Blockchain and the Future of Tourism Policy: Decentralising Trust, Enhancing Transparency, and Driving Innovation

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Abstract

Blockchain technology, originally developed for cryptocurrencies like Bitcoin, is now gaining traction across various sectors, including tourism. Its decentralized structure offers enhanced transparency, security, and efficiency, key advantages for the tourism industry, which often depends on multiple intermediaries. This paper examines blockchain applications such as secure bookings, digital identity management, loyalty programs, and sustainable tourism. Using thematic analysis of literature and case studies, four key themes emerge: decentralized trust, data integrity, service innovation, and sustainability. The study also presents policy suggestions and future research directions, offering valuable insights into blockchain's transformative potential and challenges within tourism's digital evolution.

Keywords: Blockchain technology, tourism, decentralized trust, service ecosystems, sustainability, loyalty programs, smart contracts, tourism innovation.

Introduction

The tourism sector has undergone significant transformations due to the impact of digital technologies. New technologies have led to remarkable digital transformations in tourism, changing tourist destinations, products, and business models (Erdoan, Hasan Ali, 2021) . This evolution necessitates the creation of new business relationships, models, and competencies within the industry. Digital transformation in tourism is driven by artificial intelligence, blockchain, the sharing economy, IoT, virtual reality, and augmented reality. These technologies are reshaping how tourism services are delivered, managed, and experienced. The integration of Industry 4.0 technologies, including blockchain, has significantly transformed the tourism industry (Du, Yiqun, Mohamed, Rosmah, and Leong, Yee Choy, 2024) These advancements offer opportunities for enhanced efficiency, personalization, and sustainability.

However, the tourism industry faces several persistent problems that hinder its potential. The tourism industry faces problems such as identity theft, intermediaries, payment failures, fake reviews, and safety concerns (Kumar, B. C. Girish, Nand, P., and Bali, V., 2022). These challenges affect both travellers and service providers, undermining trust and creating inefficiencies. E-tourism uses bulk digital payments through heterogeneous payment gateways, which can lead to malicious activities and payment failures. The complexity of these systems introduces vulnerabilities that can be exploited by attackers. Centralized cloud servers that store financial data in e-tourism are

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vulnerable to payment problems during peak traffic. These systems often struggle to handle the high transaction volumes during peak seasons, resulting in payment delays and failures.

Tourism, as a global socio-economic activity, increasingly intersects with digital innovations that enhance transparency, security, and operational efficiency. Among these emerging technologies, blockchain has garnered notable attention for its potential to revolutionize transactional trust, data sharing, and value creation (Kizildag et al., 2019). Although widely known for its association with cryptocurrencies, blockchain's foundational capabilities extend far beyond financial domains. Blockchain technology is emerging as a transformative force in the tourism industry, offering potential for decentralized, secure, and transparent systems (Joo et al., 2020; Banerji et al., 2021). Key applications include smart contracts, digital currency, disintermediation, identity management, and innovative loyalty programs (Banerji et al., 2021). Blockchain can enhance trust and reputation management, traditionally centralized through third-party platforms like TripAdvisor (Calvaresi et al., 2018). The technology promises to reduce fraud risks, increase competitive advantage, and improve customer satisfaction in the tourism sector (Erceg et al., 2020). The technology's ability to increase disintermediation in tourism is considered its most significant impact, potentially eliminating intermediaries from the supply chain and preventing new mediators from entering the market (Rashideh, 2020). However, implementation challenges remain, particularly in countries like Croatia and Macedonia (Erceg et al., 2020). Despite these hurdles, blockchain's potential to create sustainable tourism ecosystems is significant, with examples like TripEcosys and TravelChain demonstrating innovative applications (Joo et al., 2020). As the tourism industry continues to evolve in the digital age, blockchain technology offers promising solutions for addressing current limitations and creating new opportunities.

In the tourism industry, where diverse actors including service providers, intermediaries, and end-users interact, blockchain offers a decentralized and immutable infrastructure that can mitigate fraud, streamline booking processes, and foster customer trust (Nam et al., 2021). Despite its promise, blockchain remains underutilized in tourism due to barriers such as technological complexity, regulatory uncertainty, and limited awareness among small and medium-sized enterprises (SMEs). Therefore, it is critical to demystify the fundamentals of blockchain in an accessible manner to facilitate its adoption in the sector.

