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The role of blockchain-related technologies in transforming the tourism and hospitality industry: an overview and research guidelines

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Abstract

Purpose – This paper aims to examine the relationship between the implementation of blockchain in the tourism and hospitality industry (T&HI) and its state-of-the-art. The aim is also to identify emerging research topics and gaps in this area.

Design/methodology/approach – A bibliometric overview is presented to examine articles from Web of Science published between 2018 and January 2024. The analysis was performed by VOSviewer software using the co-occurrence technique.

Findings – The results reveal the growing interest in blockchain technologies (BCT) applications in the T&HI. To reveal the conceptual structure and emerging research hotspots in this area, seven clusters were identified along with their interrelationships. This paper discusses the features and attributes of BCT mechanisms, including cryptocurrencies, distributed ledgers, smart contracts and consensus algorithms. The analysis highlights the drivers for increasing adoption and acceptance to promote smart tourism, transparency, trustworthiness and disintermediation. This paper explores the use of non-fungible tokens (NFTs) in the metaverse to promote authenticity and enhance tourists' experiences, with emphasis on achieving cost-effectiveness and sustainability in the T&HI. In addition, key challenges are identified, with a focus on security and privacy.

Practical implications – This study provides timely and valuable insights concerning the application of BCT in the T&HI. It elucidates the factors that contribute to the optimal implementation of BCT, such as the collaboration between stakeholders and the key role of regulatory frameworks. Furthermore, it considers the implications for the design of new services towards enhancing sustainability and customer experiences.

Originality/value – This paper presents the first bibliometric analysis of the use of BCT in the T&HI. It identifies research gaps and future research avenues, which can guide further investigation in this area. This study provides valuable information for organisations, managers and academics who are considering future applications, benefits and challenges in the field of sustainability issues and technology acceptance.

Keywords Blockchain, Tourism industry, Hospitality, Emerging trends, Research avenues

Paper type Research paper

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1. Introduction

The use of blockchain technology (BCT) as a distributed ledger has rapidly increased its attention and application in the T&HI (Rashideh, 2020). This process has been accelerated since critical situations such as the COVID-19 pandemic, which resulted in movements being restricted and hindered the ability to operate and perform certain procedures (Cheng *et al.*, 2023). In this regard, paying via cryptocurrencies has the potential to eliminate intermediaries (Treiblmaier, 2021), thereby reducing or eliminating fees using smart contracts – automated agreements between parties (Demirel *et al.*, 2022) – and decentralised applications (Dapps) – facilitating a more direct connection with operators (Nam *et al.*, 2021).

In addition to contributing to payment processes, BCT improves the quality and clarity of tourists' recommendations as they can create profiles on tourism crowdsourcing platforms (Leal *et al.*, 2022). This technology could also be applied to hotel reservation systems (Strebinger and Treiblmaier, 2022) and online travel agencies (OTAs) to improve efficiency and reduce costs through the use of cryptocurrencies and smart contracts.

Despite the benefits of BCT, there are several barriers to its adoption, including a lack of information and understanding, concerns about confidentiality, a lack of standardisation and perceptions about the quality and usability of the system (Wong *et al.*, 2023). In addition, other challenges are related to limited experience with digital tools or a lack of legal and fiscal studies (Viano *et al.*, 2022). For the T&HI, the most prominent business barriers are; resistance to change; lack of knowledge and experience; uncertainty about perceived benefits (Sharma *et al.*, 2021); poorly developed technological infrastructures; lack of regulation and standardisation; and insufficient payment security (Valeri and Baggio, 2021). In this context, this research updates the state of the art by understanding the key needs and challenges of the sector with respect to BCT mechanisms.

An increasing number of publications on the breakthrough of BCT in the T&HI have been brought out (Acikgoz *et al.*, 2024), most during the period 2020 and 2024. Although there is a previous review on the use of blockchain in relation to information in smart tourism management, there are none on BCT that addresses the T&HI from a holistic perspective. For instance, Puri *et al.* (2023) conducted a study following data from 2017 to 2022, using text mining and machine learning. There are other bibliometrics focusing on other technologies related to Industry 4.0, such as Sharma *et al.* (2022b) on artificial intelligence, customer experiences and perceptions in the hospitality industry. Information and communication technologies (ICT) are also studied using a bibliometric approach (Molina-Collado *et al.*, 2022a), while Shin *et al.* (2023) analysed the evolution of technology research in this discipline. Hence, considering the volume of articles published in the field of the T&HI, it is timely to see what are the main blockchain mechanisms applied and where the opportunities for research in this domain lie. Therefore, to fill this gap, this paper identifies the emerging research trends and proposes a research agenda in line with the findings.

In light of the aforementioned research trends, this study uses a conceptual/thematic examination, a co-word analysis, focusing on blockchain mechanisms, their characteristics and the primary drivers and challenges associated with the adoption of BCT in the T&HI. Furthermore, this study presents a research outline based on the findings, which serves to guide future investigations and provides valuable information related to the T&HI. More specifically, this paper aims to review the most recent literature and identify the conceptual building blocks of BCT in the T&HI from a bibliometric approach. The objective of this article is to provide the first analysis of the state of the art in this new field. Thus, as in previous studies that have used this methodology to analyse the sector (e.g., Sharma *et al.*, 2023), a complete picture of blockchain in tourism and how research trends have evolved is outlined with the main thematic areas. This research uses a co-occurrence analysis to

examine the evolution of the conceptual/thematical structure of the blockchain field and the tourism sector. The applicability of this technique has been established as a feasible method to detect patterns and identify directions about a field in literature based on its thematic categories (Sedighi, 2015) by understanding its conceptual structure. The research attempted to be as comprehensive as possible by considering all terms related to the main term "blockchain" and its mechanisms involved in the T&HI. There is a need to know more about different research areas that are of most interest to academics in the tourism sector.

