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Perspective Chapter: Prospects of Using Blockchain Technology in the Tourism Industry

Leyla Gamidullaeva, Ivan Karelin and Svetlana Zinchenko

Abstract

This article is devoted to an actual research problem in conditions of increased uncertainty and the need for a theoretical rethinking of the tourism phenomenon in the society, when geopolitical upheavals and a decrease in international security are taking place, as well as the pandemic COVID-19, which currently poses new challenges for the tourism industry. Today, it is more relevant and appropriate than ever to think about them from the perspective of blockchain technology, using a fundamental approach to the digitalization of decentralized management of the life cycle of an internal regional tourism product. It is required to develop an integrated scientific and methodological approach to modeling and designing cyber-physical systems for monitoring and managing tourism products, objects, and processes based on blockchain technologies in order to maximize the contribution of the tourism industry to the socioeconomic development of regions.

Keywords: digitalization, life cycle management, internal tourism product, economic efficiency, management optimization, tourism

1. Introduction

Modern conditions for the development of socioeconomic systems, characterized by high uncertainty of geopolitical, macroeconomic, and epidemiological processes, lead to the need to form new organizational and economic mechanisms that ensure innovative economic growth of the Russian economy. In the current conditions, a serious reboot and a comprehensive transformation of all sectors of the economy are required. Great challenges and threats pose new challenges to the tourism industry as the most vulnerable to external shocks and threats. At the same time, the importance of the tourism industry in terms of developing the country's interior and mobilizing the existing natural, cultural, human capital, etc., is difficult to overestimate.

Today, influenced by digitalization, the global world tourism industry is undergoing very significant changes. The digitalization of the activities of enterprises and industries is happening at a tremendous speed. This dynamic is the result of many factors, such as increasing the speed and breadth of internet coverage, optimizing business processes through integrated automation, and many others. The global COVID-19 pandemic has become a significant driver of the digitalization process, creating an objective need for online services and services.

The problem is that in the face of growing uncertainty that threatens the economic security of the country, and the rapid digital transformation of the economy, the need for rational use and optimization of the management of the tourism industry is becoming more urgent. It is required to develop an integrated scientific and methodological approach to modeling and designing systems for monitoring and managing tourism products, facilities, and processes in order to maximize the contribution of the tourism industry to the socioeconomic development of regions.

The need to develop a tourist destination is primarily related to such problems as security [1], the presence of intermediaries, high demand for a national product, etc. The development of information technology has made it possible to solve some of the identified problems using distributed registry technologies.

Distributed ledger technologies are at the initial stage of development, but their influence is observed in many areas: science, manufacturing, economics, etc. They set new development trends, as they offer data anonymity, the absence of a third party in commodity-money relations [2], and low commission for economic transactions [3].

Since 2020, distributed registry technologies have been gaining ground in the travel and tourism industry [4]. The main direction was the development of smart platforms for the implementation of new systems and methods of conducting tourism activities [5].

The significance of this system in the field of tourism was confirmed in the study of a trial product. To demonstrate the usability and effectiveness of the developed approach, [6] present a hotel booking case, the analysis of which shows the significance of the proposed system. A similar result was achieved by other researchers [7].

It is important that the development also concerns such a fairly new phenomenon as medical tourism, which is travel abroad to receive medical services. Medical tourists as well as healthcare providers can benefit from technology that makes it easier to find a healthcare provider, make fast and secure payments, and keep data secure and private [3].

The further development of the tourism industry is closely related to the development of smart platforms, which are similar in technical characteristics to technological platforms. The term “technology platform” was introduced in 2004 by the European Commission to identify prioritized scientific and technical areas for the development of the European Union to ensure Europe’s technological independence [8].

According to the authors [8], the tourism technological platforms “must provide the solution to the following main tasks:

- the influx of private investment in the tourism sector;
- improving the technology level of the reproduction process of both local tourism products and regional tourism products in general;
- expansion of high-tech exports, including tourism technology exports (tourism products are referred to as so-called hidden exports, when the currency or financial resources directly enter the region from other countries and regions together with tourists);
- providing the conditions for business growth, the formation of new high-tech companies in the region’s economy (a smart resort city, digital technologies);
- increasing the efficiency of the use of tourism and other resources, as well as preventing their deterioration and even more so exhaustion, since otherwise the sustainable reproduction of regional tourism products will be undermined;

- solving significant social problems (preserving and building up the human potential of a region, industry, corporation, country, and civilization; improving the environmental situation; ensuring safety).”

