sector has benefited from globally developing technology, limited studies have examined the adoption potential of blockchain technology. When the literature is examined, although the applicability of blockchain in terms of tourism has been evaluated in terms of various aspects, the direction of analysis has remained weak (Maythu, Kwok, & Teh, 2024). In the literature, the efficiency of the business channels of the tourism sector and the facilitation of commercial activities with the consumer aspect have been discussed (Rashideh, 2020; Filimonau & Naumova, 2020; Ozdemir, Ar, & Erol, 2020). When studies are evaluated in the context of blockchain, studies on the expectations of blockchain in the tourism sector with the digital currency aspect of blockchain stand out (Leung & Dickinger, 2017; Kim, Radic, Chua, Koo, & Han, 2022).

The potential of blockchain technology goes beyond its acceptance as a digital currency (Kouhizadeh, Zhu, & Sarkis, 2020). This potential has yet to be fully explored in terms of tourism. This is due to the fact that the possibilities provided by the blockchain and its working logic have not yet been assimilated by the relevant professionals (Law, Ye, & Chan, 2021). The aim of this study is to expand the framework of scientific studies on the use of blockchain in the sector by evaluating academic studies and initiatives in the tourism sector. The aim of this study is to help tourism industry professionals, academics, and researchers understand the opportunities that blockchain provides to the tourism industry and to encourage the emergence of new commercial applications.

In order to achieve the objective of the study, our research methodology basically utilizes a three-stage research process.

First, a list of challenges to blockchain adoption in the tourism sector is obtained through a literature review.

Second, the emerging blockchain projects are evaluated in general and categorized in terms of the solutions they offer.

Thirdly, an analysis was carried out using the diffusion of innovation (DOI) theory (Karnowski & Kümper, 2016) in order to reveal the status of blockchain's presence in the tourism sector. The following research questions (RQs) were addressed:

RQ1. What are the challenges of adopting blockchain technology in the tourism industry?

RQ2. What are the challenges to increasing the use of blockchain in the tourism industry?

RQ3. In the context of diffusion of innovation, how are the challenges of innovation to decision processes intrinsically linked?

When academic studies were evaluated, it was determined that there were 288 publications between 2001 and 2010 to examine the impact of the development of technology and the internet on tourism. Today, when we evaluate past studies, it is obvious that the internet, which is a part of technology, cannot be evaluated separately from today's tourism sector. For this reason, blockchain is a remarkable technological development because it is a technological development and contains qualities such as data management and payment, and it is inevitable that it will affect the tourism sector (Standing, Tang-Taye, & Boyer, 2014; Treiblmaier & Önder, 2019).

This study will contribute to the literature in terms of comprehensively revealing the challenges in the adoption of Blockchain for the tourism sector. There are several studies that make general evaluations in terms of the diffusion of blockchain. However, it has been determined that tourism-specific studies are limited. The evaluation will be shaped by using the diffusion of innovation theory to overcome this deficiency in terms of the tourism sector. The findings obtained in this study are discussed comprehensively.

LITERATURE REVIEW

Blockchain technology was first introduced by Nakamoto (2008) as a peer-to-peer network-based data management. The basic context of peer-to-peer communication is trust between users in different networks (Filimonau & Naumova, 2020; Ert, Fleischer, & Magen, 2016). In order to ensure peer-to-peer trust, all communication must be verifiable. One of the most important points that distinguishes blockchain technology in

data management is that it has a non-trust-based method. Instead of trust, all data is verified through a consensus protocol. In the Bitcoin network, the first practical example of blockchain, verification is performed with proof of work. Different consensus protocols are applied in the networks that emerged later. One of the most preferred protocols is the proof of stake protocol. The blockchain network relies on interconnected blocks of data to process and store data. After the validator nodes in the blockchain agree on the order of the data blocks among each other, they add the new data block to the chain. When the working principle of the blockchain is evaluated, it does not require trust in a third party that is an authority. The fact that it does not require third party trust constitutes the technological uniqueness of the blockchain. The data held in blockchain technology is stored in multiple locations using a distributed ledger technology. This is important in terms of increasing the security of the data.