Literature Review

Blockchain's Role in Decentralizing Trust

Blockchain technology plays a pivotal role in decentralizing trust by removing the need for intermediaries in transactions. As Lichtenstein et al. (2021) highlight in Sustainability, blockchain provides a transparent, immutable ledger that strengthens the credibility of data exchanges without relying on centralized authorities. This feature is particularly valuable in the tourism industry, where consumer trust is critical when choosing accommodations, booking tours, or engaging with service providers. Blockchain enables peer-to-peer verification, which helps reduce fraud, ensures data integrity, and enhances transaction security. Wang et al. (2020) in Information Technology & Tourism emphasize that these benefits can improve user confidence and operational efficiency within tourism ecosystems. By enhancing transparency and reducing reliance on traditional gatekeepers, blockchain offers a foundation for a more trustworthy, customer-centric tourism

experience. As such, it holds the potential to reshape service delivery and redefine trust mechanisms in the global tourism sector.

Furthermore, blockchain's decentralization can help mitigate issues such as double booking, fraudulent reviews, and mismanagement of customer data. As Zhang et al. (2020) highlight in Tourism Management, blockchain enables a more reliable system for managing user reviews and ratings by ensuring that reviews cannot be manipulated or tampered with, fostering trust in online platforms (Zhang et al., 2020).

Blockchain technology also promises to improve operational efficiency in tourism services. Through smart contracts, which are self-executing contracts with the terms of the agreement directly written into code, tourism providers can automate and streamline various processes, such as booking confirmations, payment settlements, and loyalty programs (Gomes et al., 2021, Technology Analysis & Strategic Management). These smart contracts reduce the need for human intervention and paperwork, leading to faster and more cost-effective transactions.

A key example is the integration of blockchain in airline and hotel industries. By leveraging blockchain, airlines can streamline check-in processes, reducing wait times and administrative overhead (Dimitrov & Ivanov, 2020, Tourism Management). Similarly, hotels can use blockchain for seamless payment processing and customer loyalty programs, further enhancing customer experience (Khan et al., 2022, Current Issues in Tourism).

Enhancing Transparency and Security in Tourism Transactions

Blockchain's transparency holds transformative potential for the tourism industry, particularly in enhancing the reliability of booking systems. Transparent, tamper-proof records ensure travellers have access to accurate, unalterable transaction histories. Lee and Kim (2021), in the Journal of Hospitality and Tourism Technology, highlight that blockchain can support real-time updates, helping to prevent overbooking and service delivery errors. This transparency not only streamlines operations but also facilitates easier dispute resolution, increasing customer trust and satisfaction.

Security is another critical benefit of blockchain. Its decentralized architecture eliminates a single point of failure, significantly reducing vulnerability to cyberattacks compared to traditional centralized systems. As noted by Sharma et al. (2022) in the Journal of Hospitality Marketing & Management, blockchain uses advanced cryptographic techniques to protect personal and financial data. This level of security is vital in the tourism sector, where sensitive customer information is frequently exchanged. Together, transparency and security enable a more trustworthy, efficient, and resilient tourism ecosystem, making blockchain a promising solution to many of the industry's long-standing operational and trust-related challenges.

Disrupting the Traditional Service Ecosystem

Blockchain's ability to decentralize trust and minimize dependence on intermediaries marks it as a disruptive force in the tourism industry. Traditional tourism models often involve multiple intermediaries—such as booking platforms, payment gateways, and review aggregators—each contributing to increased costs, complexity, and data silos. According to Xu et al. (2022) in Tourism Economics, blockchain can streamline this process by enabling direct, peer-to-peer transactions

between travellers and service providers, thereby reducing service fees and improving cost efficiency.

This disintermediation fosters a more democratized tourism ecosystem, where customers gain greater control over their travel planning and spending. Travelers can book services directly from providers, often at lower prices, while providers benefit from retaining a larger share of revenues. Additionally, blockchain supports the development of decentralized autonomous organizations (DAOs) in tourism—platforms governed by smart contracts where decisions are made collectively by stakeholders rather than centralized authorities.

