Perceptions and challenges of blockchain adoption in tourism industry: A study on trust, privacy, and security

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Abstract

Purpose: This study investigates the perceptions of service providers in the travel and hospitality industry towards the adoption of blockchain technology (BCT), focusing on its impact on consumer experiences and expectations, especially in terms of trustworthiness and the management of privacy and security concerns.

Design/methodology/approach: The research employed a quantitative methodology, collecting data from 135 industry practitioners across five tourism sectors (lodging, connected industries, entertainment, FandB, transportation) in Europe. This approach aimed to understand the diverse perspectives on the benefits and challenges of implementing BCT in their operations.

Findings: The results indicate mixed perceptions regarding blockchain adoption. While there are positive views on BCT's potential to enhance customer experience and service quality, there are significant concerns about its impact on trust and security. A consensus exists between customer and provider perspectives on BCT's trustworthiness, but significant differences were observed in views on privacy and security enhancement.

Originality: This research contributes to the existing literature by providing insights into the service providers' and customers' perspectives on blockchain technology within the travel and hospitality industry. It underscores the complexities of adopting new technologies and calls for more in-depth studies to address the identified concerns, thereby offering a novel viewpoint on the adoption of distributed ledger technologies in enhancing customer experience and service delivery.

Keywords

Introduction

Tourism is a global driver of socio-economic growth, and it is expected to make GDP to increase at an average rate of 5.8% annually between 2022-2032, outstripping the 2.7% growth rate for global economy, and creating 126 million new jobs within the next decade (WTTC, 2022). Currently, emerging technologies like big data, blockchain technology (BCT), artificial intelligence (AI), and the growth of the platform economy are introducing new business models that aim to enhance customer experience, addressing both potential and ongoing customer interactions (Shen *et al.*, 2020). With implementation of emerging technologies, the communication channel shifted from

being a marginal driver to being the key market-enabler, allowing tourism companies to gather

large amounts of consumer data and design better market offerings (Buhalis *et al.*, 2023).

Technological advances are changing the power dynamics, shifting control from companies to

consumers (Ozdemir *et al.*, 2023), and enabling the increasing participation of different

stakeholders in the co-creation of value across different industries. Within this context, the tourism

sector is proactively investing in new technologies. The goal is to attract tourists by competing in

areas such as enhancing trust in services, improving customer experiences, and offering competitive

pricing and quality across all tourist-related activities (Clohessy *et al.*, 2020).

Unlike AI or big data, which are symbols of cutting-edge technologies representing the fifth

industrial revolution (Sharma *et al.*, 2024), BCT is ambiguous since little is known about the

services that customers can experience (Saraf *et al.*, 2024). Previous studies have primarily

concentrated on the challenges associated with implementing BCT, highlighting numerous

obstacles to its adoption despite the perceived benefits recognized by stakeholders (Toufaily *et al.*,

2021). When faced with the complexity and variety of BCT and cryptocurrencies, both providers

and users might prefer to stick with systems they already know well. Bridging the gap between

stakeholders to facilitate the acceptance of BCT-based innovations in everyday life is thus a critical

area of interest for academic research. Despite being labeled as a disruptive innovation, attitudes

and perceptions towards BCT use need significant enhancement (Chang *et al.*, 2022). Consequently,

there's a pressing need for more research to fully understand BCT's implications. While certain

studies have explored BCT's potential advantages in the tourism and hospitality sector (Jain *et al.*,

2023), concerns regarding customer experience, trust, and the security/privacy associated with BCT

might impede its broader acceptance in this industry. Additionally, Jain *et al.* (2023) and Dadkhah

et al., (2022) highlight a general lack of awareness and understanding about BCT among

stakeholders in tourism and hospitality, which could further obstruct its uptake.

Leveraging a multi-theoretical approach, this study aims to uncover whether the adoption of

BCT can significantly enhance the quality of customer experience (CEQ) in various tourism service

sectors including lodging, connected industries, entertainment, food and beverage, and transportation. Furthermore, it investigates if BCT can address the critical concerns of trust, privacy, and data security, which are identified as the foundational pillars for its adoption within the tourism industry. To the best of our knowledge, this is the inaugural effort to compare the perceptions of service providers with customer expectations regarding these issues, marking a significant contribution to existing literature. This dual-perspective analysis considers the different roles played by the same individuals in the tourism sector, as highlighted in prior research (de Lima *et al.*, 2020) and, particularly, the significance of examining service providers' insights into tourists' expectations (Hung *et al.*, 2015). The primary goal of this research is to empirically assess the impact of BCT on key aspects of tourism services—customer experience quality, trust, privacy, and data security—by gathering and contrasting perceptions from both tourism service providers and customers. Tourism providers can use these insights to better integrate BCT into their operations, aligning services more closely with customer expectations. BCT stands out for its potential to revolutionize service quality and operational efficiency and, therefore, this alignment can lead to greater customer satisfaction and a competitive edge in the market, illustrating the broader applicability of BCT beyond theoretical advantages to tangible improvements in service delivery. The significance of this research stems from the critical need to address the prevalent issues such as data breaches, fraudulent transactions, and lack of transparency that undermine customer trust and satisfaction in the tourism sector. Existing literature has highlighted numerous obstacles to BCT adoption (Happy *et al.*, 2023), yet there is a pressing need for empirical studies that delve into both customer and service provider perspectives. Unlike previous studies, this paper uniquely contributes by comparing these dual perspectives, providing a comprehensive view of the potential and challenges of BCT in enhancing customer experience and service quality. Moreover, this research differs from existing literature by offering an in-depth analysis of the distinct perceptions regarding BCT's impact on trust, privacy, and security within the tourism industry.