This bibliometric overview is well-timed due to the increasing volume of research in this field (Jang *et al.*, 2023), as evidenced by the growing number of published papers. Additionally, to the best of the authors' knowledge, this is the first known bibliometric study on the T&HI that provides a comprehensive approach to the research. Considering the emergence and rapid development of BCT, it is important to identify opportunities for its application and to improve transparency, efficiency, and information security in this industry (Pérez-Sánchez *et al.*, 2021; Line *et al.*, 2020). By analysing the existing literature according to their keywords, this review sheds light on the trends in the adoption of BCTs in this sector, their characteristics and attributes, as well as the main challenges and barriers and how to overcome them. Finally, based on the previous findings, this review, together with a research agenda, provides future guidelines in the T&HI for researchers and practitioners. Therefore, by identifying this gap, this review addresses the following research questions:

RQ1. Which are the research hotspots and emerging trends identified in the literature?

RQ2. What are the main opportunities for future research agendas in this domain?

2. Blockchain in the tourism and hospitality industry

BCT is a decentralised ledger that records transactions in blocks on a peer-to-peer network (Valeri and Baggio, 2021). These transactions store more secure data since they require the consensus from a majority of validators, rendering modification impossible (Önder and Treiblmaier, 2018). At present, BCT is in its third stage of development and has the potential to be used in a variety of sectors, including the T&HI (Rashideh, 2020). Nevertheless, this field of study remains under-researched.

The connection between BCT applications in the T&HI is examined from a theoretical standpoint focused on the customer: *The Theory of Planned Behaviour* (TPB) and *The Technology Acceptance Model* (TAM). TPB (Ajzen, 1991) points out that intentions associated with subjective norms and attitudes are the determining factors in an individual's awareness of their inclination to engage in specific actions. Similarly, TAM (Davis, 1989) indicates that perceived usefulness and user-friendliness are pivotal in the acceptance and adoption of new technologies, such as BCT.

The use of BCT helps improve the T&HI by enabling direct interaction with stakeholders, thereby circumventing the involvement of intermediaries such as travel agents. BCT also serves to enhance security and transparency in the T&HI, thus fostering trustworthiness. Furthermore, these technologies enhance efficiency, innovation and competitiveness by cultivating brand loyalty and tourist satisfaction (Pérez-Sánchez *et al.*, 2021). The use of smart contracts in the T&HI allows users to book hotels, restaurants and tickets, all carried out using a single cryptocurrency (Bodkhe *et al.*, 2019). Cryptocurrencies are a form of digital currency that operates without the need for a central authority. Instead, transactions are validated by other users on the network, ensuring cryptographic encryption. It expedites the exchange of money, circumventing the need for third parties and establishing

novel procedures for customer-to-customer (C2C) transactions within the tourism sector (Önder and Treiblmaier, 2018). To illustrate, *Winding Tree* provides users with real-time inventory and pricing information for shared accommodations (Nam *et al.*, 2021).

3. Methodology

To address the RQs and to understand the conceptual structure of this research domain according to the gap detected in the literature, a bibliometric analysis was conducted. In this section, the data collection is first explained and then the co-occurrence (bibliometric) analysis is explored.

3.1 Data collection

The Web of Sciences (WoS) Core Collection was the database selected, which is commonly used to run bibliometric techniques due to its citation information (Birkle *et al.*, 2020). Figure 1 indicates the methodological development. This paper considers the period between 2018 (coinciding with the first article that appears in WoS about this field) to January 2024. Our search focuses on the main term "blockchain" and other associated terms according to their relationship with the T&HI (see Figure 1). Therefore, the sample obtained in this analysis (n = 70) is between the minimum average (50–100) for conducting a bibliometric analysis to show consistent results (Seglen, 1994; Rogers *et al.*, 2020).

3.2 Bibliometric analysis

Bibliometrics is a quantitative technique (Zupic and Carter, 2014) that visualises scientific maps to examine an investigation area development. A cluster analysis based on the co-occurrence of keywords using VOSviewer is carried out to identify emerging research topics (van Eck and Waltman, 2010). The co-word method is widely used to recognise the evolution and the conceptual network of a specific domain and to identify research trends (Ding *et al.*, 2001). This technique uses the actual content of the documents based on their keywords and their bi-directional relationships (see Figure 2) (Zupic and Carter, 2014). Considering the importance of these technologies and their potential impact on the industry, this bibliometric study is timely and suitable since 82.5% of the total publications retrieved from WoS have been published between years 2020–2024. Hence, this co-occurrence provides the conceptual structure of BCT in the T&HI, filling this gap in the literature. The VOSviewer software is used to perform the analysis, using clustering through the normalisation method to measure the strength of the links between concepts (van Eck and Waltman, 2010). Moreover, the density-based clustering follows the full-counting method in VOSviewer. VOSviewer builds the visualisation map by normalising the co-occurrence matrix. Referring to the data cleaning, a thesaurus was created to manually group duplicates and to homogenise the sample and ensure consistency, for example, supply chain management and supply chain-management, or plurals such as cryptocurrency and cryptocurrencies.

4. Results

Table 1 (Supplementary Materials) illustrates the clustering of co-occurrences, including the average year of publication to identify the most recent keywords. On this basis, the terms that appear later in each cluster are considered special knowledge hotspots and research trends (such as Ranjbari *et al.*, 2022 study). Figure 3 shows the analysis. This analysis provides a total of seven clusters differentiated by colour.