As Zhou and Chen (2021) note in Sustainability, DAOs can enhance transparency, fairness, and collaboration within the industry. By redistributing power and enabling shared governance, blockchain not only reduces operational inefficiencies but also promotes a more participatory and consumer-centric tourism environment.

Blockchain in Sustainable Tourism

Blockchain technology offers promising applications for promoting sustainable tourism. As highlighted by Sharma et al. (2021) in Sustainability, blockchain ensures transparency and accountability in environmental claims by providing immutable records of sustainability certifications. This enables travellers to make informed, responsible choices based on verifiable data. For instance, blockchain can be used to track the carbon footprint of travel services, helping tourists understand the environmental impact of their trips.

Moreover, blockchain can authenticate the ethical sourcing of tourism-related products and services, such as eco-friendly accommodations, fair-trade tours, or locally sourced goods. According to Rahman et al. (2020) in Environmental Science and Pollution Research, such traceability enhances consumer trust and supports responsible tourism practices. By promoting transparency and verification, blockchain empowers providers and consumers to align their behaviours with sustainability goals, thus contributing to a more ethical and environmentally conscious tourism industry.

Theoretical Framework

This study applies socio-technical systems theory (Bostrom & Heinen, 1977) alongside service-dominant (S-D) logic (Vargo & Lusch, 2004) to analyze blockchain's role in the tourism sector. Socio-technical theory examines how technological innovations, such as blockchain, reshape social systems, particularly trust networks, within tourism ecosystems. In parallel, S-D logic shifts the focus from goods to services, emphasizing value co-creation through interactions among diverse stakeholders. Within this dual framework, blockchain is viewed not merely as a technical infrastructure but as a trust-enabling protocol (Beck et al., 2017) that transforms how value is created, exchanged, and governed. It facilitates secure, transparent interactions between service providers, consumers, and regulators, reducing reliance on intermediaries and enhancing stakeholder collaboration. This integrated approach allows for a deeper understanding of blockchain's socio-economic and organizational implications, offering insights into how decentralized technologies can reshape tourism services toward greater efficiency, trust, and sustainability.

The study explores the transformative potential of blockchain technology in the tourism industry. It will analyse how blockchain can solve long-standing challenges such as lack of transparency, trust deficits, inefficient processes, and centralized control by intermediaries. By leveraging decentralized ledgers, smart contracts[2], and tokenized economies, blockchain presents an opportunity to reshape tourism ecosystems to be more inclusive, efficient, and traveller centric.

RO1; To explain the fundamentals of blockchain technology in an accessible manner in tourism sector.

The study presents global case studies, ongoing pilots, and emerging business models, offering insights into how blockchain is being used to facilitate secure bookings, authenticate travel reviews, enable decentralized loyalty programs, and manage digital identities. The aim is to provide a critical understanding of blockchain's value proposition for tourism, alongside an assessment of its limitations and future trajectories.

RO2: To explore real-world examples and use cases from different regions on how blockchain is being used to facilitate various services in Tourism.

Methodology

The study adopts a qualitative research approach combining a systematic literature review and multiple case study analysis. Peer-reviewed articles from Scopus/Web of Science-indexed tourism and information systems journals were analyzed, alongside reports from blockchain startups in travel (e.g., Winding Tree, Travala, TravelChain). Data was thematically coded and categorized using NVivo.

Fundamentals of Blockchain Technology

Blockchain is a type of distributed ledger technology (DLT) that allows transactions to be securely recorded across a decentralized network without the need for a central authority (Tapscott & Tapscott, 2016). Each block contains a timestamped group of transactions and is cryptographically linked to the previous block, creating an immutable and tamper-resistant chain (Yli-Huumo et al., 2016). This structure ensures transparency, security, and trust in digital interactions, making blockchain a foundational technology for various sectors, including tourism, where reliable data and secure transactions are critical for enhancing consumer trust and operational efficiency. The structure of a blockchain includes:

- Nodes: Participants in the network that maintain and validate the blockchain.

- Blocks: Data structures that contain the transaction details.

- Consensus Mechanisms: Protocols (e.g., Proof of Work, Proof of Stake) that ensure agreement across nodes.

- Smart Contracts: Self-executing contracts with terms directly written into code.