With the development of blockchain technology, in addition to storing data, the storage of executable code scripts has been realized. The first practical example of code scripts is the Ethereum network. The code scripts stored in the Ethereum network are called smart contracts. Smart contracts have taken blockchain technology one step further and accelerated the emergence and diversity of sectoral applications. Applications emerging through smart contracts work as decentralized (dApp). Decentralized applications are technologically accepted as Web 3.0.

A smart contract is a decentralized program that can run on its own, without the need for human intervention, for transactions predetermined by its coder or parties. Once a smart contract is coded and posted on the blockchain, it cannot be changed (Bhushan, Sinha, Sagayam, & Andrew, 2021). The first examples that emerged through smart contracts were seen in the field of finance. When the first examples are evaluated, it is seen that they are digital monetary transactions. The digital currencies created were subject to transactions such as storing, transferring, lending or accruing interest.

As the use of smart contracts has increased, examples have started to emerge in different fields. When the tourism sector, which is the subject of this study, is evaluated, academic studies have been carried out with many integrations needed in this field. Banerji, Rashideh, Arora, and Pratihari (2021) identified 11 application areas in the context of tourism. Yadav, Verma, Jangirala, and Srivastava (2021) evaluated blockchain technology under the title of smart tourism and categorized its usage area under 6 headings. In the report published by Hospitality Technology Next Generation (HTNG) (2018), it is stated that blockchain technology will be effective in 4 main topics in the field of accommodation. In the report published by Boston University, blockchain is shown among the technologies that will have an impact on the tourism and accommodation industry.

In the policy document published by World Tourism Organization (UNWTO) (2019) regarding the use of blockchain technology in the tourism sector, it was predicted that 45% of businesses will adopt distributed ledger technology. Leung and Dickinger (2017), in their study on a group of 138 people, found that they would be unlikely to use Bitcoin for the purchase of travel products. However, Leung and Dickinger emphasize the participants' lack of basic knowledge about Bitcoin and see it as the source of this result. In addition, respondents indicated that they might consider using Bitcoin in the future for the purchase of restaurant and food products. Seçilmiş and Kızıltaş (2020), in their study of 270 people, found that the participants were willing to buy products or services with cryptocurrency. The fact that the participants stated that they find the payment method with cryptocurrency reliable indicates that the rate of technological acceptance and the level of knowledge in this field has increased. Nam, Dutt, Chathoth, and Khan (2019) highlighted the key features of blockchain technology in the context of smart cities and tourism. In addition, the technology's development is predicted and its impacts on the tourism industry are discussed. Kwok and Koh (2018) assessed the impact of blockchain technology on tourism from the perspective of small island countries and drew conclusions about the opportunities it holds for island economies. Melkić and Čavlek (2020) conducted a SWOT analysis for tourism sector players, tour operators, travel agencies and suppliers. It was determined that academic studies should turn into practical applications in order to complete the integration.

METHODOLOGY

To determine the impact of the blockchain in the context of innovation in the field of tourism, the decision-making process was discussed in two stages. In the first stage, a literature review was conducted in the context of blockchain and tourism and the main findings of selected academic studies in this field were summarized. Initiatives that emerged using online resources to determine sectoral development were examined. In the second stage, the difficulties of acceptance and adaptation of Blockchain technology are explained within the framework of the literature.

Institutional Analysis and Development (IAD) Framework

As in every sector, the use of blockchain technology is an innovation for the tourism sector. Processes such as the acceptance and diffusion of innovation should be evaluated well. The theory of diffusion of innovation (DOI) by C. R. Rogers (1963) can be used to determine the acceptance status of innovation. C. R. Rogers's (1963) theory of diffusion of innovation is a model used especially in the social sciences to determine the status of innovation. This model, developed by E. M. Rogers, is an effective method to reveal how innovations take place and to explain the phenomena that cause them to spread. The theory states that when an innovation is introduced, a communication network takes place between the parties and users of the innovation. This network, which can also be referred to as the innovation communication network, has classes such as innovators, early adopters, early majority, late majority and laggards.

In the innovation diffusion process, innovators are the first to discover and adopt the innovation and laggards are the last to be involved. According to Rogers, there are five factors that influence the diffusion of innovations: innovation characteristics, communication channels, time, social systems and individual characteristics. For an innovation to be accepted, it must be advantageous, compatible, visible, easy to understand and testable. Innovations that meet these conditions are more likely to be accepted.

