The blockchain technology and the scope of its application in hospitality operations

Abstract

The recently emerged concept of the blockchain technology (BCT) can disrupt the traditional realm of tourism and hospitality operations. While some research has looked into the implications of BCT for tourism management and marketing, no studies have explicitly considered the scope of its application in the context of hospitality operations management. This is arguably a major omission as available evidence points at the foremost potential of BCT to affect the nature of hospitality business. This study partially plugs this knowledge gap and, by reviewing examples of existing applications of BCT in various economic sectors and across different consumption markets, evaluates its potential for future integration into hospitality operations management. The framework of prospective use of BCT in the hospitality industry alongside the related organisational, institutional and technological challenges that need to be overcome for its wider industrial adoption are outlined.

Keywords

Digital technology

Disruptive innovation

Blockchain

Operations management

Supply chain management

Highlights

- Explains the blockchain using plain business language
- Reviews examples of existing blockchain applications
- Evaluates the scope of blockchain integration in hospitality operations management
- Highlights challenges of prompter commercial uptake

1. Introduction

The potential of the blockchain technology (BCT) to revolutionize industries, disrupt entire economic sectors and lead the global digital transformation in the years ahead is well recognised (Iansiti & Lakhani 2017). Together with the Artificial Intelligence, 5G mobile technology and the Internet of Things BCT is believed to present an enticing opportunity for many businesses as it can aid them in strategic planning and management (Kewell & Ward 2017). BCT can inspire business and social innovation and uncover new entrepreneurial opportunities (Singh & Singh 2016), thus highlighting the need for its faster embracement by the industry professionals (Manski 2017).

Digital technology has embedded itself deeply into the services industries (Buhalis & O'Connor 2005). In particular, by penetrating into both supply and demand, it has become a critical element in effective management of tourism and hospitality operations (Stankov *et al.* 2019). As a result, the concepts of *'smart tourism'* (Gretzel *et al.* 2015a) and *'smart hospitality'* (Buhalis & Leung 2018) have emerged underlining the ever increasing role of digital technology in building the long-term business sustainability of tourism and hospitality enterprises and calling for a better understanding of the determinants of its prompter commercial uptake (Gretzel *et al.* 2015b).

Although the sectors of tourism and hospitality can benefit from global digital transformation, very few studies have attempted to examine the potential of BCT to be adopted within. While some previous research has considered BCT's applicability in the context of tourism (Kwok & Koh 2018), it remains limited in scope of analysis. The literature has discussed the potential of BCT to optimise the business distribution channels (Calvaresi *et al.* 2019; Colombo & Baggio 2017; Önder & Treiblmaier 2018) and facilitate the consumer-to-consumer (C2C) business trade models in tourism (Sigala 2017). A preliminary analysis of

the adoption prospects held by the most simplistic variation of BCT, i.e. the digital currencies, in tourism has also been performed (Leung & Dickinger 2017).

The potential of BCT in the sectors of tourism and hospitality extends beyond mere use of digital currencies, optimised product distribution and refined trade models (Treiblmaier 2019). However, this potential remains largely unexplored, especially in the context of hospitality services. This is in part due to confusion widespread among the industry professionals about what BCT is and how it works (Nam *et al.* 2019). The contribution of this paper is in that it extends the scope of scholarly research on BCT's use in services by reviewing examples of existing applications and evaluating the implications of their future integration into hospitality operations management. The paper is therefore intended to aid industry professionals, academics and students in understanding the business opportunities that BCT holds to enhance provision of hospitality services, thus encouraging its more active commercialisation.

2. The foundations of BCT

The idea of BCT was introduced by Nakamoto (2008) who first conceptualized the peer-to-peer networks as the basis of BCT's architecture. Peer-to-peer networks are not new and have laid the foundation of transactions within the phenomenon of the 'sharing economy' (Guttentag 2015). The past experience of using peer-to-peer networks in this particular consumption context has highlighted trust between the different network users as a key to the networks' success (Ert *et al.* 2016). It has further shown that, to build this trust, all transactions within a peer-to-peer network should be meticulously verified (Kwok & Koh 2018). The novelty of BCT was in that it revolutionised the verification of transactions within peer-to-peer networks through the use of the so-called consensus protocol, or the concept of *'trustless trust'* (Kosba *et al.* 2016).

The BCT's network relies upon a system of nodes joined together in a chain with the purpose of storing and authorizing transactions(Goldman & Sachs 2017). The block can only be added to the chain once all nodes in the network have agreed with their order, thus operating the consensus protocol (Stevens 2018). The consensus is reached by the parties that have had no previous knowledge of each other, meaning no past trust has been built within a network (Kosba *et al.* 2016). This prevents the transaction recorded in the network from being intruded and subsequently faked, thus improving the visibility and refining the accountability of the entire system (Dhillon *et al.* 2017). BCT converts monetary or information flows into a system of transactions that are recorded in a chain of blocks and securely maintained across a number of computers in a peer-to-peer network (Viriyasitavat and Hoonsopon 2019). This is unique as the consensus protocol obviates the need for having a trusted central party, such as a bank, a government or a business intermediary, whose purpose is to authorize, validate and, therefore, control each transaction made within the network (Singh & Singh 2016). Instead, BCT distributes the control power to multiple actors (peers) across the digital network by making use of a public-key cryptography in a *´distributed database, containing records of transactions´* (Efanov & Roschin 2018, p.116). This enables shared responsibility of the network and enhances the overall security of the transactions within (Kasireddy 2018).

Accordingly, BCT is defined as '*…a distributed database of records, or public ledger of all transactions or digital events that have been executed and shared among participating parties'* (Crosby *et al.* 2016, p.7). The distributed ledger technology represents a cornerstone of BCT as it allows each actor within the network to own an identical copy of the software on their personal electronic device through a peer-to-peer client (Dresher 2017). Unlike a traditional ledger, it does not however require a central system for ownership management (Christidis & Devetsikiotis 2016) which makes BCT decentralized, but also more transparent, equitable and accountable (Al–Saqaf &Seidler 2017).

In terms of its functionality, BCT is grounded on a complex computational algorithm which collects data, organizes these data into blocks and then chains the blocks together by means of cryptography (Goldman & Sach 2017). Each block is stamped with a header containing a set of unique information, i.e. a hash code, a time stamp, an ID and a version of the client (Kumar 2018).The user of BCT can see a list of all transactions within each block once the blocks have been chained (Dhillon *et al.* 2017). BCT adds new blocks to the chain via a process known as *'mining'* with the *'miners'* representing the nodes that connect, hold and maintain the network (Kewell *et al.* 2017). The miners are rewarded for their work; for instance, in the case of the digital crypto currency Bitcoin, the reward is given to the first miner who resolves the mathematical problem (Dhillon *et al.* 2017). Once the transaction has been hashed and time-stamped, it gets recorded on a block (Miau & Yang 2018) which is subsequently digitally validated via a consensus protocol, as per above (Konstantopoulos 2017).