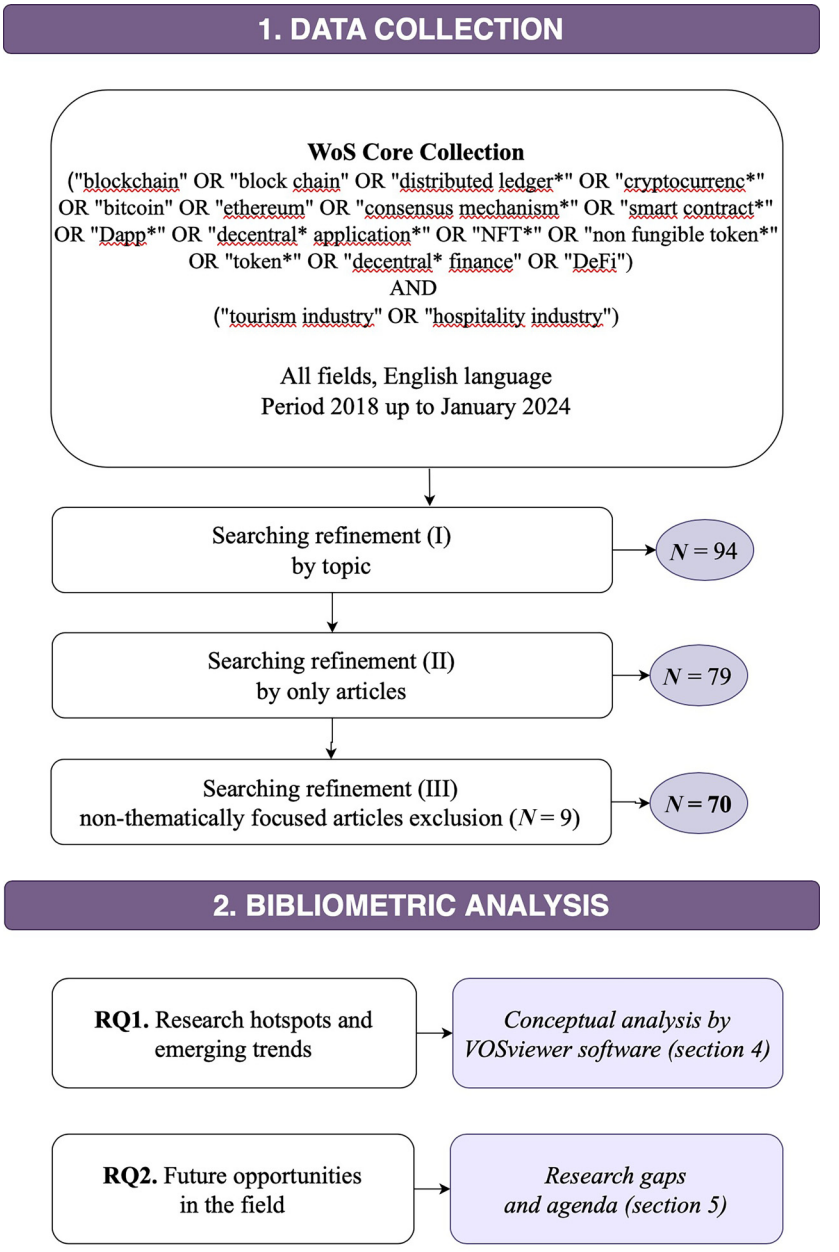

Figure 1. Methodological process
Source: Authors' own work

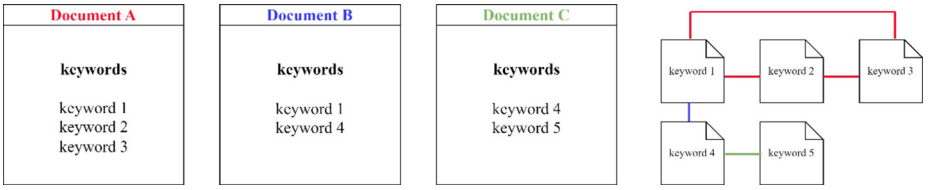

Figure 2. Co-occurrence relationships
Source: Authors' own work

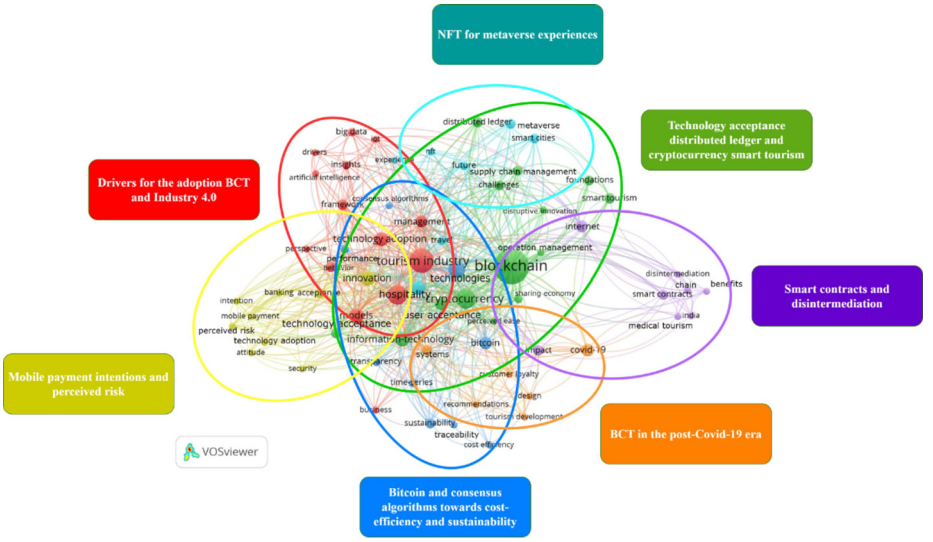

Figure 3. Co-word analysis by VOSviewer software
Source: Authors' own work

4.1 Drivers for the adoption of blockchain technology and industry 4.0 technologies in the tourism and hospitality industry (red cluster)