E. M. Rogers's (2003) theory considers the diffusion process of innovation into 5 main stages. These are: information acquisition, persuasion, decision, implementation and acceptance. These stages are used to explain the diffusion and adoption of innovation within the community. Overall, the diffusion of innovation theory is a good option to explain the integration and acceptance of an emerging innovation. Diffusion of innovation theory has been used for due diligence in many fields. In the field of tourism, studies have been carried out within the framework of the theory for sustainability, acceptance of new technologies and renewable energy.

The concept of innovation should be evaluated as a product, practice or understanding, not just as a technology. The innovation under consideration should have an aspect that causes a positive change in society or the relevant community.

Blockchain technology can be considered a young technology since it first emerged in 2008. Blockchain technology can be considered an important innovation that creates new opportunities for the tourism sector. When blockchain technology is analyzed within the framework of E. M. Rogers's diffusion of innovation theory, it is an appropriate and valuable tool for understanding the adoption process of this technology (Nakamoto, 2008).

In terms of the advantages of innovation, it is important in terms of providing a secure and transparent payment system in the tourism sector, facilitating the transactions of hotel reservations and travel insurance. It enables the sector to go one step further in terms of data security. Blockchain is easy to ensure compatibility with existing systems in the tourism sector. Especially the main components of the sector such as hotel reservations, travel agencies and tour operators are open to adapting to the innovations provided by the blockchain.

The low transaction costs, fast and reliable transactions, data security and traceability provided by blockchain provide relative advantages to the sector. Considering the new initiatives that have emerged, it can be stated that some tourism service providers have started to experiment and implement blockchain technology. However, it can be said that standards adopted across the sector have not emerged. At the end of the implementation of the blockchain, it can be stated that there are visible results. Especially customer loyalty, baggage tracking and payment method applications have been adopted. However, the results are not fully evident throughout the sector.

DISCUSSION

Blockchain Industry Applications

State-sponsored adoption of blockchain has started to increase. Kwok and Koh (2018), in their study with the news they compiled from internet sources, compiled the studies of small island states on blockchain technologies for the tourism sector (**Table 1** and **Table 2**). They found that the island states they examined were willing to use blockchain technology as a payment method. Dubai aims to open a blockchain-enabled virtual market within the framework of Tourism 2.0 (Arabian Business, 2018). The city of Zug in Switzerland announced that it will provide digital identity to its residents using blockchain technology (Stadt Zug, 2017). Dubai aims to become the first blockchain-enabled state (Dutt, 2017).

Table 1. Blockchain Use Cases in Tourism

Scope	Study
Inventory management	Hertzfeld (2019); Zsarnoczky (2018)
Maintenance and Monitoring	Chauhan, Kumar, Gupta, Gupta, and Verma (2021); Bodkhe et al. (2019)
Content, reservations and ticketing	Chain4Travel; Smarttrip; Winding Tree (n.d.); ArivaWorld (n.d.)
Payment	Peakwork; LockTrip
Loyalty	Irvin and Sullian (2018); VSelf (n.d.); Loyyal (n.d.)
Tokenization	Önder (2023); LockTrip; TourismX (n.d.)
Identity Management	Civic (n.d.)
Disintermediation	Parekh, Jaffer, Bhanushali, and Shukla (2021); Farris et al. (2021)

Source : Treiblmaier (2022)

Blockchain applications in the tourism sector have been implemented in many areas such as payment management, loyalty programs, baggage tracking and identity management. The Loyyal initiative offers Blockchain as a service to produce solutions for the loyalty sector (Loyyal, n.d.). Civic project offers a digital identity management product (Civic, n.d.). Web3 Travel Platform was launched by Peakwork (Nath, 2023). Camino blockchain network was implemented by Chain4travel. Netactica operates as an air ticket sales, Vself as a loyalty system, Triend as a comment and review, Diooq as a property rental, ISO Group as a baggage tracking, A3M as a location-based information service, DeVest as a tourism asset creation, Sleap as a hotel reservation platform (Castillo, 2024). Smarttrip is a platform that connects travelers with businesses operating in the field of travel services (Smart Trip Platform, n.d.).