The security of BCT is attributed to its cryptographic hash function design (Fisher 2019). To prevent intrusion and modification of the records that the blocks contain, the code used to encrypt the transaction differs from the one used to decrypt it (Apte & Petrovsky 2016), the process known as *'decryption key'* in cryptography (Lord 2019). The utilization of cryptography fosters irreversibility and enhances trust between peers (Lisk 2018). It also inhibits unauthorised access to encrypted information (Fisher 2019) as, to penetrate BCT, at least 50% of all computer systems in the network have to be hacked (Ksehtri 2017b). Cryptography has thus made it challenging to cancel or fake an already recorded transaction within the BCT network (Hoy 2017; Efanov & Roschin 2018) hereby reducing the risk of fraud (Kshetri 2017a).

Smart contracts represent an integral component of BCT (Shermin 2017). They allow parties within a peer-to-peer network to create their own agreements, with no need for

external authorization, thus accelerating and simplifying the management of transactions through automated execution (Prybila *et al.* 2017). Smart contracts are likely to underpin the future development of BCT, the so-called *'Digital Society era'*, in which new, decentralized e-business models are expected to arise and become widespread across numerous economic sectors (Efanov & Roschin 2018).

In terms of critique, Zheng *et al.* (2018) question the complete security and cyber resilience of BCT by arguing that hackers can still track its user's IP address. Further, it takes different amount of time for each peer to receive a copy of the last recorded in the chain transaction which makes BCT system susceptible to temporary exploitation on behalf of external parties (Reyna *et al.* 2018). Moreover, Dresher (2017) argues that, because of its excessive novelty, BCT can violate the integrity of the traditional peer-to-peer systems. A related challenge is attributed to the reluctance of many businesses to invest in BCT given its concept is difficult to comprehend while its future outlook remains unclear (Ksehtri 2017a). Lastly, Dresher (2017) argues that, once mature, BCT can be taken over by giant tech corporations and/or national governments who will provide it to the businesses of smaller size and/or consumers, thus monopolising and controlling the market and negating the original value of decentralisation and ultimate flexibility BCT has brought.

In summary, BCT can revolutionise the global realm of financial transactions and information exchange by making them more transparent, flexible and secure. BCT can further eliminate the need for a trustworthy *'third party'* to control the monetary or information flows, thus reducing the complexity of the system and minimising the related operational costs. The downside of BCT is in its over-reliance on digital technology and expert knowledge of cryptography. These challenges are however likely to fade in the future following continued technological and conceptual development of BCT.

3. Industrial applications of BCT

Although originally designed to be used as a security enhancer in the online micropayment systems, the scope of BCT's application has expanded dramatically to date (Heilman *et al.* 2016). This is because, being similar to conventional electronic transactions, BCT does not only allow its users to exchange digital money, but also the property rights of physical goods in a digitized form and/or secure data over a computer-mediated peer-to-peer network (Nakamoto 2008). This has enabled BCT to spread across multiple industries beyond the sectors of banking and finance, but also to disrupt traditional finance and investment markets (Treiblmaier 2019).

BCT has gained its prime recognition due to digital/crypto currencies, such as the Bitcoin (Bohme *et al.* 2015). These have recently become a widespread method of processing global digital payments with many legitimate companies increasingly investing into them (Walport 2016). For example, the German National Tourist Board started accepting the Bitcoin in 2018 while the JP Morgan Bank launched its own crypto currency, the *'JPM Coin'* (Simms 2019) in response to growing consumer demand and market pressures (Kasanmascheff 2018). Likewise, the leading financial institutions in Luxemburg have developed a tool called the Fundchain (http://fundchain.lu) aiming to evaluate the potential of crypto currencies for application in the field of corporate asset management and insurance (PWC 2018).

Due to the continued appeal of the crypto currencies, the financial sector represents the prime beneficiary of BCT (Scott *et al.* 2017) but the scope of its use in finance is not limited to digital monetary transactions (Cocco *et al.* 2017). For example, the Heliocor project (https://heliocor.com) employs BCT in the design of an integrated software solution aiding businesses in combating financial fraud and scam (Robolitics™ Inside 2018). The JP Morgan Bank has invested in a BCT-based tracking system which validates payments (Simms 2019).

Further, by using true, transparent and unbiased market data, BCT can be utilised for more effective advertising and marketing (Berkowitz 2017). Lastly, another reason for BCT's close integration within the banking and financial systems is in its better resilience to cyber-attacks that are likely to accelerate in the future (Blockchain Hub 2017).

Given its grounds in the peer-to-peer transactions, BCT can enrich existing peer-to-peer business models through the optimization of the 'sharing economy' applications (Huckle *et al.* 2016). For instance, Pazaitis *et al.* (2017) report on a BCT-based project, the 'Backfeed' (http://backfeed.cc), which promotes the decentralised business management and decision-making by allowing consumers to openly communicate the true value of their trade transactions. This holds the potential to boost the infrastructural viability of the 'sharing economy' and foster trust of the peer-to-peer communities within (Efanov & Roschin 2018).

Property estate and urban planning represent sectors where the adoption of BCT solutions has grown rapidly with the purpose of securing digital monetary transactions and reducing the costs of home purchase (Colaso 2016). The Agent Not Needed (https://www.agentnotneeded.com) is an example of a BCT-based platform which can replace traditional estate agents in the real estate market by removing the need for any third parties' interferences (Pentland 2018). A project funded by the Kenyan Government allows an optimized allocation of housing units in the country through the use of BCT (Aki 2018). Lastly, Marsal-Llacuna (2018) pinpoints the value of BCT for urban planners as a means of reaching decisions on how to transform the dilapidated urban zones into the zones of alternative functional use through active local community engagement and anonymous voting.

BCT has been adopted with the purpose of institutional governance and, more specifically, with an aim of poverty alleviation, hunger fight and human rights reinforcement. For example, Lucsok (2018) reports on a BCT-based project developed by the United Nations' World Food Programme (WFP), the Building Blocks. The Building Blocks allows

the United Nations to monitor cash-based transactions in food procurement without the need for a third-party financial service. In this particular instance, BCT does not only enable transparency of monetary spend, but also reduces the level of institutional interference which, in the context of many developing countries, can be substantial and, most importantly, fraught with corruption. Further, BCT can nurture effective enforcement practices by the national and international governments, thus preventing breaches in law regulations, especially in the context of emerging democracies (Ksehtri 2017a). Lastly, another application of BCT by governmental and non-governmental institutions comprises protection of online user privacy by limiting censorship and online surveillance (Kshetri 2017b; Al-Saqaf & Seidler 2017; Singh & Singh 2016) which is particularly relevant for electronic voting (Kshetri 2018a).