Literature review

Blockchain in Tourism: Bridging Privacy, Trust, and Experience

Over recent decades, the tourism industry has progressively turned to information and communication technologies (ICT) to create value propositions centered around customers (Hsieh and Chuang, 2020). The COVID-19 pandemic has accelerated the integration of ICT into the daily operations of both businesses and customers, highlighting the role of emerging technologies in modern business practices. Despite its nascent state (Önder and Gunter, 2022), BCT demonstrates potential as a future mainstream technology in tourism, offering substantial improvements in privacy and security, customer experience quality, and trust, surpassing the capabilities of existing digital solutions (Marikyan *et al.*, 2022). However, the perception of these benefits can vary significantly between customers and providers of tourism services. This discrepancy frequently stems from the diverse objectives of stakeholders in the tourism industry (Amore and Hall, 2016) or from providers' limited interest in understanding customers' expectations regarding service quality.

The literature presents various perspectives on BCT's potential in the tourism industry. While some studies emphasize the enhanced security and trust BCT can provide (Marikyan *et al.*, 2022), others point out the practical challenges and cost implications of its implementation (Thees *et al.*, 2020). This dichotomy highlights the necessity for a nuanced understanding of BCT adoption from both customer and provider perspectives. Tourism providers and customers face opportunities and challenges differently, including transaction processing, customer database management, operational cost reduction, cycle time reduction, risk minimization, creation of new revenue opportunities, and capital cost reduction, among other applications (Thees *et al.*, 2020). This situation underscores the importance of deepening our understanding from both the customer and provider perspectives, especially regarding the enhancement of privacy/security, customer experience quality, and trust—identified as the three main benefits and challenges of BCT implementation (Marikyan *et al.*, 2022) —.

Recent literature on BCT adoption in the tourism and hospitality industry spans various themes and factors (Jain *et al.*, 2023). The concept of smart tourism has experienced significant

development due to its potential to reduce reliance on intermediaries between tourism businesses and travelers (Rashideh, 2020). Specifically, the decentralized nature of BCT has allowed for the elimination of third-party travel agencies, leading to the emergence of new architectures and conceptual models that directly connect tourists with service providers (Tyan *et al.*, 2020). Understanding travelers' perceptions, behaviors, and attitudes has become crucial in determining their interest in adopting new technologies and driving further diffusion in the sector (Treiblmaier, 2022). In addition to traveler-centric themes, several studies have been conducted on BCT implementation and adoption in the tourism and hospitality sector. These studies aim to uncover different drivers, critical barriers, threats, challenges, paradoxes, and misunderstandings related to BCT (Irannezhad and Mahadevan, 2021; Önder and Gunter, 2022). However, there is a notable gap in the literature concerning comprehensive theoretical frameworks that can explain the varied adoption rates and practical applications of BCT in different contexts.

Moreover, token economy and digital payments have also emerged as prominent themes in the existing literature within the field of study (Irannezhad and Mahadevan, 2021). These themes have added further depth to the exploration of BCT's potential impact on the tourism and hospitality industry. Regarding theoretical approaches, the Technology Adoption Model, the Unified Theory of Acceptance and Use of Technology, Diffusion of Innovation Theory, and Social Cognitive Theory have been widely used to explore technology adoption from both the customers' and suppliers' viewpoints (Park *et al.*, 2023). Yet, it is crucial to recognize that while BCT has the potential to be revolutionary, its widespread acceptance in businesses remains uncommon, in contrast to its successful applications in the public domain of tourism and hospitality. This gap has resulted in confusion and mixed expectations about BCT's effectiveness (Jain *et al.*, 2023). In summary, the literature highlights the potential applications and benefits of BCT in the tourism industry, but some significant challenges and discrepancies in stakeholder perceptions remain. This paper focuses on addressing these gaps, particularly by applying robust theoretical frameworks to explore the dynamics of BCT adoption and its impact on both providers and customers in the tourism sector.

Theoretical Background

Recognizing that a single theory may not fully capture the dynamics of provider and customer behavior towards BCT, this research utilizes a multi-theoretical framework to enrich the understanding and response to the identified lack of strong theoretical foundations in BCT literature (Jain *et al.*, 2023). Specifically, this research draws upon the Resource-Based View (RBV - Barney, 2001), Institutional Theory (IT - DiMaggio and Powell, 1983), Protection Motivation Theory (PMT - Menard *et al.*, 2017), and Trust Transfer Theory (TTT – Stewart, 2003), along with the Diffusion of Innovation Theory (DIT - Rogers, 2003), the Unified Theory of Acceptance and Use of Technology (UTAUT - Venkatesh *et al.*, 2003), and the Social Cognitive Theory (SCT - Bandura, 1986). The Theory of Reasoned Action (TRA) is excluded due to its limited scope in addressing emotional aspects of behavior prediction in the context of BCT for privacy and security issues. Instead, the focus on theories that offer insights into customer experience, trust, and decision-making processes regarding privacy and security within the BCT adoption context were explored. RBV and DIT examine the competitive advantages of BCT in enhancing customer experience quality (CEQ), while UTAUT and SCT explore user adoption intentions. IT and TTT are utilized to analyze trust, and PMT addresses how privacy and security concerns influence decision-making. By combining these theories, the study provides a more comprehensive understanding of BCT adoption, considering both technological and human factors. Our study seeks to address the limitations identified in previous studies on BCT which only offer valuable insights into its potential and challenges, primarily on the technological aspects, but neglecting both the human and organizational factors (Demirel *et al.*, 2022) and the empirical validation in sectors such as tourism.

Blockchain Technology and Trust

The impact of BCT on trust, according to research applying IT theory to tourism businesses of all sizes (Treiblmaier, 2022), shows a positive link between institutional norms and trust. This encompasses trust derived from knowledge sharing within institutions (institution-based trust) and

trust in technology functioning as expected (technology-based trust) (Yavaprabhas *et al.*, 2022).