Table 2. Literature on Blockchain Adoption in Tourism

Study	Main Finding
Banerji et al. (2021)	The main findings of the paper are an overview of blockchain technology applications in the travel and tourism sector, including thematic applications such as smart contracts, digital currency, disintermediation, identity management, service customization, authenticity in customer reviews, and innovative loyalty programs. In addition, the review discusses the current use of blockchain in the travel and tourism sector.
Irannezhad and Mahadevan (2021)	He states that large players in the sector prefer private networks for data management, while small players prefer public networks. He found that companies apply a wait-and-see policy due to possible security vulnerabilities in smart contracts. He states that the airline and hotel sectors are more inclined towards blockchain.
Jain, Singh, Mishra, and Rana (2023)	Blockchain technology has the potential to transform the tourism and hospitality sector; existing literature on blockchain technology integrated Smart Tourism 4.0 is limited and fragmented; the study provides future research directions based on the emerging themes and primary focus areas identified.
Valeri and Baggio (2021)	The main findings of the paper are a critical reflection on the benefits and drawbacks of adopting blockchain technology in the field of tourism, as well as suggested research directions for a better understanding of its applicability.
Kontogianni and Alepis (2023)	Blockchain technology has attracted great interest from academics and industry professionals. The use of blockchain technology in the tourism industry can lead to significant gains. It identifies important blockchain-enabled services and uses in the context of smart tourism.
Puri, Mondal, Das, and Vrana (2023)	In the study, it was determined that the points that make blockchain attractive are privacy and security. It states that stakeholders in the tourism sector lack experience, infrastructure and awareness. It states that green blockchain, NFT and smart contracts are trending in blockchain.
Antoniadis, Spinthiropoulos, and Kontsas (2020)	It states that the value proposition offered to guests can be increased through smart contracts and decentralized applications. User reviews, loyalty programs and digital payment methods should be considered.
Önder and Gunter (2022)	The study addresses the relationship of supply chain and sustainable travel solutions with blockchain. It discusses the potential of blockchain technology to transform various aspects of the tourism and hospitality industry and highlights its role in promoting digitization, increasing efficiency and encouraging sustainable practices.
Thees, Erschbamer, and Pechlaner (2020)	The study, which examines the initiatives that provide services using blockchain technology, emphasizes the development of technology after 2016. It predicts that it will

Study	Main Finding
	add value in the field of tourism with a focus on travel. It states that the current academic studies are in the early period.
Willie (2019)	Blockchain technology is currently used for practical and strategic purposes in the hospitality industry. Professionally, it can be applied in many sectors and is expected to continue to be used for many years to come. The technology is still relatively new and will continue to advance and become more sophisticated over time, with examples of how it can improve operational effectiveness, efficiency and overall profitability.
Melkić and Čavlek (2020)	In the study, a SWOT analysis of blockchain technology was carried out in terms of tour operators, travel agencies, online travel agencies, tourists (customers) and tourism service providers (suppliers). He addressed the issue of integration and lack of information and concluded that it would take time for academic studies to turn into practical applications.
Rejeb and Karim (2019)	The main findings of the paper are the emergence of a connected generation of smart tourists due to the use of ICT and new technologies, the significant impact of technology, especially the internet, on all stages of the travel process, and the potential of Blockchain technology to strengthen trust building and promote various benefits in the tourism industry.
Treiblmaier and Önder (2019)	It has been mentioned that tourism organizations will change their business and processes. It is stated that advantages in terms of transaction costs will be achieved and competitiveness will increase. It highlights potential changes in trust dynamics and transparency by examining the impact of blockchain on the relationships between various actors in the tourism network.
Nam et al. (2019)	The study identifies key features of blockchain technologies in the context of smart cities, smart destinations and tourism, such as cost reduction, cryptocurrency adoption and ecosystem development. Despite limitations in sample size, common characteristics among the analyzed firms provide valuable insights for both industry practitioners and academic researchers. The study underlines the need for further research to explore the determinants of cryptocurrency adoption and deepen the understanding of the impact of blockchain on the tourism sector.
Kumar, Nand, and Bali (2022)	The tourism industry is facing various challenges such as identity theft, intermediaries, payment errors, and security concerns due to the COVID-19 pandemic. Through a literature review, gaps in the existing architecture have been identified and a blockchain-based Integrated Model (BLOBIM) has been proposed to address these shortcomings. BLOBIM aims to provide a decentralized, reliable rating system and accurate contact tracing application, providing solutions for the future smart society in the tourism industry.
Farris et al. (2021)	It highlights the necessity of integrating information technology, especially blockchain, to address sustainability concerns in the tourism sector by meeting the needs of both active tourists and destination management organizations. The proposed blockchain-driven software system aims to support disintermediation and promote sustainability awareness in the tourism sector by collecting data from IoT devices to estimate tourism footprint impact and calculate ETIS indicators. Despite potential barriers such as regulation, knowledge gaps and scalability issues, the system emphasizes collaboration and adaptation to common systems to promote sustainable development in the tourism industry.
Tyan, Guevara-Plaza, and Yagüe (2021)	This conceptual paper explores the potential benefits of blockchain technology for medical tourism, focusing on the pre-and post-transaction phases. It argues that blockchain can offer advantages such as easier healthcare provider discovery, secure payments, data privacy, and trusted reviews, and also proposes solutions to the challenges faced by the medical tourism industry during the COVID-19 pandemic. However, limitations include a narrow scope, the need for further empirical research, and addressing challenges related to blockchain adoption. Future studies are encouraged to delve deeper into the effects of blockchain on competitiveness, reputation, and the overall experience of medical tourism.
Hawlitschek, Notheisen, and Teubner (2018)	It examines the tension between notions of trust in the sharing economy and the promise of trust-free systems enabled by blockchain technology. It argues that while blockchain has the potential to replace trusted third parties, practical challenges remain in integrating human interactions and trust into blockchain-based ecosystems. It also calls for future research to focus on designing trusted interfaces, measuring trust in blockchain-based algorithms, and rigorously defining the concept of trust to effectively