BCT can be employed to enhance the quality of public services provision. For example, it can be integrated within the national health care data systems (Hoy 2017) or within the digitalized governmental services to confirm citizens' identity documents, authorize business licenses or safely store criminal records (Ølnes *et al.* 2017). Ksehtri (2017b) pinpoints another fundamental application of BCT in public services in strengthening the cyber security in the (vulnerable to external impacts but of strategic importance to the country's economic prosperity and national security) operational systems, such as defense, water supply and food procurement.

Developing and transitional economies can particularly benefit from early adoption of BCT. Although the digitization of these countries remains low, it will gradually improve (Reynolds 2018) which offers numerous opportunities for BCT use, such as, for example, with the purpose of tracking electric power distribution in rural/remote and/or poor communities (Kshetri 2017a). Concurrently, Ma (2018) and Lecarme (2019) outline the scope for BCT use in the context of the controversial social credit scoring system in China. BCT can

register and store behavioral data of citizens which allows the Chinese government to surveil its citizens anonymously, thus hindering their privacy and, potentially, violating human rights.

Research on the application of BCT for the management of natural resources has grown significantly. In this regard, Park *et al.* (2018) ascertain that the integration of BCT into the *'smart home'* and *'smart building'* environments can reduce energy use and save money for home owners and landlords which, ultimately, will improve the socio-economic and environmental sustainability of the global building construction sector . The self-owned forest terra0 project (https://terra0.org) promotes participation of BCT-based artificial intelligence, a non-human actor or the *'NHA'*, in the management of ecosystems, which should result in a more accurate valuation of the ecosystem services given it eliminates the need to employ (often subjective) 'third' party valuators (Seidler *et al.* 2016). Further, the patterns of land use, the issues of water, air and soil pollution and climate change represent the matters that can be tackled through the interconnected FEW (food, energy and water) nexus projects as facilitated by BCT. To this end, Bergendahl *et al.* (2018) report on how BCT could be employed to build better cohesion between the ecological modernization, sustainable supply chain management and trans-disciplinarity in an attempt to foster the development of more operable and efficient FEW networks. Next, tracking provenance of furniture through a BCT-based labelling system constitutes the main application of this technology in forestry, wood processing and the related industry of furniture making (Dabbs 2017). The Provenance project (https://www.provenance.org) expands the scope of BCT use towards food production and procurement (Provenance 2016; Kshetri 2018b) by building trust in the food chain, ensuring transparency, eliminating the *'middleman'* and empowering key stakeholders, such as smallholder farmers and consumers (Lucas 2018). Lastly, BCT can potentially be employed to more accurately track the carbon emissions of specific industries and business enterprises

(Walker 2017), thus contributing to better carbon accounting and, ultimately, carbon footprint management.

The foremost potential of BCT's application arguably rests in tracking assets within the supply chains (Galvez *et al.* 2018). The supply chain comprises an (often significant) number of intermediaries which normally results in additional costs for both producers and consumers (Goldman and Sachs 2017). Further, intermediaries reduce the supply chain velocity and inhibit transparency (Korpela *et al.* 2017). Concurrently, consumers are increasingly developing high expectations of the supply chain in terms of its efficiency and agility which the industry has to respond to by capitalising upon the advantages of the digital technology, such as BCT (Alicke *et al.* 2016). To this end, by reducing the complexity of the supply chain, BCT can contribute to more accurate demand forecasting when planning on inventory purchasing, thus not only gaining cost advantages, but also eliminating unnecessary wastage of resources (Kamble *et al.* 2018). This suggests the potential contribution made by BCT to the sustainable management of the global supply chains and, ultimately, to more circular models of the global economy (Min 2019; Casado-Vara *et al.* 2018; Queiroz & Wamba 2019). Besides, BCT can be employed in the supply chain management to detect and prevent fraud (Hackius & Petersen 2017) as it can address the shortage of trust which is particularly noticeable in the poorly performing and overly extensive supply chains, such as those in developing and transitional economies (Saberi *et al.* 2018). Further, by integrating BCT into the supply chain, the likelihood of occurrence of faulty and/or illicit inventory is reduced (Apte & Petrovsky 2016). The resultant increased transparency of the supply chain will in turn make it more traceable (Francisco & Swanson 2018). Grounding upon this, BCT can cater for better integrated flows in the supply chain where accurate recording of the provenance of goods and services is required (Saberi *et al.* 2018). Better integration of data through a BCT-based cloud network service can, for example, facilitate trust, thus enabling

more cost-effective collaboration between the main stakeholders within the supply chains (Korpela *et al.* 2017).

The bulk of empirical research on the integration of BCT into the supply chains has focused on food. It has primarily been concerned with the issues of food traceability, food production control, food quality assessment and food supply chain transparency (Kairos Future 2017). Casado-Vara *et al.* (2018) considered BCT in the context of integrated agriculture supply chains and proposed an upgraded business model for its future integration. Galvez *et al.* (2018) discussed the potential to adopt BCT for analysing the foodstuff ingredients and displaying the outcome of this analysis on food labels. Arildsen (2017) studied BCT as a means of certifying the origin of olive oil and ensuring its safe transportation to a final consumer. Wyers (2019) examined the application of BCT for traceability in the food chain and focused on a business-to-consumer relationship, which was considered more complex and multifaceted than the business-to-business cooperation in food supply (Richards 2017). The Ripe.io project (https://www.ripe.io) presented a BCT-based solution for tracing goods throughout the global food supply chain and demonstrated how the concept of the '*Food Bundles*' could record and display the data on food additives and intolerances, thus enabling consumers to make informed purchases (Wyers 2019).

4. BCT application in hospitality operations management

4.1. Scope of use

Critical review of scholarly research and the '*gray*' literature highlights a number of examples of existing and prospective BCT application in the hospitality industry. These are summarised in Figure 1 and explained in detail below.

[Insert Figure 1 here]

The largest chunk of the literature (Huckle *et al.* 2016; Önder & Treiblmaier 2018; Calvaresi *et al.* 2019) focuses on the potential disruption which BCT can bring to the traditional online travel aggregators (for example, Expedia) but also to those aggregators operating specifically in the hospitality segment of the 'sharing economy' market (for instance, AirBnB or Deliveroo). BCT's potential in building trust, enabling direct, cashless and more secure monetary transactions and information exchange, cutting costs and facilitating transparency can effectively eliminate the need for the *'middleman'* (Poorigali 2018), thus making the extant umbrella brands redundant. Further, Calvaresi *et al.* (2019, p.305) argue that such issues as *'strategic lies, malicious behaviors, and formation of deceiving coalitions'* by either the AirBnB guests or the hosts that often take place below the surface can be effectively tackled by BCT, thus making transactions in the hospitality segment of the 'sharing economy' more equitable and assigning equal powers to the provider and consumer of its services.