Despite its extensive discussion in technology adoption, trust lacks a unified definition. In this

study, trust is understood as one party's openness to being influenced by another, expecting the

latter to act in a way important to the former, regardless of oversight capabilities (Mayer *et al.*,

1995). For service providers, drawing on IT and RBV theories, trust in BCT is crucial and relates to

their control over its architecture, operation, and auditability (Naef *et al.*, 2022). This perspective

aligns with previous findings that emphasize the importance of control and transparency in building

trust in technological systems (Demirel *et al.*, 2022). BCT's shift from trusting platform providers to

trusting algorithms raises questions about whether it genuinely creates a more trustworthy

environment or merely shifts control from traditional authorities to algorithms (Demirel *et al.*,

2022). From the customer's perspective, TTT theory suggests that BCT-based systems, perceived as

secure for private data and transparent, can foster trust, potentially shifting from personal trust to

trust in BCT (transaction and information security) (Stewart, 2003). BCT's positive evaluation by

users suggests a transfer of trust across different contexts (Shao *et al.*, 2022). However, this transfer

of trust can be contingent upon users' familiarity and comfort with the technology, which may vary

significantly (Naef *et al.*, 2022). In summary, by leveraging the principles of IT and TTT theories,

perceptions of trustworthiness in BCT-enabled environments could align between providers and

customers, enhancing user confidence and engagement (Tan and Saraniemi, 2023).

Hence, the study proposes the following null hypotheses regarding the reliability and trust in BCT:

> H1a. There is no difference on the perception of providers vs customers of tourism services
>
> concerning the impact of BCT on the enhancement of reliability in tourism services.
>
> H1b. There is no difference on the perception of providers vs customers of tourism services
>
> concerning the impact of BCT on the enhancement of trust in transaction and
>
> information in tourism services.

Blockchain Technology and Quality

Marketing practices have evolved from focusing on product sales to fostering customer relationships and now to crafting comprehensive customer experiences. The concept of CEQ emphasizes cognitive and emotional aspects of the service provider-customer interaction, including peer-to-peer exchanges (Ali *et al.*, 2016). CEQ is seen as the sensory engagement customers expect from a service (Pine and Gilmore, 2011), encapsulating the emotions generated by an encounter as a bundle of sensory memorabilia. This emotional and hedonic dimension typically leads to positive outcomes like customer satisfaction (Qiu *et al.*, 2020).

From a provider's standpoint, leveraging the RBV and the UTAUT theories, achieving a sustainable competitive edge in technology necessitates both the requisite technological infrastructure and professionals skilled in BCT across the tourism sector (Chang *et al.*, 2022). BCT promises to transform the tourism value chain into a seamlessly coordinated network, enhancing tourist experiences and ensuring optimal capacity utilization without overbooking (Rashideh, 2020). This transformation is critical for improving operational efficiencies and customer satisfaction (Wang *et al.*, 2019). The RBV theory also underscores the critical role of technology in delivering superior services and strengthening customer relationships (Wang *et al.*, 2019), suggesting a positive outlook from providers on the impact of BCT on CEQ. From the customer's perspective, the DIT, SCT and UTAUT theories suggest that BCT, as an innovative technology, could improve the tourism experience by providing customers more control over their travel experiences through interactive platforms (DIT), enabling the sharing of travel experiences with integrity (SCT), and offering personalized services with enhanced security and efficiency (UTAUT) (Chang *et al.*, 2022). Thus, customers are expected to view BCT as beneficial for enhancing their tourism experiences because this technology may enhance service personalization and security (Chang *et al.*, 2022). In summary, theoretical foundations -RBV, DIT, UTAUT, and SCT theories- and empirical evidence supports that BCT may fundamentally transform service delivery by improving transaction transparency, reducing fraud, and enhancing data security. These improvements not only streamline operations for providers but also foster a higher level of trust and satisfaction among customers, creating a more

robust and reliable service ecosystem (Casino *et al.*, 2019). Consequently, the following null

hypotheses are proposed:

> H2a. There is no difference on the perception of providers vs customers of tourism services
>
> > quality concerning the impact of BCT on the enhancement of customer experience in
> >
> > these services.
>
> H2b. There is no difference on the perception of providers vs customers of tourism services
>
> > quality concerning the impact of BCT on the enhancement of customer satisfaction in
> >
> > these services.

Blockchain Technology and Security and Privacy

BCT is designed with inherent security features like consistency, tamper-resistance, and protection

against various cyber-attacks, while also offering pseudonymity and preventing double-spending

(Zhang *et al.*, 2019). However, BCT is not immune to security threats within peer-to-peer networks.

BCT's approach to data privacy allows users to transact using pseudo-identities, though security

breaches could compromise anonymity and privacy (Zheng *et al.*, 2018). For tourism providers,

integrating BCT poses challenges due to potential security and privacy concerns. Despite BCT's

robust security properties and advancements like Proof of Work or Proof of Stake algorithms

enhancing system security, providers must navigate varied global data protection regulations

(Hammi *et al.*, 2018). From the customers' perspective, their belief in BCT's privacy protection

impacts their trust and adoption intentions -PMT theory- (Marikyan *et al.*, 2022). Given that BCT's

privacy-by-design and robust encryption techniques afford considerable privacy benefits

(Treiblmaier, 2020), customers are expected to view BCT adoption positively in terms of privacy,

although they acknowledge the necessity for enhanced security against digital threats in

decentralized networks (Zhang *et al.*, 2019). Based on PMT, while tourism service providers and

customers might agree on BCT's privacy benefits, their views on its security solutions could differ.

Therefore, it is anticipated that the research findings will not support the H3a null hypothesis

regarding uniform perceptions of BCT's impact on security solutions, but will support H3b,

suggesting agreement on its privacy benefits.