Tyan et al. [5] highlighted the following positive aspects of developing a smart platform for tourism:

- enhancing tourism experience;
- rewarding sustainable behavior;
- ensuring the benefits for local community;
- reducing privacy concerns.

As noted in the study [9], the most important advantage of such a system is the creation of new forms of communication between the supplier and the consumer. In decentralized systems, there is no need for outside support to complete a transaction. The transaction occurs due to a consensus mechanism that protects the network and provides a mechanism for the interaction of its participants. The development of this technology will especially affect the SME (Small and Medium Enterprises) sector [10], where there is the greatest pressure from large companies [7].

Developers of smart platforms for various industries, including the tourism industry, are faced with the task of choosing the optimal technology that provides a mechanism for interaction between participants, maintaining confidentiality, eliminating intermediaries, etc. This study also aims to substantiate the need for a tourism smart platform based on distributed ledger technology as a tool and mechanism for optimizing tourism industry development *via* digital transformation under the influence of current challenges.

2. Tourism and sustainable development

It is extremely important for tourism to develop in the context of the sustainable development goals proclaimed by the UN in 2015 (Agenda 2030). This poses new challenges for the industry, the solution of which is possible with the use of the latest information technologies. The growth of sustainable tourism implies a long-term development, in which a balance is achieved between economic, social, environmental, and cultural goals, and the interests of all stakeholders are taken into account. In the period of transition to a digital and smart economy, the introduction of tourist technological platforms is a necessary condition for increasing the competitiveness of regional tourism products in Russia. Tourism within the framework of sustainable development acquires environmentally friendly tourism products, and reduces the financial costs of users. The constant and long-term development of tourism information platforms is expected through technology transfer and capacity building, both public and private [8]. The need to develop this area is emphasized by the study by [11], which notes that sustainable development in the field of tourism is relevant not only for the consumer but also for the service provider, the state, etc. The level of use of advanced manufacturing technologies; and the number of organizations performing research and development. The demand for sustainable tourism is constantly

growing, and studies are being conducted on the relationship between sustainable and urban tourism [12], where the authors focus on improving the technological environment in this area, introducing solutions to optimize existing ones, as well as creating new, relevant solutions in this area. Studies conducted in the field of tourism show a high correlation between tourism development and STP, this research has also confirmed the influence of absorption, adaptation, and innovation capabilities in the sustainable development of the tourism sector [13].

With the development of IT technologies and the globalization of our world, the attention of companies is increasingly focused on the “green image” (charity, support for those in need, social development, and culturalization). Producers tend to the location of the client, to reapply for the services provided. Research shows that there is a positive relationship between sustainability practices and return visit intent, and between a green image, both directly and indirectly through trust [14]. This shows the relevance of the development of the system, as well as the development of new solutions for the development of the tourism region.

3. Features and limitations for the introduction of distributed ledger technologies in the tourism industry

Tourism business models include accommodation services, food & beverage services, travel transportation services, transportation supporting services, rental services, recreation & sports services, and souvenir retailers, as well as online & offline travel agencies and reservation services [15]. Support for such a number of solutions in the system determines a number of limitations. To obtain an acceptable result when introducing TRR into the tourism environment, it is necessary to solve three main blocks of problems [16]:

1. Legal - There are no norms, rules, or laws that regulate the activities of network participants. Norms on the form, conditions, and procedure for concluding smart contracts are not provided. There are no legal norms to protect consumer rights, there is no mechanism for bringing intruders to justice, and the issue of taxation when making a transaction has not been resolved.
2. Technical - In case of loss of personal data, there is no way to return the profile. Failures, errors, malfunctions, and attacks on the network are possible. There may be problems associated with the processing or transmission of data, which is unacceptable in financial systems, an insufficient level of scientific and technical progress, and the absence of cyber-physical devices that allow recording and collecting the necessary data [17]. The confidentiality of information, at the moment, can be violated by any physical purchase, for example, renting a car or buying a plane ticket, which is impossible without presenting personal data, which will link information on the network with a specific individual [18].
3. Economic - Innovative transition is associated with large financial investments. It is necessary to constantly maintain a stable state of the system, as well as organize sufficient computing power to protect against intruders. It is necessary to train and train specialists to work with TRR, develop the system, modernize technology, and develop new solutions to maintain relevance [16], and it is also necessary to overcome the low level of consumer awareness [5].

The development of the digital tourism area is achieved through the creation of a favorable business environment, which is achieved by combining the efforts of the state, science, and business [8]. Overcoming these barriers will open the C2C market within the system, new forms of investment will appear, and there will also be disintermediation in the tourism sector [18].