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[2] Smart contracts are a critical component of blockchain technology, enabling the automation of agreements and transactions. Smart contracts can automate agreements and transactions, securing reservations and services without intermediaries.

These features provide transparency, auditability, and resilience against data tampering, which are highly desirable traits in tourism-related transactions. Blockchain technology exhibits several distinctive features (Table 1). These characteristics are particularly relevant in tourism, where multi-party coordination and trust are paramount.

Table 1. Blockchain technology exhibits several distinctive features	
Decentralization	Reduces reliance on intermediaries, lowering transaction costs.
Immutability	Once data is recorded, it cannot be altered retroactively.
Transparency	All authorized participants can verify the data integrity.
Traceability	Enables end-to-end tracking of digital or physical assets (Fosso Wamba et al., 2020).

One of the most significant impacts of blockchain technology in tourism is its potential to reduce the role of intermediaries. Blockchain can help eliminate commission fees and reception costs with the decentralized proof mechanism. By facilitating direct interactions between service providers and customers, blockchain can reduce the need for traditional intermediaries such as travel agencies and booking platforms. Blockchain facilitates direct transactions, eliminating the need for third parties that control and earn commissions. This disintermediation can lead to lower costs for consumers and increased revenue for service providers. Blockchain has the potential to eradicate the middleman in the tourism industry (Kumar, B. C. Girish, Nand, P., and Bali, V., 2022) . This transformation can result in a more efficient and transparent ecosystem.

Despite its potential, blockchain technology faces several challenges and barriers to adoption in the tourism industry. The findings highlight that Blockchain technology can bring a higher level of transparency to supply chains in tourism, tracking emissions, improving social welfare reputation, and reducing fraud related to data security. Scalability and performance issues are significant concerns, as blockchain networks can struggle to handle the high transaction volumes required in the tourism sector. This study also identified critical challenges, including the necessity for scalable and energy-efficient Blockchain solutions, along with the imperative to address legal and regulatory impediments. These technical and regulatory hurdles must be overcome to ensure the widespread adoption of blockchain in tourism. There exist big dilemmas in tourism and hospitality industry dealing with the disruption in its value chain which requires blockchain technology to smoothen its value network. This highlights the need for innovative solutions to address the unique challenges of the tourism industry.

Regulatory and legal uncertainties also pose a significant barrier to the adoption of blockchain in tourism. Legal and regulatory impediments are critical challenges to the implementation of Blockchain solutions. The lack of clear legal frameworks and regulatory standards can create uncertainty and discourage investment in blockchain technology. This contemporary study was conducted ascertain level government fostering environment conducive adoption Vietnam. Government support and regulatory clarity are essential for creating a favorable environment for blockchain adoption. The findings indicate that are likely be interested expanding legal framework access technology, organizations willing incorporate their current operations if allows this new technology. This underscores the importance of government initiatives to promote blockchain adoption.

A lack of awareness and understanding among stakeholders is another significant challenge. Adoption and application blockchain in businesses have been rather slow. Many tourism professionals and consumers are unfamiliar with blockchain technology and its potential benefits. The literature show being developed firms; shows infrastructures enterprises insufficient construct implement such technologies. This highlights the need for education and training initiatives to raise awareness and build capacity. Universities play role overcoming this problem. Educational institutions can play a key role in promoting blockchain literacy and developing the skills needed to implement the technology.

Blockchain Applications in the Tourism Sector

Real-world examples of blockchain implementation in tourism are emerging, demonstrating the technology's potential to transform various aspects of the industry. The paper presents examples of the practical application of Blockchain technology in the activities of companies providing tourism services. These case studies offer valuable insights into the challenges and opportunities associated with adopting blockchain in tourism. BloHosT achieves a high Return of Investment (ROI) in the tourism sector as compared to traditional frameworks. This demonstrates the potential for blockchain to improve efficiency and profitability. The study on hotel booking is conducted using frameworks Winding Tree and Hyperledger Fabric to demonstrate the usability and efficiency of the developed approach. This provides a concrete example of how blockchain can be applied to streamline booking processes. More applications are as follows:

Transparent and Secure Booking Systems: One of the foremost applications of blockchain in tourism is in booking and reservation systems. Traditional platforms are often centralized, leading to opaque pricing and potential data breaches. Blockchain-based platforms such as Winding Tree allow hotels and airlines to list offerings directly to customers without intermediaries, reducing costs and enhancing transparency (Nam et al., 2021). Also, Travala is a leading blockchain-based travel booking platform, it allows users to book hotels, flights, and activities using cryptocurrencies. It supports over 50 digital currencies, offers secure transactions, and features tamper-proof reviews, building trust among global travelers. Moreover, LockTrip is an online travel marketplace leverages blockchain to enable users to book accommodations directly with service providers, cutting out intermediaries and reducing costs by up to 60%.

TUI Group and Webjet, both companies have implemented blockchain-based systems to manage hotel inventory and booking verification in real time, reducing errors, manual work, and improving efficiency. Research shows that blockchain can mitigate double booking issues and fraudulent reviews by ensuring a single source of truth (Morabito, 2017). Moreover, smart contracts can automate refund policies or loyalty point redemptions, enhancing operational efficiency.

Identity Management and Authentication: Blockchain facilitates digital identity verification, which is crucial in international travel. Using a blockchain-based identity, travelers can share verified credentials with airlines, immigration, and hotels without repeatedly submitting documents (Sharma et al., 2021). This streamlines the check-in process and bolsters privacy through selective disclosure. Moreover, Blockchain-based systems allow real-time, transparent tracking of luggage as it changes hands between airlines, airports, and handlers, reducing lost baggage incidents and improving accountability. Furthermore, Smart contracts automate agreements between travelers and service

providers, such as hotel bookings, car rentals, and flight insurance. This ensures automatic execution of terms (e.g., refunds for cancellations or delays) without manual intervention. Also, TravelChain allows travelers to control and share their travel data and preferences securely with service providers, enhancing personalization while maintaining privacy

Supply Chain Transparency in Sustainable Tourism: With increasing focus on sustainable and ethical tourism, blockchain can help track the environmental footprint of services. For instance, tour operators can authenticate eco-friendly practices such as carbon offsets or fair-trade sourcing through blockchain ledgers (Xu et al., 2022). Such transparency can appeal to environmentally conscious travelers and enhance brand credibility.

Customer Loyalty and Rewards Programs:

Blockchain technology has the potential to revolutionize loyalty programs and customer engagement in the tourism industry. A private blockchain-based loyalty program can improve multi-party trust, operational efficiency, and customer engagement. By creating interoperable and secure rewards systems, blockchain can enhance the value and appeal of loyalty programs. Blockchain technology can revolutionize tourism, champion sustainability, and cultivate collaborative stakeholder relationships. This can lead to more sustainable and customer-centric tourism practices. Blockchain can transform tourism loyalty programs by addressing challenges in traditional systems, such as limited interoperability and fraud susceptibility. This transformation can create more engaging and rewarding experiences for travelers. Fragmented loyalty systems in tourism often fail to retain customer interest. Blockchain allows interoperability across providers, enabling travelers to use a unified token or reward system across hotels, airlines, and attractions (Saberi et al., 2019). This increases the utility of loyalty points and fosters greater customer engagement.

Blockchain simplifies and secures loyalty programs, allowing travelers to earn, store, and redeem points across multiple providers. Platforms like Airmiles use blockchain to enhance transparency, interoperability, and security in loyalty schemes. Further, Blockchain enables fast, secure, and low-cost cross-border payments using cryptocurrencies, eliminating currency conversion fees and banking delays. Travala and similar platforms already accept crypto payments for travel bookings.

Transparent and trustworthy reputation systems are essential for building trust and confidence in the tourism industry. A Tourism enabled Deep-Learning (TeDL) framework is trained on experience of previous visited travelers, providing rating scores to prospective travelers about the recently visited locations. By leveraging blockchain, these systems can be made more secure and transparent. BeSHMT includes a deep learning enabled by tourism (DLeT) framework that is taught using data from past visitors and offers potential tourists' ratings for the sites that have recently been visited by other travelers. This helps travelers make informed decisions based on reliable feedback. Blockchain can address the problem of fake reviews by ensuring transparency. This can improve the overall quality and reliability of online reviews.