This cluster focuses on the main drivers for the adoption of BCT and other Industry 4.0 related technologies in the T&HI. These technologies are "artificial intelligence" (the most recent keyword in this node, see connections in Figure 4), "IoT" and "Big Data". AI and BCT enhance customer satisfaction *by providing personalised experiences according to the customer's behaviour* (Rane, 2023) or through sustainability marketing engagement (Liu and Dong, 2021). In the same vein, the combination of IoT and BCT ensures transparency (blue cluster) and integrity of customer preferences, *thereby enhancing personalisation to engage tourists while improving connectivity security* (Mercan *et al.*, 2021). Big Data is used to identify demand patterns and forecasting in the T&HI as well as in personalising tourism-related services. Within BCT, data can be processed and stored in a decentralised system, providing enhanced security (Line *et al.*, 2020). However, there are still disadvantages in the adoption of these technologies in the T&HI. *To increase the uptake of these technologies,*

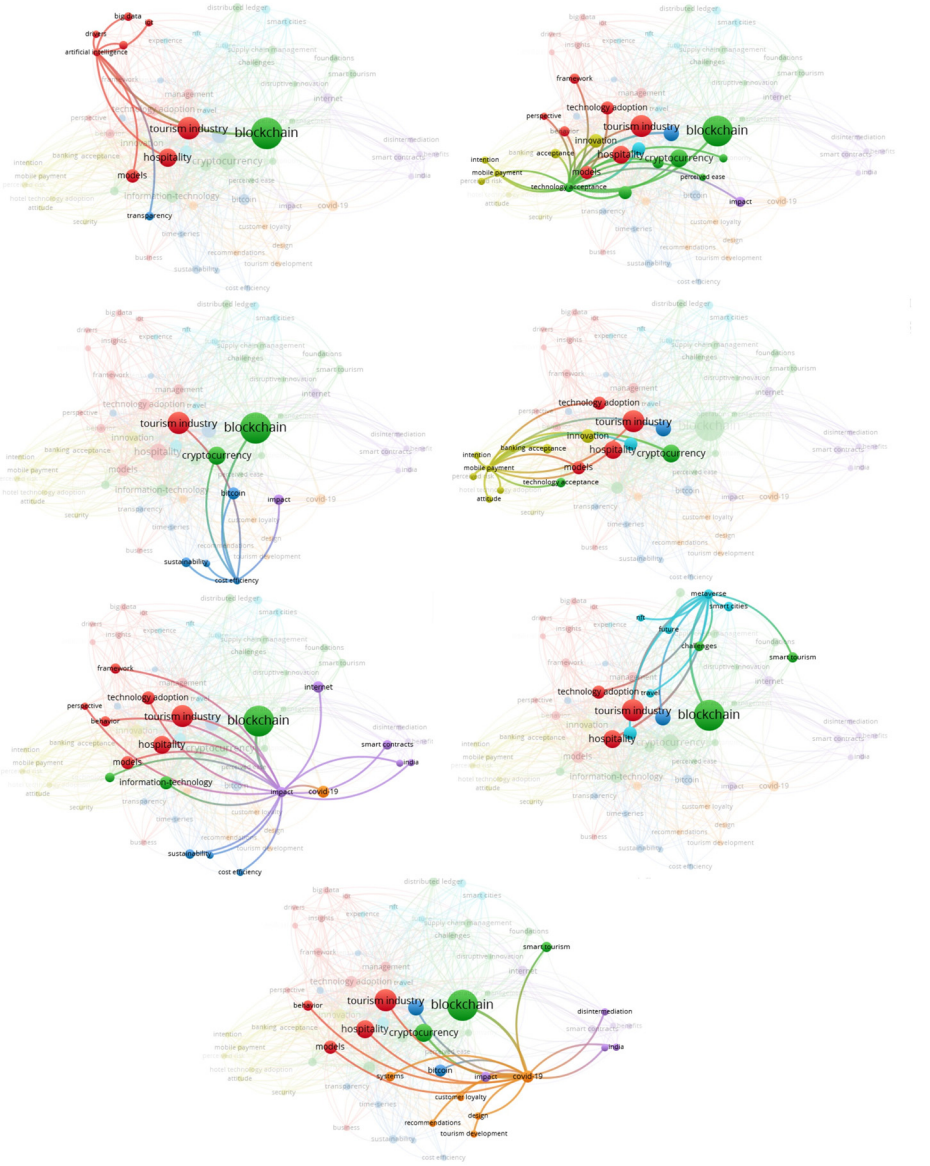

Figure 4. Keywords connections
Source: Authors' own work

employees, managers and other stakeholders in the industry need to be trained and educated. Resistance to change is identified as one of the major problems (Walsh *et al.*, 2021). The need to exchange sensitive customer data raises concerns about customer security, and trustworthiness is also an important issue as well as the high cost of implementation (Biswas and Gupta, 2019).