4. Comparative analysis of distributed ledger technologies

On a schematic representation of the blockchain systems (**Figure 1**) and the Hashgraph (**Figure 2**), circles indicate blocks of transactions, lines indicate their relationship, and dashed lines indicate unapproved transactions. When depicting the TraceChain technology (**Figure 3**), circles represent network nodes, lines show their interconnection.

4.1 Blockchain

In 2008, the first technology was introduced, based on the concept of a decentralized network called blockchain. If in a centralized network, the security of a transaction is assumed by the central authority, then in this concept, security is determined by the interaction of its participants. The classic representative of the system is Bitcoin, based on this technology. Bitcoin is a chain of immutable blocks (**Figure 1**), the integrity of which is confirmed by the Proof-of-Work consensus protocol. To add a new block to the network, it is necessary to perform some “work,” during which the block information is confirmed [19]. This protocol provides sufficient network security, but the structure in the form of series-connected blocks and the use of an expensive protocol for finding consensus do not allow unlimited scaling. In our

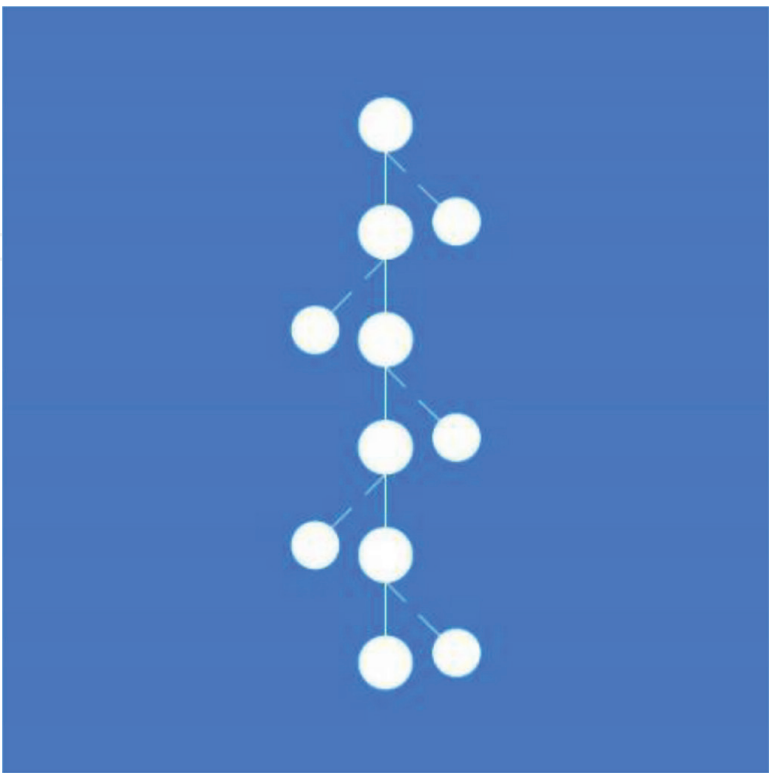


Figure 1.
Visualization of blockchain technology.

