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

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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.

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 and 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 and Ward, 2017). BCT can inspire business and social innovation and uncover new entrepreneurial opportunities (Singh and 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 and 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 and 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 and 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 and Baggio, 2017; Önder and 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 and 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.

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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 and 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 and 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 and Singh, 2016). Instead, BCT distributes the control power to multiple actors (peers) across the digital network by making use of public-key cryptography in a *´distributed database, containing records of transactions´* (Efanov and 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 and Devetsikiotis, 2016) which makes BCT decentralized, but also more transparent, equitable and accountable (Al-Saqaf and 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 and Sachs, 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 and 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 and 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 and Roschin, 2018) hereby reducing the risk of fraud (Ksehtri, 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 and 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 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 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 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 and 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 (Ksehtri, 2017b; Al-Saqaf and Seidler, 2017; Singh and Singh, 2016) which is particularly relevant for electronic voting (Ksehtri, 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 (Ksehtri, 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; Ksehtri, 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; Quieroz and Wamba, 2019). Besides, BCT can be employed in the supply chain management to detect and prevent fraud (Hackius and 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 and Petrovsky, 2016). The resultant increased transparency of the supply chain will in turn make it more traceable (Francisco and 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 Fig. 1 and explained in detail below.

The largest chunk of the literature (Huckle et al., 2016; Önder and 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 and 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 and 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 and Koh, 2018; Önder and 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 and 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 (European Union-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 and 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

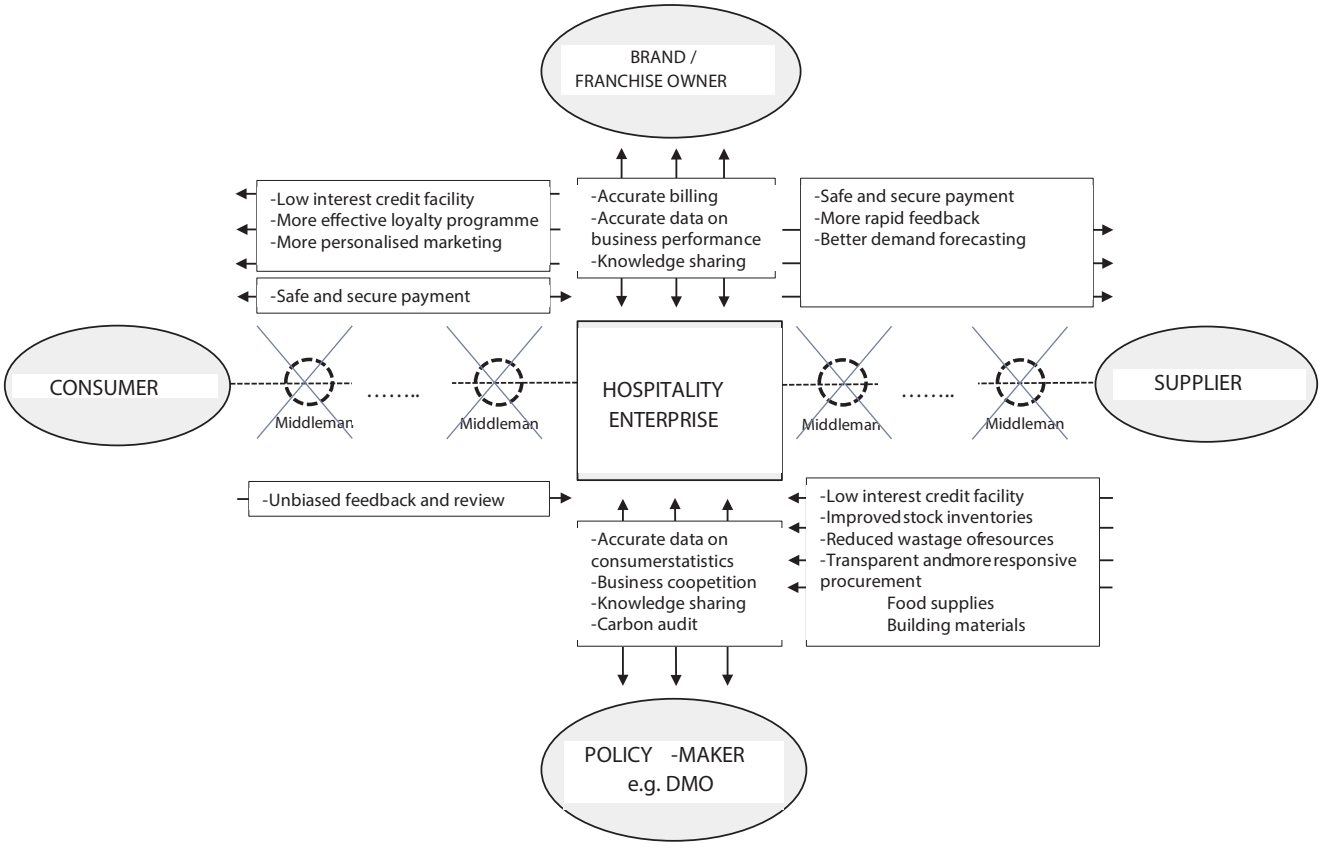

Fig. 1. The scope for the BCT application in hospitality operations.

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 and 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 in '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 and 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 and 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; Ksehtri, 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

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 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 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 BCT for regulators/policy-makers -Managerial unwillingness to invest into uncertain future	-Train the regulators -Streamlined regulation adopted at the (inter)national level
BCT's transaction speed	-The truly global scale of 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

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.

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 the 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, represents 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 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.

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