4.2 Technology acceptance and challenges of distributed ledger and cryptocurrencies towards smart tourism in the tourism and hospitality industry (green cluster)

"Technology acceptance" – the most recent keyword (see relationships in Figure 4) – relies on the "perceived ease" of "blockchain-related" technologies such as "distributed ledger" and "cryptocurrencies" and "smart tourism". The "transparency" given by BCT may improve trustworthiness for tourists using these technologies. Moreover, stakeholders can benefit from increased connectivity facilitated by automated payment systems that use cryptocurrencies (Nam *et al.*, 2021). *The main "challenges" in the acceptance of these technologies in the T&HI are concerns about trustworthiness and the complexity of integration, which can result in high costs for organisations and resistance to change among employees* (Walsh *et al.*, 2021). According to Aiazbekov (2023), *the main challenges facing cryptocurrencies are the absence of a regulatory framework*, knowledge, scalability and price volatility. As for distributed ledgers, transaction authorisation, data integration and authentication are the major obstacles to overcome (Sabbioni *et al.*, 2022).

4.3 Bitcoin and consensus algorithms towards cost-efficiency and sustainability in the tourism and hospitality industry (blue cluster)

The blue cluster's highest co-occurring keywords relate to the role of "bitcoin" and "consensus algorithm" mechanisms linked to "cost efficiency" – the most recent keyword (see Figure 4) – and "sustainability" issues. The efficiency and security of a cryptocurrency depends on the consensus mechanisms used (Treiblmaier, 2022). In the hospitality industry, this consensus improves hotel inventory management, reservation systems and ticketing (Treiblmaier, 2021). Furthermore, *BCT also plays a crucial* role *in promoting sustainability by providing eco-efficient solutions, reducing environmental impact and minimising the use of natural resources* (Jang *et al.*, 2023). However, there are some disadvantages in the use of Bitcoin and consensus algorithms in terms of efficiency and sustainability. Firstly, Bitcoin uses PoW, which is less energy-efficient than PoS. Besides, the price volatility of Bitcoin results in uncertainty. The complexity of its implementation, the risk of network attacks and tourists' preferences to use cash over virtual currency are the main concerns in its use (Kim *et al.*, 2021).

4.4 Mobile payment by cryptocurrencies, intentions and perceived risk in the tourism and hospitality industry (yellow cluster)

"Mobile payment" appears in this yellow cluster as the most recent keyword. Accordingly, "intention" and "perceived risk" are highly related concepts in this method of payment. Mobile payments enabled by BCT allow for transactions such as online bookings using smart devices (Rashideh, 2020). For instance, Travala uses its own cryptocurrency to make payments by Dapps (Barkel *et al.*, 2021). In terms of "security", Bodkhe *et al.* (2019) highlight that cryptocurrencies support online transactions with travel agencies, hotels, cruises and restaurants avoiding identity fraud and hacking wallets. However, the main barriers in using mobile phones for payment in the hospitality industry include the lack of access to financial services in some regions, as well as the impact of fees and inflation (Xu *et al.*, 2020). The limited storage capacity of devices and storage costs are also important

issues. Furthermore, *the adoption of cryptocurrency payment solutions in accommodation establishments and restaurants will depend on organisational and customer attitudes, acceptance intentions and behaviours, which will also influence the adoption of BCT* (Albayati *et al.*, 2020).

4.5 Smart contracts impact as an enabler for disintermediation in tourism and hospitality industry (purple cluster)

As can be seen in Figure 3, purple nodes share more connections or similarities with keywords from the same node than with those outside the cluster, which represents the strength of co-occurrence between the nodes (van Eck and Waltman, 2010). "Impact" is the most recent keyword of this cluster (see relationships in Figure 4). Regarding the "benefits" of implementing BCT "smart contracts" in the T&HI, these are widely used for hotels' and OTAs legal agreements, and peer-to-peer transactions that play a key role in minimising costs (Rashideh *et al.*, 2022). *Smart contracts could facilitate direct bookings providing real-time information, payments, and loyalty cards, as well as currency conversions* (for international travel). *Regarding the main disadvantage of smart contracts, the lack of legal protection and the need for a regulatory framework is highlighted*. This technology presents also limited flexibility; its immutability is a problem when it comes to making any required modifications (Sklaroff, 2017).

4.6 The use of non-fungible tokens for metaverse experiences related to the tourism and hospitality industry (cyan cluster)

The cyan cluster comprises concepts linked to the "metaverse" and "non-fungible tokens" (NFT), with the former being the most recent keyword in this node (see relationships in Figure 4). In the metaverse the digital assets are represented and exchanged as NFTs (Gursoy *et al.*, 2023). Buhalis and Karatay (2022) highlight that the future of the T&HI should see these virtual experiences and the metaverse as a new opportunity. The rise of the metaverse is partly due to the COVID-19 pandemic (linked to the orange cluster), which consolidated metaverse events due to social distancing and lockdowns (Gursoy *et al.*, 2022). The development of metaverse tourist destinations has been boosted by NFTs – a kind of smart contract (connected to the purple cluster) (Lin *et al.*, 2023). This BCT has the potential to enhance "trust", traceability (as indicated by the yellow cluster), authenticity, and the quality of user opinions (Leal *et al.*, 2022). *The challenges of implementing NFTs in the metaverse are primarily related to the lack of technological development, standardisation and human resources* with expertise in this field (Lin *et al.*, 2023).

4.7 Blockchain technology for the tourism and hospitality industry in the post-Covid-19 era (orange cluster)

The last cluster in orange focuses on "COVID-19" (the most recent keyword) and how BCT facilitates the T&HI activities during and after this period of crisis. COVID-19 is strongly related to many of the clusters analysed previously (see relationships in Figure 4). Thanks to BCT, intermediaries can be removed, and commission charges and reception costs can be eliminated in the T&HI (Demirel *et al.*, 2022). *BCT enhances resilience in the management of COVID-19 disruptions*, which hugely impact food supply chains (Sharma *et al.*, 2022a). Thus, redesigning T&HI supply chains within BCT will benefit stakeholders in future disruptions. *The main drawbacks to the use of BCT are the lack of regulatory frameworks* (Balasubramanian *et al.*, 2022), the high cost of implementation, energy consumption

(e.g. PoW) *and the lack of education and training among stakeholders in the T&HI* (Ratna *et al.*, 2023).