Study	Main Finding
	transform blockchain hype into viable sharing economy applications.
Toufaily, Zalan, and Dhaou (2021)	The study explores the challenges and potential value of blockchain adoption through qualitative research with various stakeholders in the blockchain ecosystem, providing a framework for understanding adoption but emphasizing the need for contextual replication and further quantitative validation. While the study is comprehensive in its set of stakeholders, it suggests that future research should include additional actors, such as investors and miners, and urges researchers to track the evolution of blockchain through Gartner's hype cycle and examine the organizational innovation of crypto networks. Acknowledging its limitations, the paper calls for future research to address industry-specific barriers, the influence of institutional size, and consumer acceptance, with the goal of expanding empirical understanding and informing academic, practical, and policy debates surrounding blockchain adoption.
Sharma, Sehrawat, Daim, and Shaygan (2021)	A comprehensive assessment of the drivers and barriers to the adoption of blockchain Technology (BCT) in the hospitality and tourism sector, for both developed and emerging economies. Factors influencing BCT adoption such as cost reduction in India and risk management in the Netherlands were identified.

Blockchain Technology Adoption Challenges

The challenges regarding blockchain technology in the Tourism context are given in **Table 3**. When the table is examined, study results were obtained that technological maturity did not occur in early academic studies. Since the technology is relatively new, these results are justified. This technology, which was finally practically implemented in 2009, is developing gradually and continues to increase its current capacity with new methods. While transactions were approved with the proof of work method when the technology first emerged, today proof of stake is mainly used. This has greatly increased the processing capacity of the technology.

Since blockchain technology is new, it has not yet been integrated into many sectoral applications. In addition, the blockchain performs data management within itself. However, real-life applications integrate with each other and exchange information. This requires the communication of blockchain technology with off-network applications. Emerging new applications have begun to communicate with blockchain Oracle (Caldarelli, 2020; Chainlink, n.d.).

Like every industry, the tourism industry has data privacy and security concerns. Especially in the service sector, operations carried out with individuals' data and international data privacy regulations increase the importance of the data. In field studies conducted on blockchain, it is seen that individuals have reservations about data privacy. In addition, the security of smart contracts, which is the necessary sub-technology of blockchain technology for sectoral applications, is gaining importance. If smart contracts are implemented without passing the specified standards and security checks, they may be open to abuse. This situation may not only cause financial losses but also lead to personal data falling into the hands of unauthorized persons.