The potential held by BCT to disrupt existing business models in hospitality operations is well justified by looking at the emergence of novel players in the hospitality and 'sharing economy' markets. The *hotel P2P* project has recently evolved which represents the first digital platform underpinned by BCT and smart contracts. The project aims to connect all (otherwise decentralized) global hotels into the *One Global Hotel* hub, offering more choice to customers, better visibility to providers and, ultimately, enabling direct contacts between the two (Riquelme 2018). Likewise, the *Winding tree* project promotes an innovative business ecosystem which strives to connect suppliers, providers and customers of hospitality services directly, minimising barriers for (international and national) market entry and eliminating costly intermediaries (Önder & Treiblmaier 2018). It is important to note that, while the above BCT-based initiatives have been predominantly set to reduce the dependence of hospitality businesses on intermediaries, they represent, to some extent, the intermediaries themselves.

For them to succeed and deliver the intended outcomes, it will be important to ensure that they maintain transparency and commercial independence. Lastly, some small island destinations in the Caribbean, whose economies over-rely on tourism, are investing into the design of BCT platforms that could directly connect incoming tourists with local hotel and restaurant businesses, thus eliminating economic leakage from the destination and enhancing the socio-economic well-being of the local communities (Travers 2017 cited by Kwok & Koh 2018).

Another obvious application of BCT in the context of the hospitality industry is in its ability to reshape traditional communication channels in digital marketing by authenticating customer reviews, but also by detecting and eliminating fake and unfair consumer comments left on social media (Kwok & Koh 2018; Önder & Treiblmaier 2018; Sigala 2017). Fake and unfair reviewing represents a critical issue for hospitality operations which has the potential to become recurring due to ever increasing business competitiveness (Calvaresi *et al.* 2019). BCT can protect hospitality enterprises through improved credential management, thus facilitating their business longevity and building commercial resilience (Colombo & Baggio 2017).

BCT can aid hospitality businesses in budgeting by simplifying and safeguarding monetary transactions, enabling cashless payments and offering (interest-free or low-interest) credit or finance facilities to both customers and suppliers (Amadeus 2017). This becomes particularly important in the context of many developed countries where the digitization agenda is on the rise (EU 2018). Concurrently, this BCT application may not benefit immediately the developing and transitional economies which is due to their continued reliance on cash (Do and Nguyen 2017) albeit this status-quo is likely to change in the future. Further, Leung and Dickinger (2017) suggest that it may take some time before consumers

and suppliers of hospitality services will develop sufficient familiarity with crypto/digital currencies for these to become a mainstream payment method.

Customer loyalty management holds multiple opportunities for BCT use, thus being of prime relevance to the hospitality industry (Kwok & Koh 2018) and, especially, to its luxury segment (Amadeus 2017). BCT can facilitate the design of novel loyalty programmes that can be transferable across particular hospitality businesses, but also across entire economic sectors (TTI Forum 2018). For instance, the *Loyyal* is a BCT-based platform which improves the inter-operability of airline loyalty programmes by easing the transfer of points to other airlines, but also to partner hotels and car rentals (Amadeus 2017).

BCT can streamline the relationship of hospitality enterprises with their brand/franchise owners. For a start, it can safeguard and accelerate the speed of digital payments, but also offer more accurate billing. Moreover, BCT can provide more precise and timely data on business performance, both operational and environmental management-related, thus contributing to (more) informed decision-making of the brand/franchise owners and the investors behind (Hospitality Technology 2017). Lastly, expert knowledge and/or business performance data held by the brand/franchise owner can be shared more securely, thus eliminating leakage of business sensitive information, customer records and patented technologies to 'third parties' and/or cyber-criminals (Winder 2019). This is of high relevance to hospitality services that are generally easier to copy and replicate compared to traditional manufacturing industries.

BCT can contribute to the design of more collaborative business models in the context of destination management and marketing. This can be attributed to streamlined exchange of knowledge and information from policy-makers/destination managers to industry practitioners, but also to the provision of more accurate statistical data on, for instance, the number of tourists and their preferences by hospitality enterprises to destination managers

(Kwok & Koh 2018). BCT can further facilitate coopetition (as opposed to traditional competition) between hospitality businesses at a specific destination due to data transparency and improved trust (Carson *et al.* 2018). This can be of particular relevance in the context of popular tourist destinations at 'high' seasons as to avoid customer dissatisfaction and build business reciprocity.

Last but not least, (food) supply chain management and (food) logistics management hold substantial scope for BCT use in the hospitality industry, especially from the viewpoint of contributing to its (environmental) sustainability. This is attributed to the optimization of business procurement strategies thanks to increased visibility onto the provenance and the status of crucial supplies, in particular food (Poorigali 2018). This is of prime importance to the rapidly emerging hospitality markets in developing and transitional economies, especially those in South East Asia and China, where the issues of food fraud, adulteration and crime persist (Galvez *et al.* 2018). This is further critical due to the rise in health- and allergen-consciousness among consumers of food service provision worldwide which underlines the need for hospitality businesses to identify and accurately label the ingredients, but also the production methods used, of the food served (Fishcoin 2018). Lastly, this is because of religious considerations and, in particular, the growing significance of halal food consumption (Battour and Ismail 2016). To tap into this large market, hospitality managers should guarantee the provenance and religious compliance of the food they provide.

4.2. Key issues to overcome

The key factor which hampers the adoption of BCT in the context of hospitality operations management is attributed to its conceptual complexity and excessive market novelty (Gatteschi *et al.* 2018). The hospitality industry is often described as being risk-averse, conservative and resistant to the embracement of disruptive innovations. As a result, the novelty of BCT imposes the biggest challenge towards its more ubiquitous commercial

adoption (Wyers 2019). This issue must be overcome as the inability of hospitality businesses to adopt and withstand market disruptions can lead to market extinction, which is well exemplified by the lasting effect of the 'sharing economy' on the provision of (more) traditional hospitality services (Guttentag 2015). The speed of the industry adoption of market disruptions determines business competitiveness (Buhalis & Leung 2018), thus suggesting that hospitality managers need to comprehend the potential held by BCT for their operations and innovate accordingly. In turn, it represents a crucial task of policy-makers and destination managers to provide expert training and industry workshops on BCT use in the context of hospitality services, thus facilitating knowledge sharing, enhancing business agility and promoting business innovation.

A few obstacles must be addressed to enable the adoption of BCT in the management of the hospitality's supply chain, namely: regulatory uncertainty **(**Hackius & Petersen 2017); immaturity of the supporting technological infrastructure, such as the quality of Wi-Fi connectivity in hotels and restaurants (Wyers 2019) and the imminent collaboration on BCT projects between a large variety of partners, often hailing from different cultural backgrounds, which foments mistrust (Saberi *et al.* 2018). Further challenges that a prospective adoption of BCT in the hospitality industry would pose are related to the cost of its operation (Karame and Androulaki 2016; Kshetri 2017a; Stein 2018). Operating Bitcoin is currently considered unprofitable, especially for small scale business ventures (Tuwiner 2019). This holds true for hospitality businesses that, in majority, are represented by small-to-medium-sized enterprises (UNWTO 2018).