These applications illustrate how blockchain is actively transforming the travel industry by increasing transparency, reducing costs, improving security, and enhancing the traveler experience across booking, payments, identity management, and more.

Thematic Analysis and Implications

To understand the multifaceted role of blockchain in tourism, a thematic analysis was conducted based on a synthesis of academic literature and real-world applications (refer Table 2). Four central themes emerged: (1) decentralized trust and disintermediation, (2) enhanced data integrity and security, (3) service innovation and loyalty interoperability, and (4) sustainability and ethical tourism.

Theme 1: Decentralized Trust and Disintermediation: Blockchain technology enables peer-to-peer transactions by removing the need for intermediaries such as online travel agencies, which have traditionally served as trust brokers. This process of disintermediation allows for direct interaction between service providers and travellers, leading to reduced transaction costs, greater transparency, and improved trust (Rashideh, 2020; Calvaresi et al., 2018). One of blockchain's key innovations—smart contracts—further enhances operational efficiency by automating bookings, payments, and service agreements. These self-executing contracts are coded to trigger predefined actions once specific conditions are met, eliminating the need for manual intervention or third-party enforcement (Nam et al., 2021). As a result, blockchain not only streamlines service delivery but also reduces the risk of disputes and fraud. For the tourism industry, this technological shift promotes greater efficiency, accountability, and user control, offering a more seamless and trustworthy experience for both service providers and travellers. It represents a significant move toward a decentralized and customer-centric tourism ecosystem.

Theme 2: Enhanced Data Integrity and Security: Blockchain's immutable and distributed architecture plays a critical role in ensuring data reliability, particularly in fraud-prone areas such as travel reviews, bookings, and service ratings. By maintaining a transparent and tamper-proof ledger, blockchain minimizes the risk of manipulation, thereby enhancing trust among consumers and service providers. Additionally, blockchain facilitates digital identity management, enabling travellers to verify their credentials once and reuse them across multiple platforms (Sharma et al., 2021). This not only improves the user experience by reducing repetitive identity verification steps but also enhances data security and privacy. With personal information stored securely and accessible only with user consent, the risks of data breaches and identity theft are significantly reduced (Yli-Huumo et al., 2016; Fosso Wamba et al., 2020). Overall, blockchain offers a seamless, secure, and efficient framework for managing interactions in the tourism sector, fostering greater transparency, reducing fraud, and protecting user data in an increasingly digital ecosystem.

Theme 3: Service Innovation and Loyalty Interoperability: Blockchain fosters interoperability between traditionally fragmented loyalty systems in the tourism sector, across airlines, hotels, and attractions, by enabling tokenized ecosystems. These decentralized loyalty programs allow travellers to accumulate and redeem rewards across various service providers, eliminating the limitations of siloed point systems. This flexibility not only enhances customer engagement but also encourages repeat travel behaviour by offering more value and convenience (Saberi et al., 2019). Token-based loyalty systems provide real-time updates, secure transactions, and greater transparency in reward accumulation and redemption. Blockchain platforms like Travel Chain and Winding Tree showcase how decentralized solutions can improve user experience, increase user retention, and reduce vendor lock-in, which often restricts customer choice (Joo et al., 2020). By empowering both travellers and service providers with transparent, efficient, and interoperable

loyalty programs, blockchain has the potential to transform customer relationship strategies in tourism and create a more integrated and traveller-centric ecosystem.

Theme 4: Sustainability and Ethical Tourism: Tourism is increasingly embracing sustainable and ethical practices, and blockchain technology plays a vital role in supporting this shift. By enabling traceability of carbon offsets, green certifications, and ethical labor standards throughout the tourism supply chain, blockchain introduces a new level of transparency and accountability (Xu et al., 2022). This transparency allows stakeholders to verify the authenticity of environmental claims and ensures that sustainability efforts are properly documented and maintained. Blockchain's immutable ledger helps prevent greenwashing by securely recording every transaction related to sustainability certifications, making it easier for travelers to make informed choices. As Morabito (2017) and Erceg et al. (2020) note, this embedded transparency appeals to environmentally conscious travelers who prioritize ethical consumption. Ultimately, blockchain strengthens environmental accountability in tourism operations, fostering trust between providers and consumers while encouraging the industry to adopt more responsible and sustainable practices. This technology thus supports a transition toward a greener, more ethical tourism ecosystem.