H3a. There is no difference on the perception of providers vs customers of tourism services

concerning the impact of BCT on the enhancement of security in these services.

H3b. There is no difference on the perception of providers vs customers of tourism services

concerning the impact of BCT on the reduction of privacy issues in these services.

While the existing theoretical background provides a comprehensive view, there is room for clearer

connections to the current study objectives. Previous research highlights the potential of BCT in

improving trust and customer experience but often lacks empirical validation in the context of

tourism. By critically analyzing these studies and integrating insights from multiple theories, this

study aims to address these gaps. Additionally, a thematic organization of the literature review

could build a more persuasive argument for the study, categorizing the discussion into themes like

trust, quality, security, and privacy. This approach will help in clearly delineating how each

theoretical framework contributes to the understanding of BCT's impact on these dimensions,

providing a robust foundation for the paper's research questions and methodology. The limitations

of existing empirical studies, such as their narrow focus on specific technological features or the

generalizability of their findings across different sectors, underscore the need for a more holistic

approach that this study seeks to provide.

Figure 1

Methodology

This study used a self-administered English questionnaire to collect data for testing research

hypotheses. Surveys were chosen for their ability to facilitate quantitative analysis, leading to

generalized findings. Ensuring a representative and unbiased sample through random selection was

crucial (Crotts *et al.*, 2008). The survey, based on prior studies about attitudes towards BCT in

tourism (Chang *et al.*, 2022; Kvakarić, 2022), consisted of three major areas evaluating enhancing

customer experience, 10 questions adopted from Albayati *et al.* (2020), Demirel *et al.* (2022),

Inkson and Minnaert (2022), and Ozdemir *et al.* (2023). The section focused on Privacy and Security, with adopted scales from Chan *et al.* (2022), Tyan *et al.* (2020) and Zhang *et al.* (2019). And lastly the third section focused on Trust, with scales adopted from Treiblmaier (2020), Irannezhad and Mahadevan (2021) and Chan *et al.* (2022). The questionnaire defined all the key concepts (customer experience, trust, security, privacy and so on) and used yes/no questions to offer simplicity and clarity, thereby reducing respondent burden and enhancing data quality. This binary format facilitates straightforward coding and efficient quantitative analysis, crucial for testing our research hypotheses on BCT adoption and impact. Such questions align well with inferential statistical methods, ensuring robust and reliable outcomes (Dillman, *et al.*, 2014) -see Appendix 1 for details-. The survey targeted representatives from companies in five tourism subsectors (lodging, connected industries, entertainment, FandB, transportation) across Europe, using non-probability random sampling due to the lack of a comprehensive respondent list (Garg and Kumar, 2021). The Orbis4Europe (2024) database was used to identify companies within the EU-28 region (including UK firms prior to Brexit) involved in the hospitality and tourism sectors. Following the EU recommendation 2003/361, we specifically targeted the largest companies—those with over 250 employees—who are more likely to invest in innovation, as indicated by their Research and Development (RandD) expenditure. This approach was informed by the RandD ranking of the top 1000 companies in the EU and UK published by the European Union (Grassano *et al.*, 2020), resulting in a preliminary selection of 166 companies for the current study due to their potential for blockchain technology adoption.

The survey respondents were official representatives from these selected companies, chosen for their experience, knowledge on the subject, and willingness to participate in the study. Data were collected from October 2020 to September 2022, resulting in 135 valid questionnaires after excluding incomplete responses. These were coded in SPSS 28 and analyzed using descriptive and inferential statistics. The sample selection and survey design aimed to reduce common method bias (CMB) (MacKenzie and Podsakoff, 2012). Respondents considered different roles' perspectives (de

Lima *et al.*, 2020), especially regarding service providers' insights into tourists' expectations (Hung *et al.*, 2015). Despite criticisms of Harman's Single-Factor Test for inadequately controlling CMB, it remains widely used, particularly when a single factor accounts for over 50% of variance (Fuller *et al.*, 2016). In our study, the Total Variance Explained for each construct (customer experience, privacy and security, and trust) was below 50% -see Appendix 2-, indicating minimal bias. Significant differences in median values between groups were identified using contingency table analysis and the Mann-Whitney U test (Henseler *et al.*, 2016).

Results

Sample Description

The final sample included 135 respondents (response rate 81.32% of total sample selection). Most respondents were male (61%), with females constituting 35%, and 4% not disclosing their gender. Age-wise, the largest group was those between 50-60 years (37%), followed by those aged 40-50 years (24%). A significant proportion of the respondents (73%) held a university degree, with 25% having completed high school. Degrees were further broken down into Bachelor's (27%), Master's (36%), and PhD (2%), with some respondents not disclosing their educational background. Respondents represented various sectors within the tourism industry, with 36% from the accommodation sector, 41% from connected industries, 13% from the entertainment sector, 4% from food and beverage, and 7% from transportation. Most respondents had more than 5 years of job experience (62%), indicating a survey population with significant industry insight and professional longevity. Further details may be found in Table I.

Table I

Hypotheses Testing

The findings presented in Table II indicate a generally negative perception of BCT's ability to enhance transparency and trust (low standard deviation scores), with median values of 0 reported

by 68% and 78% of respondents for reliability and trust in transactions and information (consumers) and 62% of providers, respectively. Conversely, both groups exhibit a positive outlook on BCT's potential to enhance customer experience and service quality (low standard deviation scores), with 86% and 81% approval rates, respectively, and a modal and median score of 1. An overwhelming 83% of providers believe BCT can improve service quality which may positively affect customer experience and satisfaction. Despite concerns from 62% of customers about BCT's security, 78% do not view it as posing privacy risks, suggesting a distinction between concerns over security vulnerabilities and confidence in data privacy protection. In contrast, 83% of providers maintain a positive stance on BCT's security and privacy capabilities, underscoring differing perspectives between customers and service providers regarding BCT's implementation in tourism services.