Additionally, Stein (2018) argues that BCT can often have long waiting times for the transaction to be authorized. This is due to the safety mechanisms of BCT which dictate that the parties holding authority to approve transactions can be based anywhere in the world and often represent different time zones. Any delays in the authorization process would plummet

the cost advantage for the performance of the e-commerce transaction. Its efficiency and speed are crucial for the hospitality industry, characterized by high prices, low profit margins, restricted access to cash and limited marketplace dynamics (Hua 2016). This raises questions about the immediate suitability of BCT to serve the needs of many hospitality businesses unless a suitable solution is identified and politically reinforced in the foreseeable future. Table 1 summarises the key issues that need to be addressed in order to facilitate the hospitality industry's uptake of BCT and proposes some measures that can be applied to this end.

[Insert Table 1 here]

5. Conclusions

The disruptive effect of BCT on the global economy and its specific sectors is well recognised and, yet, remains under-studied in the context of hospitality services provision. The lack of understanding of BCT's potential by hospitality managers hampers its commercial uptake and hinders business innovation. As a bare minimum, this may put many hospitality enterprises into a disadvantaged market position, especially given the industry's renowned reluctance to innovate but, also, to effectively adopt to external market innovations.

This paper contributed to the body of knowledge by examining the scope of the potential integration of BCT into hospitality operations. The paper clarified the opportunities of BCT to be applied in hospitality operations management and evaluated the challenges to be addressed for its more effective application, thus building a platform for industry and academic debate on the feasibility of the broader commercialization of BCT concept within hospitality services. The paper reviewed evidence of existing applications of BCT in the industries that constitute an integral part of the hospitality services' supply chain and that are

closely related to hospitality's business operations. It further highlighted examples of BCT use holding the foremost potential for its adoption by hospitality managers. The paper summarised its findings in the form of a framework outlining the possible scope of BCT application in the realm of hospitality operations management.

The paper argued that BCT holds the largest potential for application in the context of hospitality, rather than 'pure' tourism and/or travel, industries. It can boost the transparency of the digital communication channels in hospitality marketing by developing a mechanism for the detection of fake and biased consumer reviews. It can revolutionise the hospitality-related 'sharing economy' applications by eliminating the need for the *'middleman'*, securing monetary transactions, and improving the host-guest relationship in the case of the home-shared rental businesses. Last but not least, BCT can contribute significantly to the management of the hospitality industry's supply chain, especially in terms of food procurement. This is arguably the most exciting area of BCT application given the growing global importance of food service provision and an array of associated operational issues within, such as food fraud and adulteration.

The future applicability of BCT to the realm of hospitality operations management is constrained by a number of factors. Industry confusion with BCT's functionality is a prime obstacle to business forward-thinking and its participation in BCT innovations. Similar issue persists in the case of policy-makers which, in combination with subsequent regulatory immaturity, represent another impediment. The lack of knowledge is particularly pronounced in the context of developing and transitional economies where the hospitality industry is rapidly growing and where this growth comes at a cost of numerous socio-economic and environmental externalities. To reduce these externalities, there is a need for business and policy-making training to review existing examples of BCT use and promote innovative

thinking. This training should be grounded on research which has generated evidence-based BCT solutions and tested their applicability in the real world settings.

In terms of directions for future academic research, as per above, it is important to first hand test the feasibility of BCT to be applied in hospitality operations with industry professionals. Expert opinions (via, for example, Delphi studies) should be sought to conduct a reality check of BCT's prospects versus its actual uses. These should examine the topic from the viewpoint of hospitality business practitioners, but also as policy-makers and destination managers as the latter stakeholders play a crucial role in facilitating the commercial uptake of BCT. Besides, the case studies of existing practical instances of BCT use in the hospitality context should be identified and thoroughly reviewed to enable a critical analysis of the determinants of their broader industry rollout. Further, the evolvement of the political and research agenda on the *'digital economy'*, *'smart cities'* and *'smart tourism'* calls for dedicated studies on the role of BCT within, again with a comprehensive review of the industry case studies and success examples. Within this context, closer consideration of the implications of BCT for the design of 'smart' hotel buildings and/or 'green' (hotel or restaurant) procurement models, especially in relation to the food supply chain, is necessary, as an example.

References

Aki, J. 2018. Kenyan Government to use Blockchain to distribute affordable housing. *CCN*, 16 October 2018. Available from: https://www.ccn.com/kenyan-government-to-use-blockchain-to-distribute-affordable-housing [Accessed 5 February 2019].

Al-Saqaf, W. & Seidler, N. 2017. Blockchain technology for social impact: opportunities and challenges ahead. *Journal of Cyber Policy*, 2(3), 338–354.

Alicke, K., Rachor, J. & Seyfert, A. 2016. Supply Chain 4.0–the next-generation digital supply chain. *McKinsey & Company*, June 2016. Available from: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Operations/Our%20Insights/Supply%20Chain%2040%20%20the%20next%20generation%20digital%20supply%20chain/08b1ba29ff4595ebea03e9987344dcbc.ashx [Accessed 30 April 2019].

Amadeus. 2017. *Blockchain: harnessing its potential in travel.* Madrid: Amadeus.

Apte, S. and Petrovsky, N. 2016. Will blockchain technology revolutionize excipient supply chain management? *Journal of Excipients and Food Chemicals*, 7(3), 76–78.

Arildsen, V. 2017. *Blockchain can prevent fraud in the food industry*. Available from: https://en.itu.dk/about-itu/press/news-from-itu/2017/blockchain-can-prevent-fraud-in-the-food-industry [Accessed 12 April 2019].

Battour, M., & Ismail, M.N. 2016. Halal tourism: Concepts, practises, challenges and future. *Tourism Management Perspectives*, 19(Part B), 150-154.

Bergendahl, J.A., Sarkis, J. & Timko, M.T. 2018. Transdisciplinarity and the food energy and water nexus: Ecological modernization and supply chain sustainability perspectives. *Resources, Conservation & Recycling*, 133, 309–319.

Berkowitz, D. 2017. *Twenty-seven ways marketers can use Blockchain.* Available from: https://adage.com/article/digitalnext/twenty-ways-marketers-blockchain/311105 [Accessed 4 April 2019].

Blockchain Hub 2017. *What is Blockchain?* Available from: https://blockchainhub.net/blockchain-intro/ [Accessed 12 March 2019].

Bohme, R., Christin, N., Edelman, B., and Moore, T., 2015. Bitcoin: Economics, Technology, and Governance. *Journal of Economic Perspectives*, 29(2), 213-238.

Buhalis, D., & Leung, R., 2018. Smart hospitality—Interconnectivity and interoperability towards an ecosystem. *International Journal of Hospitality Management,* 71, 41-50.