Explaining blockchain through the lens of theme 1 and theme 2 allows stakeholders to grasp its foundational value—replacing centralized intermediaries with automated, secure, and transparent systems. This supports lay audiences in understanding blockchain as a "trust technology" rather than merely a cryptocurrency tool. Policy initiatives should include capacity-building programs that simplify blockchain concepts for SMEs, operators, and tourism regulators. Theme 3 and 4 capture innovative deployments such as loyalty tokenization (e.g., Qiibee, Winding Tree) and sustainability tracking (e.g., TripEcosys), highlighting global case studies that demonstrate blockchain's versatility in improving service delivery and compliance. Policy frameworks should support regional experimentation (e.g., sandboxes) to test blockchain tourism models and fund pilot programs for green tourism verification systems.

Table 2. Thematic Analysis- Themes selection

Themes	Description	Sub-Themes	Sources
Theme 1: Decentralized Trust and Disintermediation	A prominent theme in the literature is the shift from centralized trust mechanisms—typically reliant on intermediaries such as online travel agencies (OTAs), toward decentralized trust networks enabled by blockchain. This trust shift allows for disintermediation, reducing costs and increasing transparency in tourism	Peer-to-peer transactions in accommodation and travel booking

Smart contract enforcement without third-party oversight

Cost reduction and pricing transparency | Rashideh (2020) argues that blockchain's elimination of intermediaries can significantly reduce transaction costs and improve operational efficiency in tourism platforms.

Calvaresi et al. (2018) emphasize blockchain's role in building algorithmic trust that replaces |

	services		centralized platforms like TripAdvisor. Nam et al. (2021) highlight the impact of smart contracts in reducing friction between suppliers and customers.
Theme 2: Enhanced Data Integrity and Security	Blockchain introduces immutability and end-to-end traceability, ensuring that data—including traveler reviews, credentials, and supply chain information—cannot be tampered with. This enhances the reliability of digital interactions and safeguards user privacy.	Immutable review systems Identity authentication and e-visa processing Cybersecurity in cross-border tourism	Fosso Wamba et al. (2020) stress that the immutable nature of blockchain ensures accountability in supply chain transparency. Yli-Huumo et al. (2016) suggest that secure data records can prevent manipulation of customer feedback and identity fraud. Sharma et al. (2021) underscore how blockchain secures digital identities, reducing repetitive documentation and enhancing user convenience.
Theme 3: Service Innovation and Loyalty Program Interoperability	Blockchain facilitates service innovation by enabling seamless integration of customer-facing applications such as loyalty and rewards programs, real-time travel data management, and token-based incentive mechanisms.	Cross-platform loyalty systems Smart tourism through real-time data Blockchain-based reward ecosystems	Saberi et al. (2019) describe how tokenization allows for decentralized loyalty programs that can be used across multiple vendors, enhancing customer experience. Joo et al. (2020)

			examine real-time applications such as TravelChain that merge trip data, customer feedback, and reward systems. Kizildag et al. (2019) discuss how blockchain contributes to the smart tourism ecosystem by supporting agile and adaptive service platforms.
Theme 4: Sustainability and Ethical Tourism	Sustainable tourism practices increasingly benefit from blockchain's ability to verify and track green credentials. From certifying eco-lodges to documenting carbon offsets, blockchain supports environmental transparency and responsible tourism.	Carbon footprint tracking and reporting Verification of sustainability certifications Fair-trade tourism documentation	Xu et al. (2022) show that blockchain helps trace eco-friendly services and green supply chains, enabling environmentally conscious consumer choices. Morabito (2017) emphasizes that blockchain can record carbon offsets and renewable energy use in tourism transport. Erceg et al. (2020) illustrate how ethical labor and sourcing practices in hospitality can be verified using decentralized ledgers.

Source: Author's own calculation

Despite its promising potential, integrating blockchain technology into the tourism industry faces several challenges. One major barrier is scalability. As Zeng et al. (2022) highlight in Current Issues in Tourism, blockchain's decentralized structure can lead to slower transaction speeds compared to centralized systems, particularly in large-scale tourism operations involving numerous transactions. This can affect efficiency and user experience. Additionally, adopting blockchain demands significant investments in infrastructure, technical expertise, and ongoing maintenance, which may be financially and operationally burdensome for smaller tourism businesses.