Table II

Hypothesis testing using Mann-Whitney U tests revealed that there is no significant difference in how customers and providers view the role of BCT in enhancing the reliability, transparency, and auditability of tourism services (H1a, p=0.182), despite a general skepticism regarding BCT's effectiveness in these areas. However, a significant difference was observed between customer and provider perceptions of BCT's capacity to enhance trust in transactions and information, as opposed to its impact on enhancing service transparency and auditability (H1b, p=0.038) -BCT's trustworthiness-, with providers expecting more negative perceptions from customers than their own.

Despite positive perceptions on BCT's potential to enhance CEQ, statistical tests did not find these differences to be significant (H2a, p=0.048 and H2b, p=0.042). This suggests nuanced opinions exist between customers and providers, although they are closely aligned in recognizing BCT's impact on improving the customer experience in tourism services.

Significant differences between customers and providers were also found in views on BCT's impact on privacy (H3b, p=0.024) and security (H3a, p=0.002) enhancement in tourism services. While customers have concerns about the security of BCT systems, they believe BCT will protect their personal data. Providers, on the other hand, see BCT as a means to mitigate both security and privacy issues. Despite differing views on security, both groups agree on BCT's positive impact on privacy.

The generally negative perception of BCT's ability to enhance trust suggests a lack of understanding or familiarity with the technology among both customers and providers, highlighting the need for better education and communication about its benefits. Conversely, the strong positive perception of BCT's potential to enhance CEQ indicates that both groups see clear, tangible benefits, driven by expectations of streamlined operations and personalized interactions. The mixed perceptions on security and privacy reflect a nuanced understanding among customers, who differentiate between systemic security risks and data privacy protections, while providers view BCT as a comprehensive security solution. Addressing these specific concerns and expectations is crucial for broader acceptance and successful implementation of BCT in the tourism sector, allowing stakeholders to capitalize on its strengths and work towards a more trusted and secure tourism environment.

Discussions and Conclusions

Drawing on Hung *et al*. (2015) and de Lima *et al.* (2020), this study explored the dual perspectives of service providers and customer expectations on the potential of BCT in tourism services, focusing on trust (reliability, transaction, and information trust), customer experience quality, and security and privacy issues. The empirical findings predominantly do not support the hypotheses, except for H1a. This exception indicates that service providers recognize a discrepancy between the impact of BCT on customer perceptions and its impact on operational processes within tourism businesses, such as technological enhancements. Specifically, H1a was accepted, illustrating a mutual skepticism among both providers and customers regarding the reliability of

BCT. Despite the necessity for trust among all participants within the network for successful integration, the inherent need for the BCT system itself to generate trust through its decentralized nodes is highlighted. This skepticism is attributed to several shortcomings of BCT, including inadequate software engineering practices tailored to blockchain development in tourism (Kizildag *et al*, 2019). The slow adoption rate of BCT in the hospitality and tourism sectors is further hampered by the network's inability to efficiently manage the surge in BCT applications, leading to potentially higher transaction costs and strain on BCT infrastructures. These issues are critical, especially given the network's current limitations in processing the high volume of simultaneous transactions typical in hotel and airline bookings. According to TTT theory, improving the reliability of BCT systems in the tourism industry involves more than establishing transparent and auditable frameworks. It also necessitates creating an operating environment that is both familiar and reliable to users. This approach aims to alleviate user apprehension towards novel technologies by fostering trust in BCT's adoption. Casey and Wong (2017) highlight that the complexity of operating environments can obstruct the seamless integration of BCT into business processes, while Venkatesh (2000) notes such complexity may lead to technological anxiety, influencing consumer hesitancy and fear towards new technologies.

H1b was not supported, revealing a divergence between service providers' views and customer expectations. Despite a general distrust towards the transparency and auditability of transactions and information via BCT, it appears customers are more likely to view the trustworthiness of BCT more negatively than providers do. This observation aligns with the IT Theory and corroborates findings by Wamba and Queiroz (2022), which suggest that trust stems not solely from technology but also requires supportive institutional and contextual frameworks. Recent studies have underscored a general mistrust in BCT adoption (Yun and Strycharz, 2023) and a hesitance among businesses to implement BCT in environments where trust is low, as consumers do not see it to enhance product quality or corporate trustworthiness (Biswas *et al.*, 2023). Furthermore, the role of technology-related and usage-related factors in shaping trust is complex,

particularly when users possess limited understanding of BCT's mechanisms (Nejati *et al.*, 2022). Often, perceptions of BCT's ease of use and convenience influence user attitudes more than trust in the technology itself (Balzarova *et al.*, 2022).

H2a and H2b not being supported aligns with recent findings by Belhadi *et al.* (2023), suggesting that the adoption of digital technologies does not automatically lead to increased customer satisfaction and loyalty. This outcome is particularly pronounced at the cognitive and conative levels and is highly dependent on the context of technology adoption. Despite this, current research uncovered a generally positive reception towards BCT implementation in tourism services from both customers and providers, suggesting potential for enhanced service quality and improved customer experience. This optimism might stem from the positive feedback of BCT usage on online platforms, supporting theories such as the RBV theory -advocating for superior service quality through technology-, and the DIT and SCT theories -higher empowerment of customers through technological control of their travel experiences-. Given the ambiguous results related to BCT's impact on service quality, customer experience, and satisfaction—potentially influenced by the varied contexts in which respondents operate—future studies should consider a broader sample across diverse settings to gain more nuanced insights. Additionally, examining the connection between customer experience enhancement and increased satisfaction through sentiment analysis could provide deeper understanding, as the relationship between customer experience levels and satisfaction holds significant implications for both tangible products and tourism services, where repeated usage is common (Wang *et al.*, 2019).