Buhalis, D., & O'Connor, P., 2005. Information Communication Technology Revolutionizing Tourism. *Tourism Recreation Research,* 30(3), 7-16.

Calvaresi, D., Leis, M., Dubovitskaya, A., Schegg, R. &Schumacher, M. 2019. Trust in Tourism via Blockchain Technology: Results from a Systematic Review. *In:* Pesonen, J. & Neidhardt, J., eds. *Information and Communication Technologies in Tourism 2019: Proceedings of the International Conference in Nicosia, Cyprus, January 30–February 1, 2019*. London: Springer, 304–317.

Carson, B., Romanelli, G., Walsh, P., & Zhumaev, A. 2018. *Blockchain beyond the hype: What is the strategic business value?* McKinsey & Company, June 2018.

Casado–Vara, R., Prieto, J., De la Prieta, F. & Corchado, J.M. 2018. How blockchain improves the supply chain: case study alimentary supply chain. *Procedia Computer Science,* 134, 393–398.

Christidis, K. & Devetsikiotis, M. 2016. Blockchains and Smart Contracts for the Internet of Things. *IEEE Access*, 4, 2292–2303.

Cocco, L., Pinna, A. & Marchesi, M. 2017. Banking on Blockchain: Costs Savings Thanks to the Blockchain Technology. *Future Internet*, 25(9), 1–20.

Colombo, E. & Baggio, R. 2017. Tourism distribution channels: Knowledge requirements. *In:* Scott, N., De Martino, M. & Van Niekerk, T., eds. *Knowledge Transfer To and Within Tourism: Academic, Industry and Government Bridges.* Bingley: Emerald Publishing, 741-754.

Colaso, V. 2016. *10 multibillion dollar #blockchain ideas for the Housing Market*. Available from: https://www.linkedin.com/pulse/10-multibillion-dollar-blockchain-ideas-housing-market-vikrant-colaso/ [Accessed 12 March 2019].

Crosby, M., Nachiappan, M., Pattanayak, P., Verma, S. & Kalyanaraman, V. 2016. BlockChain Technology: Beyond Bitcoin. *Applied Innovation Review*, 2, 6–19.

Dabbs, A. 2017. *What can Blockchain do for the environment?* Available from: https://ensia.com/features/blockchain-environment-sustainability/ [Accessed 16 April 2019].

Dhillon, V., Metcalf, D. and Hooper, M. 2017. *Blockchain Enabled Applications: Understand the Blockchain Ecosystem and how to make it work for you*. New York: Apress.

Do, H. and Nguyen, P., 2017. The Level of Factors Influences on Customer's Adoption of Internet Banking: The Case of Vietnam. *International Journal of Economics, Finance and Management Sciences*, 5(3), 194-203.

Dresher, D. 2017. *Blockchain Basics*. New York: Apress.

Efanov, D. and Roschin, P. 2018. The All-Pervasiveness of the Blockchain Technology. *Procedia Computer Science*, 123, 116–121.

Ert, E., Fleischer, A., and Magen, N., 2016. Trust and reputation in the sharing economy: The role of personal photos in Airbnb. *Tourism Management*, 55, 62-73.

European Union-EU 2018. *Digital economy.* Available from: https://ec.europa.eu/jrc/en/research-topic/digital-economy [Accessed 31 May 2019].

Fishcoin 2018. *Fishcoin: A Blockchain Based Data Ecosystem For The Global Seafood Industry*. Available from: https://fishcoin.co/ [Accessed 31 May 2019].

Fisher, T. 2019. *Cryptographic Hash Function.* Available from: https://www.lifewire.com/cryptographic-hash-function-2625832 [Accessed 3 April 2019]

Francisco, K. and Swanson, D. 2018. The Supply Chain has no clothes: technology adoption of Blockchain for supply chain transparency. *Logistics*, 2(2), 1–13.

Galvez, J.F., Mejuto, J.C. & Simal–Gandara, J. 2018. Future challenges on the use of blockchain for food traceability analysis. *Trends in Analytical Chemistry*, 107, 222–232.

Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C. & Santamaría, V. 2018. Blockchain and Smart Contracts for Insurance: Is the Technology Mature Enough? *Future Internet*, 10(20), 1–16.

Goldman & Sachs 2017. *Blockchain: The New Technology of Trust*. Available from: https://www.goldmansachs.com/insights/pages/blockchain/ [Accessed 5 March 2019]

Gretzel, U., Sigala, M., Xiang, Z., and Koo, C., 2015a. Smart tourism: foundations and developments. *Electronic Markets*, 25(3), 179-188.

Gretzel, U., Werthner, H., Koo, C., & Lamsfus, C., 2015b. Conceptual foundations for understanding smart tourism ecosystems. *Computers in Human Behavior*, 50, 558-563.

Guttentag, D.A. 2015. Airbnb: disruptive innovation and the rise of an informal tourism accommodation sector. *Current Issues in Tourism*, 18(12), 1192–1217.

Hackius, N. & Petersen, M. 2017. Blockchain in Logistics and Supply Chain: Trick or Treat? *In:* Kersten, W., Blecker, T. & Ringle, M., eds. *Proceedings of the Hamburg International Conference of Logistics (HICL)*, October 12–13, 2017. Hamburg.

Heilman, E., Baldimtsi, F. & Goldberg, S. 2016. Blindly signed contracts: anonymous on-blockchain and off-blockchain bitcoin transactions. *In:* Clark, J., Meiklejohn, S., Ryan, P.Y. A., Wallach, D., Brenner, M. & Rohloff, K., eds. *Financial Cryptography and Data Security*, Barbados, February 26, 2016. London: Springer, 43–60.

Hospitality Technology 2017. *Blockchain Could Revolutionize Hospitality*. Available from: https://hospitalitytech.com/blockchain-could-revolutionize-hospitality [Accessed 3 June 2019].

Hoy, M.B. 2017. An Introduction to the Blockchain and Its Implications for Libraries and Medicine. *Medical Reference Services Quarterly,* 36(3), 273–279.

Hua, N. 2016. E-commerce performance in hospitality and tourism. *International Journal of Contemporary Hospitality Management*, 28(9), 2052–2079.

Huckle, S., Bhattacharya, R., White, M. & Beloff, N. 2016. Internet of Things, Blockchain and Shared Economy Applications. *Procedia Computer Science* ,98, 461–466.

Iansiti, M. & Lakhani, K.R. 2017. The Truth About Blockchain. *Harvard Business Review*, 95(1), 118-127.

Kairos Future 2017. *Blockchain use cases for food traceability and control*. Malmö: Kairos Future.

Kamble, S., Gunasekaran, A. & Arha, H. 2018. Understanding the Blockchain technology adoption in supply chains – Indian context. *International Journal of Production Research*, 57(7), 2009–2033.

Karame, G. & Androulaki, E. 2016. *Bitcoin and blockchain security*. London: Artech House.