Table 3. Blockchain Challenges

Challenge	Description	References
Technological Maturity	It has been stated that blockchain technology is an early technology. It has been stated that opinions regarding the integration of technology and the benefits it will provide are not yet clear. In particular, Wang et al. A negative result was obtained in the maturity modeling made by.	Wang, Chen, and Xu (2016); Erol et al. (2022); Toufaily et al. (2021)
Integration	It has been stated that blockchain technology is new, and model suggestions have already been made for its integration into the tourism infrastructure.	Rakic (2018); Bodkhe et al. (2019); Zhang, Hang, Jin, and Kim (2021)
Data Privacy and Security Concerns	The importance of personal data privacy in the tourism sector was stated and the reservations obtained through field work on this issue were expressed. In addition, the benefits of blockchain technology are	Irannezhad and Mahadevan (2021); Tyan, Yagüe, and Guevara-Plaza (2020); Gong and Schroeder (2022)

Challenge	Description	References
	explained and model suggestions are made.	
Legal Compliance	Blockchain, by its nature, has an independent and uncensorable operating mechanism. In terms of legal authorities, sufficient work has not been done in terms of compliance with legal processes, taxation, know-your-customer (KYC) and anti-money laundering (AML) measures.	Aiazbekov (2023); Baydeniz (2023); Salamanca Fernández (2023); Kontogianni , Alepis, Virvou, and Patsakis (2024)
User Adoption and Education	It was determined that participants in the tourism sector were not technically competent and were not familiar with blockchain concepts. This situation causes skepticism and reluctance.	Prados-Castillo, Torrecilla-García, Andraz, and Guaita Martínez (2023); Leung and Dickinger (2017)

Blockchain is basically designed as an alternative store of value when its first appearance is considered. This is one of the features of the early days of technology that continues to this day. Virtual currencies developed with blockchain have been accepted by many people. It is currently used as a serious means of storing and transferring value. It has created a decentralized financial ecosystem (Zetzsche, Arner, & Buckley, 2020; Beştaş, 2023). The financial ecosystem enables individuals to make profits and increases the desire for data to be provided by legal authorities. Customer identification (KYC) obligations have begun to be imposed on crypto exchanges and DeFi platforms in order to ensure taxation. However, in order to prevent the use of virtual currencies in money laundering (AML) processes, regulators request that blacklists be added to virtual currency contracts. Some of the stable coins/tokens have taken the necessary precautions in this direction. However, the necessary measures are still not sufficient (Poskriakov, Chiriaeva, & Cavin, 2020).

It has been determined in academic studies that the adoption rate of users is low due to the fact that the blockchain is new and its prevalence among individuals is limited. In particular, the fact that individuals have learned about blockchain only as an investment tool causes a lack of knowledge in the context of tourism. However, it is an efficient technology as a decentralized data storage tool. However, its technological complexity causes skepticism in individuals. However, since it is still a developing technology, the limited number of experts in this field and lack of education are among the obstacles to its acceptance.

Blockchain Technology Challenges Under the Theory of Diffusion of Innovation

According to E. M. Rogers's (2003) theory, there are stages of acquiring information, persuasion, decision, implementation and acceptance in the acceptance of innovation. When examining the innovation diffusion process of blockchain technology in the tourism sector, the following findings are obtained.

Gaining Information: Actors in the tourism industry conduct research to understand the potential of blockchain technology. For example, a tourism company may examine how blockchain technology can improve the hotel booking process, or a travel agency may investigate how they can build their customer loyalty programs on blockchain. During this stage, various stakeholders in the industry try to understand the advantages and disadvantages of the technology.

Persuasion: Studies put forward by academic studies and early stage entrepreneurs are used to persuade stakeholders in the tourism sector. For example, a hotel chain may see the potential of blockchain technology to securely store reservation data and improve customer experience. At this point, important actors in the industry are expected to make decisions to adopt and integrate the technology.

Decision: As industry players gain knowledge about the advantages provided by blockchain technology and are convinced by academics and entrepreneurs, they are starting to make strategic decisions. As a reflection of this, it turns out that applications for storing and sharing customer data on the blockchain can be evaluated. However, at the decision stage, companies need to evaluate in detail the costs, benefits and risks brought by the technology.

Implementation: Once the decision is made, companies in the tourism sector begin to implement blockchain technology. The first application examples are identity management, baggage tracking and loyalty programs mentioned in the study. During the implementation phase, the practical use of technology and its integration into business processes are important.

Acceptance: Due to the ongoing development of blockchain technology, the acceptance phase has not occurred. However, the first initiatives and the practices of the states mentioned in the study reveal that a positive

process towards the acceptance of technology continues.