The results indicate that H3a was not supported, revealing a divergence between providers and customers in their perceptions of the security afforded by BCT in tourism services. Providers view BCT as secure, while customers remain skeptical of its security. This discrepancy highlights the importance of customer confidence in online security for enhancing their perception of service providers (Parasuraman *et al.*, 1988). Future studies should investigate why customers may not perceive BCT systems as secure from a technological standpoint.

Similarly, H3b was also not supported, suggesting uniform perceptions between providers and customers regarding a positive BCT's impact on privacy within tourism services. Nevertheless, customers are more likely to see data privacy as a significant benefit of BCT. This finding is consistent with findings of recent research indicating that BCT enhances transparency (Chang *et al.*, 2022; Demirel *et al.*, 2022; Jain *et al.*, 2023), which in turn positively influences customer commitment (Chen *et al.*, 2023). Thus, the study reaffirms PMT theory, anticipating similar views on BCT's role in privacy but differing opinions on its security implications in tourism, extending PMT's applicability to the context of BCT (Marikyan *et al.*, 2022).

The significance of this topic is underscored by research indicating that enhancing service quality directly correlates with increased customer satisfaction (Yang *et al.*, 2016). BCT is anticipated to significantly improve tourists' experiences by facilitating direct interactions between tourism providers and tourists, which are crucial for both service quality and customer satisfaction (Sarpong, 2022). BCT enables tourists to maintain a unique identity on a distributed ledger, showcasing their purchase history and simplifying processes like foreign currency conversion. Furthermore, BCT supports an immutable reputation and rating system, ensuring that review data remains unaltered, thereby enhancing trust in online reviews and aiding tourists in making informed decisions (Kim and Kim, 2020). Such advancements foster a positive perception towards customer satisfaction and loyalty -UTAUT theory-, and are vital for generating positive electronic word-of-mouth (eWOM) (Bulchand-Gidumal and Melián-González, 2023). Additionally, BCT allows tourism providers to dynamically manage inventory across sales points in real-time, ensuring demand alignment. In the hospitality sector, specifically, BCT can link hotel revenue management systems with property management systems to facilitate personalized guest experiences. Consequently, BCT is poised to elevate the quality of services provided to both customers and providers, promising a more efficient, personalized, and satisfying tourism experience.

Theoretical Implications

Drawing on a range of theoretical frameworks -IT, TTT, RBV, DIT, SCT, UTAUT, and PMT theories-, this research makes a significant contribution to the BCT discourse by advancing understanding of BCT implementation in tourism services through the adoption of a dual perspective—customer expectations and service providers' perceptions- regarding key BCT benefits and challenges, including privacy/security enhancement, CEQ, and trust development. TTT underscores the necessity of establishing transparent, auditable, and user-friendly BCT systems to foster trust among users, highlighting the importance of creating an operating environment that is both familiar and reliable to mitigate apprehensions towards new technologies. The IT theory builds upon this by proposing that trust in BCT extends beyond the technological aspects to encompass the institutional and contextual frameworks within which it is implemented, addressing the observed hesitancy among firms to adopt BCT in environments characterized by distrust. Moreover, the study supports PMT by showing consistent perceptions on privacy implications of BCT, while uncovering divergent views on its security implications, thereby broadening PMT's relevance to BCT in tourism. Concurrently, findings resonate with RBV's assertion regarding the role of technology in enhancing service quality, and with DIT and SCT's insights into the empowerment of consumers through technological solutions, as supported by the positive perceptions aligned with UTAUT. These collective theoretical insights contribute to a nuanced understanding of how trust, privacy, security, and customer experience concerns shape the adoption and perception of BCT in the tourism and hospitality sector. This work illuminates the complexities of implementing BCT and underscores the importance for service providers to foster environments that are perceived as both secure and privacy-preserving, thereby nurturing trust and enhancing the customer experience. This research thus offers a significant contribution to the existing body of knowledge on BCT, providing a foundation for future studies and practical applications aimed at harnessing the potential of BCT to improve the tourism and hospitality industry.

Practical Implications

BCT adoption in tourism reveals varied perspectives across finance, IT, and hospitality sectors. Finance emphasizes security and transparency, while hospitality faces implementation and trust challenges. IT literature focuses on technological aspects crucial for widespread adoption. This multifaceted nature necessitates tailored strategies for each sector. Practically, BCT adoption in tourism implies operational changes, enhancing transparency and security. It builds customer trust through verifiable transactions and reviews, streamlines financial operations, and reduces intermediary reliance. This creates a more reliable tourism ecosystem, benefiting both businesses and travelers. BCT addresses sector-specific issues like fraud prevention, intermediary reduction, and foreign currency risks. It optimizes operational efficiency and customer satisfaction by integrating the tourism value chain. Implementing transparent booking systems and enhancing security features can significantly improve trust in the system. Successful BCT implementation in tourism requires educating stakeholders, starting with pilot projects, and ensuring regulatory compliance. This approach can lead to a more efficient, secure, and user-friendly tourism industry.

Limitations and Future Research

This research, while providing valuable insights into the use of BCT in the tourism sector, has several limitations. The study's focus on European companies and the sample size limits the generalizability of the findings, suggesting the need for broader, global research to capture regional differences in BCT adoption. The methodology involving participants in dual roles may introduce biases, and future studies should consider separate samples for service providers and receivers for a more nuanced understanding. Additionally, the quantitative approach used may not fully capture the complexity of perceptions toward BCT; qualitative methods could offer deeper insights. The statistical methods used do not account for potential confounding variables, which may limit the findings' generalizability. Future research should employ larger and more diverse samples, and stratified sampling to enhance representativeness. While the multi-theoretical framework is a strength, its complexity may complicate findings; future studies might focus on a single theoretical lens or clearly delineate each theory's contributions. Incorporating moderators such as participants'

BCT knowledge and prior experience could provide richer insights and address gaps between

customer expectations and provider perceptions. Generalizing these results should be approached

with caution due to the demographic composition and sector distribution within the sample.