5. Discussion and research agenda

The results highlighted the lack of keywords directly related to "standardisation" and "regulation" of BCT in this sector, which represents a great challenge for its implementation, and previous bibliometrics do not consider it (Puri *et al.*, 2023). Although the terms "decentralised application" and "Dapp" are included in the search query, these keywords did not appear in the clusterisation conducted by VOSviewer (as well as in Puri *et al.*, 2023). This is due to the little attention that this concept receives from previous literature. The concept "ethereum" has been considered in our analysis as a type of cryptocurrency, however this term has also not emerged strongly enough to appear in the clusters of the VOSviewer co-occurrence analysis. The term "token" does not appear directly in the analysis, as this keyword was not included in the search query because some papers could contain it without relation to BCT. However, in the clusterisation NFT is included as a concept in the cyan cluster.

There are no related keywords focusing o*n social aspects* regarding the acceptance between tourists and hosts. Previous research also pointed out this absence (e.g., Sharma *et al.*, 2022b). However, papers such as Molina-Collado *et al.* (2022a), Shin *et al.* (2023) and Puri *et al.* (2023) do not consider the social impacts related to ICT. The concept "user acceptance" arises in the green cluster, although more emphasis on education and knowledge about BCT in this industry is needed for tourists and visitors, as these concepts are not discussed enough to show up in this co-word analysis. In this regard, the keywords "training" or "education campaigns" did not appear. This is surprising considering that this is a fundamental aspect for T&HI organisations and their employees, and a concept which is not featured in previous bibliometrics (Molina-Collado *et al.*, 2022a; Shin *et al.*, 2023; Puri *et al.*, 2023), except for Sharma *et al.* (2022b).

Results highlight that a notable obstacle to BCT includes low user acceptance. Thus, more attention on non-tech-savvy travellers could be considered (Muharam *et al.*, 2023). Although there are concepts related to the confidence and preferences of customers (trust in the red and cyan clusters), the majority of the attention is centered on how the use of BCT is perceived by tourists or visitors as well as the T&HI's employees and managers. In this regard, the terms "perceived use", "perceived risk" and "security" appear (green and yellow clusters), with the two former terms being words that do not feature in previous research (Puri *et al.*, 2023). While aspects such as "transparency" applied to personal information are present in the analysis (blue cluster), special attention to other privacy aspects should also be underlined. As there are no related keywords in the co-occurrence analysis, this indicates that this issue is not well developed in the literature and requires more attention.

The joint use of different Industry 4.0 technologies is an aspect to be highlighted within the clusters obtained, and more specifically in the red cluster. For instance, in light of the importance of personalised experiences based on tourists' patterns (Rane, 2023), AI is the most recent keyword to emerge in the red cluster. Previous bibliometrics such as Sharma *et al.* (2022b) emphasised the importance of technology acceptance in the use of AI. However, they do not address the use of blockchain to improve customer experiences. Molina-Collado *et al.* (2022a) only address the link between ICT and the T&HI, but it does point out the importance of new technologies such as blockchain in its future lines of action. In the same vein, Shin *et al.* (2023) highlight the use of blockchain and cryptocurrency as a topic that needs more attention in future research. Taking this gap in the literature into account, our paper does cover the use of blockchain for experiences in the T&HI.

From a sustainable point of view, the use of BCT in this sector is key as a booster towards sustainability and cost-efficiency issues (blue cluster). However, the term "energy" did not appear. Other related terms such as "circular economy" and the achievement of the 2030 Agenda and the Sustainable Development Goals (SDGs) are not present in the co-occurrence. Considering the importance of this paradigm in tourism and hospitality activities (Alonso-Muñoz *et al.*, 2023), more related research is required. It is noteworthy that these sustainable-related keywords are also lacking in previous bibliometrics (Puri *et al.*, 2023).

Table 2 (Supplementary Materials) shows the research gaps detected and potential research questions for further investigation in the field of BCT and its application in the T&HI. This is based on the co-occurrence analysis conducted and considering inter-cluster and intra-cluster links discussed above.

6. Conclusions

The adoption of BCT has revolutionised the T&HI. BCT ensures transparency of products with better traceability throughout the supply chain (Filimonau and Naumova, 2020; Cheng *et al.*, 2023). This technology permits payments to be made using cryptocurrencies, increasing trust between hotels and users (Rashideh, 2020; Cheng *et al.*, 2023). Additionally, smart contracts allow for agreements that secure tourists bookings without intermediaries (Filimonau and Naumova, 2020).

Based on the results obtained, the inter and intra cluster relationships provide valuable information about the current conceptual structure of this field. From a methodological approach, this paper enriches the understanding of the scientific literature related to the incorporation of BCT in the T&HI. This analysis fills this gap in the literature, as there is no previous bibliometric analysis about this novel topic.

This bibliometric analysis provides a general idea of the influence of the BCT breakthrough in the T&HI. Between 2018 and 2024, there is a growing evolution in the research. Since the COVID-19 crisis, T&HI organisations put more effort and interest into the implementation of BCT such as distributed ledgers, cryptocurrencies, consensus algorithms or smart contracts.