Kasanmascheff, M. 2018. *Germany: National Tourism Center adds cryptocurrency payments for services*. Available from: https://cointelegraph.com/news/germany-national-tourism-center-adds-cryptocurrency-payments-for-services [Accessed 4 March 2019].

Kasireddy, P. 2018. *What do we mean by 'blockchains are trustless'?* Available from: https://medium.com/@preethikasireddy/eli5-what-do-we-mean-by-blockchains-are-trustless-aa420635d5f6 [Accessed 5 April 2019].

Kewell, B. & Ward, P.M. 2017. Blockchain futures: With or without Bitcoin? *Strategic Change,* 26(5), 491–498.

Kewell, B., Adams, R. & Parry, G. 2017. Blockchain for good? *Strategic change,* 26(5), 429–437.

Konstantopoulos, G. 2017. *Understanding Blockchain Fundamentals, Part 2: Proof of Work & Proof of Stake.* Available from: https://medium.com/loom-network/understanding-blockchain-fundamentals-part-2-proof-of-work-proof-of-stake-b6ae907c7edb [Accessed 24 March 2019].

Korpela, K., Hallikas, J. & Dahlberg, T. 2017. Digital Supply Chain Transformation toward Blockchain Integration. *In: Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS-50).* Hawaii, January 4–7, 2017. Hawaii: IEEE Computer Society, 4182–4191.

Kosba, A., Miller, A., Shi, E., Wen, Z. & Papamanthou, C. 2016. Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts. *In:* O'Conner, L., ed. *2016 IEEE Symposium on Security and Privacy SP 2016.* San Jose, May 23–25, 2016. Los Alamitos: IEEE Computer Society, 839–858.

Ksehtri, N. 2017a. Will blockchain emerge as a tool to break the poverty chain in the Global South? *Third World Quarterly*, 38(8), 1710–1732.

Ksehtri, N. 2017b. Blockchain's roles in strengthening cybersecurity and protecting privacy. *Telecommunications Policy*, 41, 1027–1038.

Ksehtri, N. 2018a. Blockchain-Enabled E-Voting. *IEEE Software*, 35, 95-99, July/August 2018.

Ksehtri, N. 2018b. Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80–89.

Kumar, V. 2018. *Big Data, IoT and Blockchain: Benefits of Merging the Trending Trio.* Available from: https://www.smartdatacollective.com/big-data-iot-blockchain-benefits-of-merging-trending-trio/ [Accessed 18 March 2019].

Kwok, A.O.J. & Koh, S.G.M. 2018. Is blockchain technology a watershed for tourism development? *Current Issues in Tourism*, 21(1), 1-6.

Lecarme, L. 2019. *The Black Mirror of Blockchain and Cryptocurrencies.* Available from: https://medium.com/coinmonks/the-black-mirror-of-blockchain-and-cryptocurrencies-773622cf7cae [Accessed 6 April 2019].

Leung, D., & Dickinger, A. 2017. Use of Bitcoin in Online Travel Product Shopping: The European Perspective. *In:* Schegg. R. and Stangl, B., eds. *Information and Communication Technologies in Tourism 2017: Proceedings of the International Conference in Rome, Italy, January 24-26, 2017.* London: Springer, 741–754.

Lisk, 2018. *Cryptography Explained: Public-Key vs Symmetric Cryptography* [video, online]. YouTube. Available from: https://www.youtube.com/watch?time_continue=1&v=t21O-EiwzKI [Accessed 20 March 2019].

Lord, N. 2019. *What is Data Encryption? Definition, Best Practices & More.* Available from: https://digitalguardian.com/blog/what-data-encryption [Accessed 19 March 2019].

Lucas, L., 2018. From farm to plate, blockchain dishes up simple food tracking. *Financial Times*, 6 June 2018.

Lucsok, P. 2018. *Fighting hunger with blockchain.* Available from: https://www.parity.io/fighting-hunger-with-blockchain/ [Accessed 17 March 2019].

Ma, A. 2018. China ranks citizens with a social credit system–here's what you can do wrong and how you can be punished. *Independent*, 10 April. Available from: https://www.independent.co.uk/life-style/gadgets-and-tech/china-social-credit-system-punishments-rewards-explained-a8297486.html [Accessed 16 March 2019].

Manski, S. 2017. Building the blockchain world: Technological commonwealth or just more of the same? *Briefings in Entrepreneurial Finance*, 26(5), 511–522.

Marsal-Llacuna, M.– L. 2018. Future living framework: Is blockchain the next enabling network? *Technological Forecasting & Social Change*, 128, 226–234.

Miau, S. & Yang, J.-M. 2018. Bibliometrics-based evaluation of the Blockchain research trend: 2008–March 2017. *Technology Analysis & Strategic Management*, 30(9), 1029–1045.

Min, H. 2019. Blockchain technology for enhancing supply chain resilience. *Business Horizons*, 62, 35–45.

Nakamoto, S. 2008. *Bitcoin: A peer-to-peer electronic cash system*. Bitcoin.org.

Nam, K., Dutt, C.S., Chathoth, P., and Khan, M.S., 2019. Blockchain technology for smart city and smart tourism: latest trends and challenges. *Asia Pacific Journal of Tourism Research*, in press. https://doi.org/10.1080/10941665.2019.1585376

Ølnes, S., Ubacht, J. & Janssen, M. 2017. Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly,* 34, 355–364.

Önder, I. & Treiblmaier, H. 2018. Blockchain and tourism: Three research propositions. *Annals of Tourism Research,* 69, 1–3.

Park, L.W., Lee, S. & Chang, H. 2018. A sustainable home energy prosumer-chain methodology with energy tags over the Blockchain. *Sustainability,* 10(658), 1–18.

Pazaitis, A., De Filippi, P. & Kostakis, V. 2017. Blockchain and value systems in the sharing economy: The illustrative case of Backfeed. *Technological Forecasting & Social Change,* 125, 105–115.

Pentland, A. 2018. *PropTech: How Blockchain & Social Media are Changing the Property Industry*. Available from: https://medium.com/agentnotneeded/proptech-how-blockchain-social-media-are-changing-the-property-industry-abd02a34692c [Accessed 13 March 2019].

Poorigali, S. 2018. *The Application of Blockchain in the Hospitality Sector.* Available from: https://www.hotel-online.com/press_releases/release/the-applicability-of-blockchain-in-the-hospitality-sector#When:18:19:45Z [Accessed 10 April 2019].

Provenance. 2016. *From shore to plate: Tracking tuna on the blockchain*. Available from: https://www.provenance.org/tracking-tuna-on-the-blockchain [Accessed 16 May 2019]. London: Provenance.

Prybila, C., Schulte, S., Hochreiner, C. & Weber, I. 2017. Runtime verification for business processes utilizing the Bitcoin blockchain. *Future Generation Computer Systems,* 73, 1–16.