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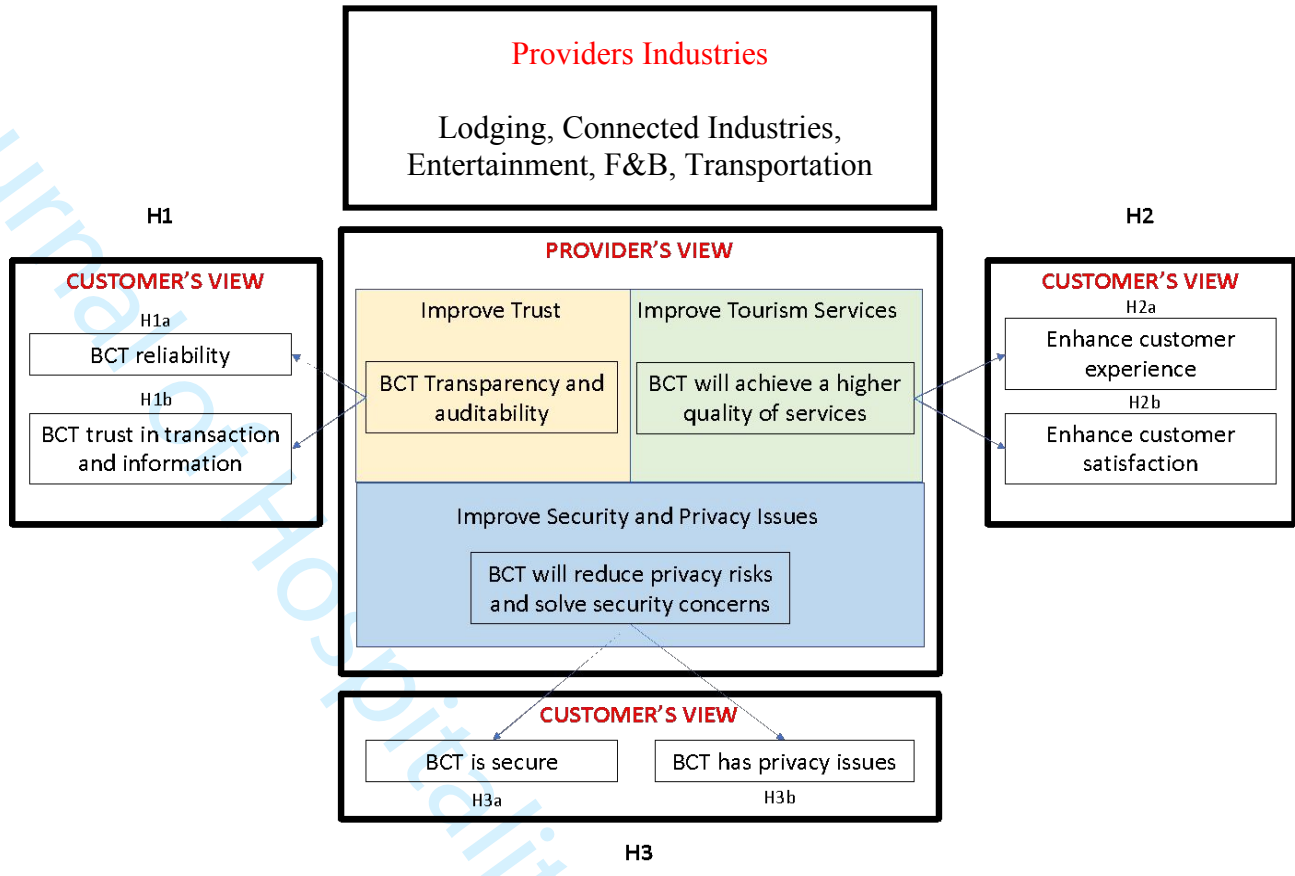
Figure 1. Conceptual Model

Table I. Demographics

Percentage			Frequency	Percentage
Gender		Company		
Female	35%	**Accommodation**	**49**	**36%**
Male	61%	*Hotels*	*40*	
Not disclosed	4%	*Farmhouse accommodation and Agri-tourism*	*6*	
		Shared accommodation	*2*	
Age		*Bed and breakfast*	*1*	
20-30 years	7%	**Connected industries**	**55**	**41%**
30-40 years	19%	*Educational services*	*2*	
40-50 years	24%	*Financial services*	*1*	
50-60 years	37%	*Tour operators*	*23*	
older than 60 years	14%	*Tourism organizations*	*12*	
		Travel agents	*17*	
Education		**Entertainment**	**17**	**13%**
Lower than High School	2%	*Tourist guides & tours*	*15*	
High School	25%	*Tourist information*	*2*	
University Degree	73%	**Food and Beverage**	**5**	**4%**
		Bar & Cafés	*1*	
		Restaurants	*3*	
		Catering	*1*	
		Transportation	**9**	**7%**
		Coach services	*2*	
		Airline industry	*5*	
		Railway	*2*	

N=135

Table II. Descriptive statistics of the data and Mann-Whitney U test results.