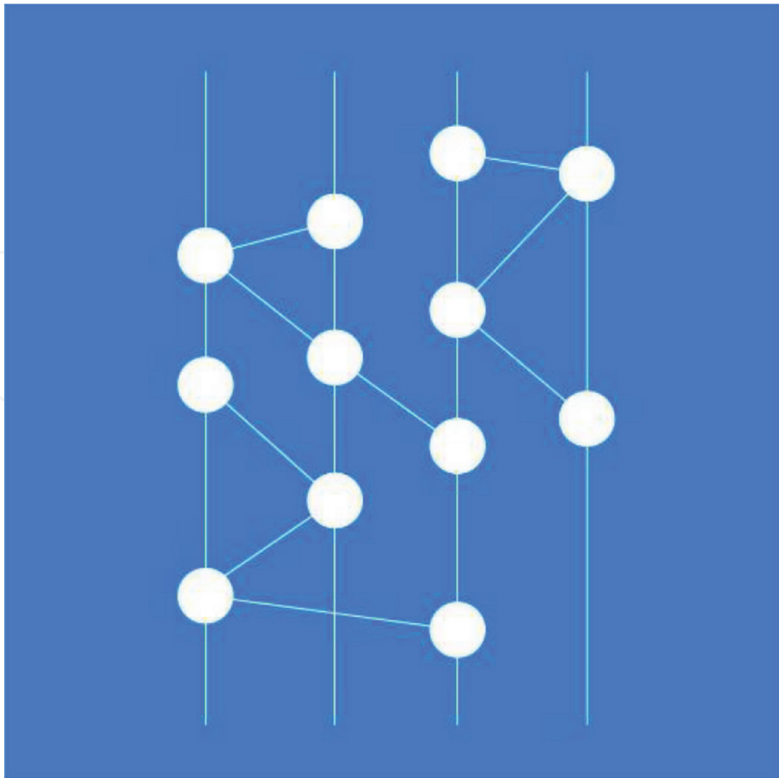


Figure 2.
Visualization of Hashgraph technology.

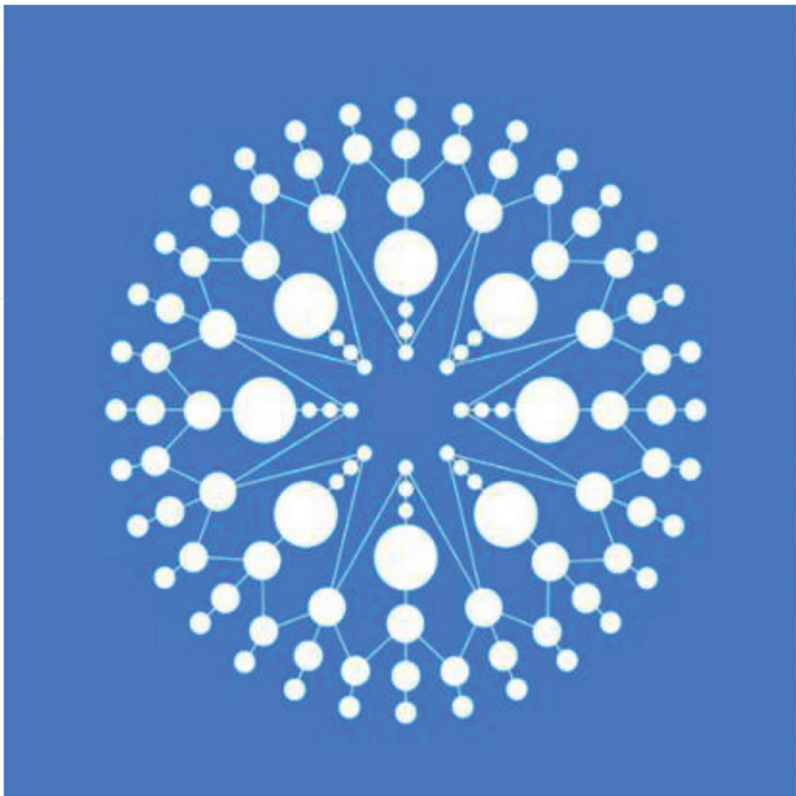


Figure 3.
Visualization of TraceChain technology.

opinion, at the moment, blockchain technology has almost exhausted its potential and is in a state of alternative to the gold exchange system.

During further development, Blockchain technology was able to increase its throughput, for example, Ethereum, but this problem still remains relevant.

4.2 Hashgraph

In 2017, the Hashgraph technology was released, the rights to the algorithms of which belong to Swirlds (HEDERA) [20]. The technology was supported by large companies that formed a platform called “Hedera Hashgraph Platform.” The technology is currently patented, and the only authorized ledger is Hedera Hashgraph (**Figure 2**).

The Hashgraph technology does not use the blockchain in its structure; directed acyclic graph (DAG) was taken as the basis. The structure of the technology is the ledger in which no transaction is discarded. The interaction of network nodes is a constantly expanding tree [21] (**Figure 2**). Hashgraph technology uses other ways to achieve consensus between network participants when interacting, one of which is called “gossip about gossip.” When sending information, a network participant randomly selects another participant to whom it transfers all the information it has accumulated in the form of a hash (Already encrypted data is transmitted, which contributes to confidentiality). This algorithm is repeated several times, resulting in a tree that has the general direction, which named Hashgraph [19]. The rate of dissemination increases exponentially until a consensus is reached.

The network structure and consensus technology allow Hashgraph to be fair, fast, compliant, efficient, inexpensive, timestamped, and resistant.

This project is supported by large companies such as LG, Google, IBM, and Ubisoft.

The HEDERA platform supports the following areas: enterprise, gaming, health-care, and case studies.