The hotspot topics (*RQ1*) are focused on the features and attributes as well as advantages and disadvantages presented in the current literature about the joint use of BCT and AI, IoT and Big Data (red cluster). Drivers to enhance forecasting demand, to obtain tourists' feedback and secure information. The distributed ledger and cryptocurrencies in the promotion of smart tourism are presented (green cluster), focusing on technology acceptance and the main challenges, such as transparency and the resistance to change, respectively (Walsh *et al.*, 2021). Another hotspot topic is how the use of Bitcoin and consensus algorithms achieve sustainability and cost-effectiveness in the industry (blue cluster) by eliminating intermediaries and simplifying transactions between stakeholders (Treiblmaier, 2021). The yellow cluster focuses on the main drivers and barriers in mobile payment by cryptocurrencies such as Bitcoin and Ethereum, highlighting how the customers' and organisations' intentions play a fundamental role (Albayati *et al.*, 2020). The application of smart contracts for disintermediation (purple cluster) in the sector (Balasubramanian *et al.*, 2022) was identified as another major topic. The cyan cluster focuses on how the use of NFT promotes metaverse experiences, in terms of authenticity and trust (Lin *et al.*, 2023) as well as its limitations. Finally, the orange cluster explores how BCT affects the industry in the post-COVID-19 era, for instance, by fostering T&HI revenue. Referring to the research agenda suggested, the proposals are associated with how the joint use of BCT with other Industry 4.0 technologies enable tourist experiences, putting more emphasis on the relationship in achieving the SDGs thanks to BCT, the regulatory framework required, the

necessity for education and training campaigns as well as rewards and loyalty programs for tourists facilitated by BCT (*RQ2*).

6.1 Theoretical implications

As there is no previous conceptual/thematic analysis of this field, to the best of our knowledge, this study is the first bibliometric analysis that uses co-occurrence to examine the evolution of the field of BCT and the T&HI. As such, providing a thematic analysis of this field is the main novel aspect of this article. This article presents a picture of the state of the art in this domain to shed light on its conceptual structure, capturing the dynamics of BCT adoption in the T&HI. This review identifies research hotspots and emerging trends based on the clusterisation displayed by VOSviewer software, which detects inter- and intra-relationships between the trending topics. In addition, this paper explains the characteristics, benefits and drawbacks of BCT connected to the T&HI and how to address the main gaps and barriers obtained from the analysis with the proposals suggested in the research agenda, similar to the study conducted by Shin *et al.* (2023) that considered other research areas. Previous bibliometrics in the T&HI focused on new technologies or ICT from a holistic perspective (Shin *et al.*, 2023; Molina-Collado *et al.*, 2022a) or other Industry 4.0 technologies (AI, Sharma *et al.*, 2022b) but with no particular emphasis on BCT. Puri *et al.* (2023) focused on smart tourism without considering hospitality. Therefore, this paper fills this gap in the literature.

The attributes of BCT in each cluster (thematic analysis) and their relationships with the T&HI were examined, providing valuable insights to this scientific field. Based on the advantages and disadvantages analysed in the co-occurrence of each cluster, from a theoretical perspective, this study provides an understanding in the field of BCT that enriches the literature. With regard to BCT adoption in the industry, this study provides information on attitudes towards transparency and data security (Leal *et al.*, 2020), based on the core of the literature in this field. In addition, this review provides features and characteristics, as well as challenges and barriers to the implementation of BCT in the T&HI. In terms of acceptability, the findings also shed light on perceptions and ease of use, highlighting the need for education and training, and how resistance to change could be one of the main barriers (Walsh *et al.*, 2021).

A controlled use of BCT, such as cryptocurrency, allows for influencing customers' decisions and acceptability (linked to the green cluster). However, a regulatory framework is still a necessity to improve trustworthiness (Albayati *et al.*, 2020). From a theoretical perspective, this study provides an understanding of the field of BCT that enriches the TPB, and the TAM applied to the T&HI. This could guide future researchers and managers in implementing blockchain successfully. According to the TPB, it is important to clarify that the attitude towards blockchain adoption could be positive or negative depending on the perception of the benefits of blockchain (purple cluster). Furthermore, the ease of use and the challenges could impact blockchain application, found in the green cluster (Kumari and Devi, 2023), and the opinion of stakeholders could influence its adoption, as seen in the red cluster (Cheng and Chong, 2022). Taking the TAM into account, the perceived ease of use and perceived usefulness of blockchain's benefits could improve blockchain adoption, shown in the red and green clusters. In this vein, more emphasis on transparency can also enhance tourists' and visitors' perceptions while improving the ease of use, for example, by using Bitcoin in accommodation establishments (blue cluster). This in turn will impact attitudes toward BCT. In this regard, the security and privacy implied in the transactions plays a key role in the perceived risk by customers (connected to the yellow cluster). Ultimately, familiarisation with these technologies through information and education

campaigns as well as training for employees (Celik *et al.*, 2024) will potentially improve the ease of use, perception, acceptance and attitude of tourists towards the implementation of BCT in this industry.

Based on the articles analysed in this sample, there is still a lack of empirical studies, and study cases analysing blockchain adoption by consumers and companies in the T&HI literature. The research agenda developed makes way for future opportunities and inspires further studies for scholars in this field, according to the emerging topics identified in the clusterisation analysis and the gaps detected in the literature. This analysis highlighted the lack of attention given to social aspects such as SDGs and empirical evidence about BCT acceptance in the T&HI. Training required for T&HI employees and information campaigns for users in the field of BCT (Ratna *et al.*, 2023) is another prominent topic which arose in this research. The need for a regulatory framework for all its mechanisms involved including cryptocurrency (Bitcoin and Ethereum), smart contracts, distributed ledgers and consensus algorithms (PoS and PoW) is also put forward as another avenue for further research. Hence, this study enriches the literature guiding future research and enables a broader understanding of the theme.

6.2 Practical implications

The co-occurrence analysis results can be used as a guideline with valuable information for governments, academics, managers and tourists in terms of practical implications (Sedighi, 2015). The practical implications of this paper can be split into two concepts – the first being the *factors contributing to the optimal implementation* of BCT; and the second being the implications for the *design of new products and services*.