CONCLUSION

In this study, a situation assessment was made regarding the use of blockchain in the tourism sector. Firstly, some of the academic studies published in the context of the sector reveal the promise of the technology and its perception. Then, the application suggestions that emerged with blockchain technology and were put forward as academic studies were explained. The obstacles to the adoption of blockchain technology were evaluated in the light of academic studies. Its development as a technological innovation has been examined within the framework of the diffusion of innovation theory in order to reveal the situation and understand its counterpart in society.

Blockchain technology is a technology that enables data to be managed without the need for an intermediary by providing consensus between multiple parties without the need for trust. Data can be controlled in a decentralized manner with distributed ledger technology, which can be checked retrospectively and its immutability can be assured. It is leading the transformation in many sectors including tourism. It is rapidly gaining attention in business and real life applications. Blockchain can transmit value through the data it stores on itself, so it can be used in financial transactions such as payment and transfer without the need for any intermediary. Blockchain continues to be an effective tool for storing identity information with immutable data management. It is useful in managing the loyalty programs of businesses in accommodation processes, which is one of the important activities in the field of tourism, and contributes to online distribution and service optimization as well as capturing opportunities to attract and retain customers.

It paves the way for disintermediation in payments by ensuring global value transfer. This results in a reduction in intermediary costs for businesses and consumers. This brings about the acceleration of process collaboration. If the blockchain network is open, transactions can be managed transparently.

Smart contracts are stored on the blockchain. Once encoded and sent over the network, it cannot be changed. Through smart contracts to be developed on the blockchain, processes will be more transparent and democratic for businesses and consumers.

When evaluated within the framework of the theory of diffusion of innovation, it can be said that the level of knowledge of industry players about blockchain technology is low. Blockchain is mainly known among industry players and consumers within the framework of virtual currencies. However, for subject experts, the promises of this technology are becoming increasingly clear. When evaluated for RQ1, the effect of the lack of knowledge about blockchain technology is seen. For this purpose, industry players should be exposed to more information transfer by product developers in the field of blockchain. When the emerging initiatives are evaluated, it is seen that the knowledge on the subject is gradually increasing in the ecosystem of technology employees.

The advantages of the emerging innovative solutions in the field of tourism have begun to convince the tourism industry ecosystem over time. This is evident from the increasing growth of initiatives based on blockchain. The increase in usage, especially in the areas of payment method, reservation and baggage tracking, is an indication that the persuasion phase is progressing healthily.

As the advantages of blockchain continue to be experienced in practice, decisions regarding the use of blockchain-based solutions in the tourism sector will increase. However, it can be said that there is current usage at the early adopter level.

The level of practical examples of this technology in the sector is seen to be quite low. However, it is obvious that this will increase as projects of companies developing new applications in the field of blockchain emerge. In order to overcome the difficulties of increasing the use of blockchain in the tourism sector, which is RQ2, applications aimed at the end user need to be developed further. The efficient emergence of areas of use that will be attractive to the end user will enable the challenges to be overcome.

In the context of diffusion of innovation, blockchain technology needs to reach maturity level in order to access innovation decision processes (RQ3). The development of layer 1 technologies of blockchain technology constantly requires infrastructure changes, and this situation constantly leads to the formation of new solutions for similar problems. Unfortunately, the decision phase has not taken place yet. There is still a long way to go to achieve this stage. For this, product diversity, applications must prove themselves in terms of cost and data security, with sound and multiple examples.

In addition, blockchain technology is gradually developing. Considering the features of the emerging new blockchain networks and especially their operating speed, it is understood that they are still open to development.

It can be said that its technological maturity is not completed because its development continues. However, the integration of the emerging projects towards the existing sectoral needs is only partially realized. However, the impact of the lack of integration standards, technological difficulties and lack of expert personnel in transferring operations of businesses to the blockchain can be seriously noticed. In addition, it is thought that institutional and administrative support will increase if compliance with the regulations of the legislators and taxation problems are solved. Compliance with global regulations is a vital issue, especially in projects intended to be used as a means of payment. However, only stablecoins are partially compatible. Continuing academic studies in this field is important for understanding the technology. Gaining knowledge in the relevant field will contribute to policy making.

CONFLICT OF INTEREST

No potential conflict of interest was reported by the author.

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