4.3 TraceChain

In 2017, TraceChain technology was developed. The technology is based on AI, which determines the structure of the network, and distributes nodes to ensure maximum speed [19]. Checking the correctness of transactions is extremely fast, as it is performed immediately on all devices at the same time. The outer radius of the network keeps connections with many clients, the middle one—the load from slow intercontinental connections, and the central parts of the network are responsible for the complete synchronization of lost transactions. This forms a new type of consensus called multi-PoS (**Figure 3**). The average transaction processing speed is up to 3 seconds [21].

This technology at this moment belongs to MetaHash AG (METAHASH) [22], which develops and promotes the product on the technology market. The transaction approval rate of more than 50,000 transactions per second is achieved by the optimal location of the nodes in the network. Like competitors, this technology has vulnerabilities, the main of which is the cybersecurity problem, which is being optimized by the developer company.

Distributed ledger technologies may become new growth points in the tourism industry (**Table 1**).

Criteria	Technologies		
	Blockchain	Hashgraph	TraceChain
Transactions per second	Up to 30	10,000	50,000
Consensus mechanism	Proof-of-Work	Gossip about gossip	multi-PoS
Transaction confirmation	15 seconds	3–5 seconds	<3 seconds
Structure	Chain	Tree	Rings
Safety	High	High	Being tested

Table 1.
Comparative analysis of the existing technologies of distributed ledger.

The introduction of distributed ledger technologies in the tourism sector opens up new opportunities, which determines the importance of technology in this area [23]. Decentralization, fee reduction, smart platform applications, elimination of intermediaries, and security will allow tourism to move to the next level. The choice of a system for the transition depends on the starting conditions (financial resources, the required speed of transactions, etc.). For example, blockchain is reliable and low in cost, while limited in the speed of transactions, Hashgraph is expensive, while providing a high transaction speed, TraceChain is budgetary, and provides a high transaction speed, while the security of this option, at this moment, is inferior to competitors. Studies conducted by other research and development organizations [18, 24] have the same results.

5. Conclusion

The formation and development of smart platforms can take place both in an evolutionary way in the conditions of market relations, and by a decision from above, that is, at the initiative of state bodies. At the same time, a smart platform, as a rule, unites all participants in business processes within a single sector of the economy (manufacturing, trading, service enterprises, their customers, public authorities, and other economic entities), creating and structuring information flows between all stakeholders in a digital format and market participants within the industry. The digital industry platform in order to improve management efficiency allows you to form a holistic objective picture of the state of the industry.

In technological terms, an industry smart platform based on blockchain is an information system for accumulating, exchanging, and managing data in a structured form, as well as for creating an ecosystem of services with information systems of smart platform participants connected to it. Thus, with the help of a smart platform, horizontal integration of information systems of market participants in a specific sector of the economy is ensured.

Obviously, for interested participants, the formation of a smart platform for the tourism industry has many positive consequences, as it opens up access to a wide range of opportunities and allows the implementation of a sustainable model for the development of the industry [25]. Therefore, the essence of the formation of a business model should be to organize work with all interested parties (external partners, contractors, government, and control bodies) without creating a rigid vertical hierarchical management system. On the other hand, the quality and efficiency of the control function are improving to assess the latent factors of growth or decline in the development of both individual business entities and the tourism industry as a whole.

A promising direction for further research is the development of universal mechanisms for modeling and synthesizing the architecture of intelligent cyber-physical systems of a new generation based on the blockchain, which is a digital ecosystem. The latter is designed to provide decision support processes based on the monitoring of tourism products and processes at distributed cyber-physical objects of the regional tourism industry.

The solution to this problem requires the development of a new scientific and methodological approach to modeling and designing cyber-physical systems for monitoring and managing distributed objects and processes in order to optimize management at all stages of the life cycle of a regional tourism product. This will eliminate the gaps between the stages of the life cycle (design, planning, promotion and commercial implementation, implementation on the ground, and optimization), ensure the control of the life cycles of all tourism products and regulate the processes of changing the shape and duration of the life cycle of each individual product at all stages in order to rationally use of tourist and recreational resources of the region. The results of the study create a methodological and practical basis for the creation of new artificial intelligence technologies, which corresponds to the priority direction of the Strategy for Scientific and Technological Development of the Russian Federation until 2035 “Transition to advanced digital, intelligent manufacturing technologies, robotic systems, new materials and design methods, creation of processing systems big data, machine learning and artificial intelligence. In future research, we are planned to continue our research work on the sustainable development of tourism, as well as methods of implementing distributed ledger technologies in the tourism areas.

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