PwC. 2018. *Blockchain, a catalyst for new approaches in insurance* . France: PwC.

Quieroz, M.M. & Wamba, S.F. 2019. Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, 46, 70–82.

Reyna, A., Martín, C., Chen, J., Soler, E. & Díaz, M. 2018. On blockchain and its integration with IoT. Challenges and opportunities. *Future Generation Computer Systems*, 88, 173–190.

Reynolds, M., 2018. Facebook and Google's race to connect the world is heating up. *Wired*, Available from: https://www.wired.co.uk/article/google-project-loon-balloon-facebook-aquila-internet-africa [Accessed 30 May 2019].

Richards, L. 2017. *B2B vs. B2C Supply Chain.* Available from: https://bizfluent.com/info-8608097-b2b-vs-b2c-supply-chain.html [Accessed 13 April 2019].

Riquelme, S. 2018. *Hotel P2P* [video, online]. Vimeo. Available from: https://vimeo.com/242257157 [Accessed 1 May 2019].

Robolitics™ Inside. 2018. *Heliocor: Restoring Trust.* London: Heliocor Ltd.

Saberi, S., Kouhizadeh, M., Sarkis, J. & Shen, L. 2018. Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117–2135.

Scott, B., Loonam, J. & Kumar, V. 2017. Exploring the rise of blockchain technology: Towards distributed collaborative organizations. *Strategic Change*, 26(5), 423–428.

Seidler, P., Kolling, P. & Hampshire, M. 2016. *Terra0: Can an augmented forest own and utilise itself?* San Francisco: GitHub.

Sharma, T.K. 2018. *Advantages and disadvantages of permission less Blockchain* . Available: https://www.blockchain-council.org/blockchain/advantages-and-disadvantages-of-permissionless-blockchain/ [Accessed 28 March 2019].

Shermin, V. 2017. Disrupting governance with blockchains and smart contracts. *Strategic Change*, 26(5), 499–509.

Sigala, M. 2017. Collaborative commerce in tourism: implications for research and industry. *Current Issues in Tourism*, 20(4), 346–355.

Simms, T. 2019. *JPMorgan Chase to Add New Features to Blockchain-Powered Network for Global Banks* . Available from: https://cointelegraph.com/news/jpmorgan-chase-to-add-new-features-to-blockchain-powered-network-for-global-banks [Accessed 22 April 2019].

Singh, S. and Singh, N. 2016. Blockchain: Future of Financial and Cyber Security. *In:* Niranjan,S.K. and Aradhya, V.N.M., eds. *Proceedings of the 2016 2nd International Conference on Contemporary Computing and Informatics (ic3i)*, Noida, December 14-17, 2016. Noida: Amity University. 463–467.

Stankov, U., Filimonau, V., and Slivar, I., 2019. Calm ICT design in hotels: A critical review of applications and implications. *International Journal of Hospitality Management*, in press. https://doi.org/10.1016/j.ijhm.2018.10.012

Stein, S. 2018. *Hashgraph wants to give you the benefits of blockchain without the limitations.* Available from: https://techcrunch.com/2018/03/13/hashgraph-wants-to-give-you-the-benefits-of-blockchain-without-the-limitations/ [Accessed 6 April 2019].

Stevens, A. 2018. *Distributed ledger consensus explained* . Available from: https://hackernoon.com/distributed-ledger-consensus-explained-b0968d1ba087 [Accessed 6 March 2019].

Treiblmaier, H., 2019. Toward More Rigorous Blockchain Research: Recommendations for Writing Blockchain Case Studies. *Frontiers in Blockchain*, 2(3), 1-15.

TTI Forum 2018. *Blockchain is 2018´s ´now´ technology but what is it and how is it being applied to the travel industry?* London: TTI Summer Forum. Available from: https://www.tti.org/home/events/tti-summer-forum-june-2018/ [Accessed 5 April 2019].

Tuwiner, J. 2019. *Is Bitcoin Mining Profitable or Worth it in 2019?* Available from: https://www.buybitcoinworldwide.com/mining/profitability/ [Accessed 25 April 2019].

UNWTO 2018. *EU Tourism Trends Report*. Madrid: UNWTO.

Viriyasitavat, W., and Hoonsopon, D., 2019. Blockchain characteristics and consensus in modern business processes. *Journal of Industrial Information Integration*, 13, 32-39.

Walker, L. 2017. *This new carbon currency could make us more climate friendly* . Available from: https://www.weforum.org/agenda/2017/09/carbon-currency-blockchain-poseidon-ecosphere/ [Accessed 12 April 2019].

Walport, M. 2016. *Distributed Ledger Technology: beyond block chain* . London: Government Office for Science.

Winder, D., 2019. Security Systems Of Major Hotel Chains Exposed By Huge Data Breach. *Forbes*, 31 May 2019.

Wyers, R. 2019. *Blockchain potential: "Food bundle" approach will be the way forward in B2C use, says start-up innovator* . Available from: https://www.foodingredientsfirst.com/news/blockchain-potential-food-bundle-approach-will-be-the-way-forward-in-b2c-use-says-start-up-innovator.html?fbclid=IwAR3lTqESNpTEyXFTMgKaSTxD1dlKYaAnzr9Em-j6rpASgOx5ULxgLJeJgqk [Accessed 29 April 2019].

Zheng, Z., Xie, S., Dai, H.-N., Chen, X. & Wang, H. 2018. Blockchain Challenges and Opportunities: A Survey. *International Journal of Web and Grid Services*, 14(4), 352–375.

Table 1. Key issues to be overcome when adopting the BCT in hospitality operations management alongside the main drivers and potential solutions.

Issue	Driver	Potential solution
BCT's conceptual novelty and managerial distrust in its value	-Traditional 'conservatism' of the hospitality industry -Limited managerial familiarity with the BCT and its value propositions -Limited knowledge of *'where to start?'*	-Targeted managerial training provided by (national and local) policy-makers/destination managers -Demonstration projects initiated and financed by (national and local) policy-makers/destination managers and led by industry 'champions' -Dissemination of case studies and examples of good practice in the market adoption of the BCT with accurate assessments and clear demonstrations of the added value
Limited technological uptake / Global digital divide	-Infrastructural and technological challenges (e.g. poor Wi-Fi connectivity in the locality)	-Affordable finance options and/or interest free loans provided by (local) policy-makers/destination managers
(Initial investment and operational) cost	-Lack of affordable finance	
Regulations / Legal uncertainty	-Novelty of the BCT for regulators/policy-makers -Managerial unwillingness to invest into uncertain future	-Train the regulators -Streamlined regulation adopted at the national level
BCT's transaction speed	-The truly global scale of the BCT operation -Global time differences / Differences in global work patterns	-'Localised' BCTs that can be more reactive and/or better adopted to meet the needs of the local markets

Figure 1. The scope for the BCT application in hospitality operations.