	Items	N	Modal value	Median	Frequency - No- (%)	Frequency - Yes- (%)	Standard Dev.	Hypothesis	Items	Obs.	P. value
									BCT Reliability	110	
	BCT reliability	110	0	0	75 (68%)	35 (32%)	0.47	**H1a**	BCT Transparency and Auditability	110	0.182
Customer's expectations									BCT Trust in transactions and information	110	
	BCT trust in transaction and information	110	0	0	86 (78%)	24 (22%)	0.41	**H1b**			0.038
									BCT Transparency and Auditability	110	
Provider's view	BCT transparency and auditability	110	0	0	68 (62%)	42 (38%)	0.49				
									BCT Enhance customer experience	56	
	BCT enhances customer experience	56	1	1	8 (14%)	48 (86%)	0.35	**H2a**	BCT Achieve a higher quality of services	52	0.048
Customer's expectations									BCT Enhance customer satisfaction	54	
	BCT enhances customer satisfaction	54	1	1	10 (19%)	44 (81%)	0.39	**H2b**	BCT Achieve a higher quality of services	52	0.042
Provider's view	BCT will achieve a higher quality of services	52	1	1	9 (17%)	43 (83%)	0.38				
	BCT is secure	110	0	0	68 (62%)	42 (38%)	0.49	**H3a**	BCT is secure	110	0.002

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Customer's expectations								BCT will reduce privacy risks and solve security concerns	54	
								BCT has privacy issues	110	
	BCT has privacy issues	110	0	0	86 (78%)	24 (22%)	0.41	**H3b**	BCT will reduce privacy risks and solve security concerns	54	0.024
Provider's view	BCT will reduce privacy risks and solve security concerns	54	1	1	9 (17%)	45 (83%)	0.38			

2

Appendix 1. Survey items

First Construct: Enhancing Customer Experience		P	C	Ref.
Q1	In your opinion, adopting blockchain technologies your company will enhance customer experience.		X	Kwok & Koh (2019)
Q2	In your opinion, adopting blockchain technologies your company will enhance customer satisfaction.		X	Thees et al. (2020)
Q3	In your opinion, adopting blockchain technologies your company will obtain feedback from experiences of customers about the true value of the trade transactions.	X		Rashideh (2020)
Q4	In your opinion, adopting blockchain technologies your company will achieve a higher quality of services.	X		Thees et al. (2020)
Q5	In your opinion, blockchain technologies adoption for smart tourism will lead to a deep understanding of human mobility.	X		Rashideh (2020)
Q6	In your opinion, blockchain technologies adoption for smart tourism will enhance tourist experience.		X	Rashideh (2020)
Q7	In your opinion, blockchain technologies allows individualization or personalization of transactions.	X		Reinhold et al. (2020)
Q8	In your opinion, blockchain technologies is useful for customer support in your company.	X		Filimonau & Naumova (2020)
Q9	Your company is adopting blockchain technologies for coordination with local providers.	X		Bodkhe et al. (2020)
Q10	Your company is adopting blockchain technologies for customer relationship management.	X		Flecha-Barrio et al. (2019)

Second Construct: Privacy & Security		P	C	
Q11	In your opinion, blockchain technologies allows confidentiality.		X	Flecha-Barrio et al. (2019)
Q12	In your opinion, blockchain technologies have privacy issues.		X	Kwok & Koh (2019)
Q13	In your opinion, blockchain technologies are secure.		X	Rashideh (2020)
Q14	In your opinion, using Blockchain Technologies in your business, your company will reduce risks and solve security concerns.	X		Flecha-Barrio et al. (2019)
Q15	Your company has adopted blockchain technologies encompassing privacy, smart contracts and/or non-native asset, blockchain tokens and capabilities.	X		Alexander & Dakos (2020)

Third Construct: Trust		P	C	
Q16	In your opinion, blockchain technologies allows trust in transactions and information.		X	Thees et al. (2020)
Q17	In your opinion, blockchain technologies allows transparency and auditability of operations.	X		Line et al. (2020)
Q18	In your opinion, blockchain technologies can enhance operations' reliability.		X	Thees et al. (2020)
Q19	In your opinion, adopting blockchain technologies your company will be more transparent in its processes and then improve trustworthiness.	X		Rashideh (2020)
Q20	In your opinion, adopting blockchain technologies your company will reduce ICT risks and solve security concerns.	X		Flecha-Barrio et al. (2019)
Q21	In your opinion, blockchain technologies can have a positive impact on the tourism/hospitality firms that use them for recovering trust in customers after crisis like Covid-19 pandemic.		X	Bovsh et al. (2020) Kapil & Kapil (2021)

Note: "X" represents the role assumed by the respondent in responding to the question. P = providers; C= customers

Appendix 2. Harman's Single-Factor Test.

Concept	Survey Items	Factor	Total Variance Explained					
			Initial Eigenvalues			Extraction Sums of Squared Loadings		
			Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Enhance Customer Experience	Q6	1	2,832	28,319	28,319	2,178	21,779	21,779
	Q8	2	1,716	17,160	45,479			
	Q7	3	1,227	12,266	57,745			
	Q5	4	0,996	9,955	67,700			
	Q9	5	0,834	8,339	76,040			
	Q10	6	0,790	7,900	83,940			
	Q1	7	0,577	5,772	89,712			
	Q2	8	0,439	4,394	94,106			
	Q4	9	0,316	3,158	97,263			
	Q3	10	0,274	2,737	100,000			
Privacy & Security	Q13	1	1,716	34,322	34,322	1,112	22,249	22,249
	Q12	2	1,295	25,908	60,23			
	Q11	3	0,768	15,359	75,589			
	Q15	4	0,76	15,191	90,781			
	Q14	5	0,461	9,219	100,000			
Trust	Q18	1	1,991	33,184	33,184	1,549	25,823	25,823
	Q16	2	1,411	23,522	56,707			
	Q21	3	1,039	17,309	74,016			
	Q17	4	0,786	13,104	87,120			
	Q19	5	0,509	8,479	95,599			
	Q20	6	0,264	4,401	100,000			

Method of extraction: Principal Axis Factoring.