Factors contributing to optimal implementation included creating a regulatory framework, establishing collaboration and information systems, and integrating different technological tools. These different factors show how BCTs (seen in the blue and cyan clusters) make "privacy", "openness" and "trust" possible (Nam *et al.*, 2021). The findings reveal to governments the need to create a *regulatory framework* (presented in the green, purple and orange clusters) for BCT in the T&HI to promote trust (Irannezhad and Mahadevan, 2021), ensure legal compliance (Nam *et al.*, 2021), prevent fraud (Barkel *et al.*, 2021), and promote standardisation (Irannezhad and Mahadevan, 2021). In terms of privacy and security (red and yellow clusters) for T&HI customers, a regulatory framework will positively affect trustworthiness. The use of BCT mechanisms can affect the privacy of travellers, for example, smart contracts are vulnerable to breaches, and therefore more protocols are needed. Furthermore, regarding identity verification, if these mechanisms fail and this data is stolen, it could potentially result in identity scams. Hence, this risk should be addressed for better implementation in the T&HI by means of regulatory procedures; more robust cybersecurity and standards (Zamani *et al.*, 2018); enhanced transparency; and educational training.

While BCT can improve knowledge and information sharing, it requires *collaboration* between governments, hotels, local tourism organisations and tourists. Public-private investment thanks to government collaborations with T&HI firms on disruptive technologies – BCT, IoT, Big Data and artificial intelligence (presented in the red cluster) – play a key role towards digitalisation in this sector. However, the impact of blockchain on relationships along the value system in the tourism industry must also consider that certain participants may disappear and must consider how this will change the relationships of the remaining members. In this respect, a few case studies have shed light on this issue (Thees *et al.*, 2020).

In terms of practical implications for the *design of services or products offered* by the business or destination, both aspects of improving the customer experience and the sustainability impact of the customer must be considered. Although customers value the

status of smart destinations (Nam *et al.*, 2021), as shown in the green cluster, there is a need to better understand the acceptance of these technologies being used in these destinations, while also considering the post-pandemic era influence and changes in customer patterns and attitudes. The "human touch" is being lost with technological advances implemented in the T&HI, and it is necessary to contemplate what tourists and guests expect. Similarly, service design needs to consider non-tech-savvy travellers (Muharam *et al.*, 2023). With that in mind, it is important to consider and to improve user acceptance, thus training and education for T&HI customers is fundamental. There is a gap in encouragement and support from tourism managers in terms of BCT education and training, which has been flagged as a potential resistance to change shown in the red cluster.

There is a need for support o*n sustainability* aspects related to the blue cluster. However, the implementation of blockchain must overcome the one-dimensional view of sustainability that links it to the environmental aspect. From a social perspective, this technology facilitates access to certain basic resources; holds up the quality of experiences; and allows for stakeholders (such as residents of these tourist destinations) to participate. Due to this, recent research has studied the case of the role of blockchain in social entrepreneurship (Sansone *et al.*, 2023) and local relations. It is therefore necessary to study the adaptation of these cases to the service sector in general and to the tourism sector in particular. This pathway to sustainability should be linked to the achievement of the SDGs, emphasising how BCT can align the T&HI in achieving the 2030 Agenda.

6.3 Limitations and future lines of research

This bibliometric overview has some limitations. Firstly, the database used for this study was the Web of Science, which only considers English-language articles. Other databases such as Google Scholar could be considered for further analysis. It might be interesting to consider and include international conferences and book chapters in future studies. Secondly, reading the results displayed by VOSviewer software may be somewhat subjective. Other bibliometric tools such as SciMat, BibExcel or CiteSpace could be used to provide complementary information about this field. Thirdly, the analysis was carried out with a small number of published articles (n = 70). Therefore, to broaden and consolidate the obtained results in this paper, a future bibliometric study could be addressed to monitor the evolution of this field and tracking if attention to this technology continues to grow over the years in relation to this industry. Other bibliometric techniques such as co-citation analysis between articles and co-authorship of researchers can easily shed light on the intellectual composition of this field and the opportunities for authors to collaborate. In addition, further research using qualitative methods or case studies could enrich the conclusions drawn in this article.

More empirical research is required to examine tourists' opinions, reviews and acceptance (green and orange clusters) of BCT use linked to experiences in this sector (Nam *et al.*, 2021). However, a differentiation between tech-savvy and non-tech-savvy tourists' demands needs to be addressed in further research. BCT could transform the T&HI's supply chains, increasing the data transparency (blue cluster); therefore, it is interesting to conduct further research on the main challenges and barriers towards its implementation. The question of how to lower infrastructure costs and how complex these technologies are to integrate are also key aspects that require further investigation. Additionally, a comparison between countries or between developing and developed countries to identify what is currently being done in the sector can be addressed. More research is needed to investigate the impact of COVID-19 on tourism patterns, including a comparison of pre- and post-pandemic periods (Kim *et al.*, 2021). It could be interesting to develop future research on improving information in the implementation of BCT in smart tourism destinations

(green cluster), considering COVID-19 as the break point (orange cluster) to analyse changes in tourists' patterns of behaviour. The use of BCT towards sustainability (blue cluster) and for achieving the SDGs in the hospitality and tourism sector are pivotal future lines of research, aligned with areas of future research from previous work, such as sustainable consumption or rural tourism development (Molina-Collado *et al.*, 2022b). Further in-depth research is required to fully understand the use of PoS and smart contracts, among other mechanisms, for sustainability standardisation in the T&HI.

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Supplementary material

The supplementary material for this article can be found online.

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