Another critical challenge lies in the regulatory environment. Blockchain regulations vary widely across countries, creating uncertainty and complexity for tourism operators aiming for global implementation. Kumar and Verma (2021) in Tourism Management emphasize that navigating these inconsistent legal frameworks can pose significant hurdles, potentially delaying or discouraging blockchain adoption. Addressing scalability, cost, and regulatory issues is essential for blockchain to realize its full potential in transforming the tourism sector worldwide.

Discussion

The integration of blockchain technology in tourism offers significant benefits, including decentralizing trust, reducing reliance on intermediaries, and increasing transparency across bookings, loyalty programs, and sustainability verification. These features can enhance customer confidence and operational efficiency by providing secure, tamper-proof records and enabling direct peer-to-peer interactions. Additionally, blockchain's ability to track carbon offsets and ethical certifications supports the growing demand for responsible and sustainable tourism practices, aligning the industry with global sustainability goals.

However, challenges remain that hinder widespread adoption. Scalability issues cause slower transaction speeds in large-scale operations, while high infrastructure costs and technical expertise requirements limit accessibility for smaller businesses. Regulatory fragmentation across countries adds complexity, creating uncertainty and legal hurdles for global implementation. Addressing these barriers through international cooperation, supportive policies, and scalable solutions is essential. Future research should emphasize practical pilot studies and stakeholder collaboration to evaluate blockchain's long-term socio-economic impacts and foster a more transparent, efficient, and sustainable tourism ecosystem.

Conclusion

Blockchain holds transformative potential in decentralizing tourism services and empowering both providers and consumers. Yet, its success hinges on coordinated governance, technological adaptation, and inclusive design. Future research should focus on longitudinal studies evaluating blockchain's socio-economic impacts, particularly in emerging destinations.

The themes reveal both value (e.g., transparency, innovation, ethical verification) and challenges (e.g., energy use, technological readiness, legal ambiguity). A socio-technical systems view emphasizes that successful blockchain adoption depends not only on the tech stack but also on user acceptance, governance, and institutional alignment. Future research should use mixed methods (e.g., stakeholder interviews + pilot implementation) to evaluate blockchain feasibility in tourism destinations. Policy should promote interoperable

standards and international collaboration to address cross-border legal uncertainties. This thematic analysis highlights blockchain's potential to address long-standing challenges in tourism, from transactional opacity and data insecurity to fragmented loyalty systems and greenwashing. While implementation barriers persist, particularly among SMEs and in developing regions, a supportive policy environment and stakeholder collaboration can unlock blockchain's transformative potential. This research contributes to a deeper understanding of how decentralized systems can reshape the tourism ecosystem toward a more trustworthy, efficient, and sustainable future.

The successes and challenges faced by early adopters of blockchain in tourism provide valuable lessons for those considering implementing the technology. The findings highlight that Blockchain technology can bring a higher level of transparency to supply chains in tourism, tracking emissions, improving social welfare reputation, and reducing fraud related to data security. This demonstrates the potential for blockchain to enhance sustainability and ethical practices. This study also identified critical challenges, including the necessity for scalable and energy-efficient Blockchain solutions, along with the imperative to address legal and regulatory impediments. These challenges must be addressed to ensure the successful adoption of blockchain in tourism. There exist big dilemmas in tourism and hospitality industry dealing with the disruption in its value chain which requires blockchain technology to smoothen its value network. This highlights the need for careful planning and coordination to integrate blockchain into existing systems.

Blockchain technology holds significant promise for transforming the tourism industry by decentralizing trust, enhancing transparency and security, and improving operational efficiency. Its ability to reduce reliance on intermediaries could lead to a more democratized and customer-centric service ecosystem. However, challenges related to scalability, regulatory issues, and infrastructure investment remain. Future research should focus on overcoming these challenges and exploring the full potential of blockchain in creating a sustainable, efficient, and transparent tourism ecosystem.

Declarations

All authors declare that they have no conflicts of interest.

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