



## How Smart Tourism Embrace Blockchains and Smart Contracts

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*Abstract:* The purpose of the research is to investigate the implementation of blockchains (BCs) and smart contracts (SCs) in smart tourism. BCs and SCs in the context of tourism are underexplored. Data were collected and analysed from relevant secondary sources in extensive desktop research between January and August 2018. The results highlight some implemented examples of BCs and SCs in tourism and few that are still in probation phase. The findings are interesting for tourism policymakers, professionals, academics and tourism suppliers who are interested in real value added of BCs and SCs in tourism.

*Keywords:* smart tourism; digital ledger technology; blockchain; smart contracts

*JEL classification:* Z32

## Kako pametni turizem povezuje tehnologijo veriženja blokov in pametne pogodbe

*Povzetek:* Namen članka je raziskati uporabo tehnologije veriženja blokov in pametnih pogodb v pametnem turizmu. Tako tehnologija veriženja blokov kot pametne pogodbe so v okviru turizma premalo raziskani. Podatki so bili zbrani in analizirani iz ustreznih sekundarnih virov v obsežnih namiznih raziskavah v obdobju od januarja do avgusta 2018. Rezultati kažejo na nekatere uveljavljene primere tehnologije veriženja blokov in pametnih pogodb v turizmu, malo pa jih je še v poskusni fazi. Ugotovitve so zanimive za oblikovalce turistične politike, strokovnjake, akademike in turistične dobavitelje, ki jih zanima realna dodana vrednost tehnologije veriženja blokov in pametnih pogodb v turizmu.

*Ključne besede:* pametni turizem; digitalna tehnologija; tehnologija veriženja blokov; pametne pogodbe

*JEL klasifikacija:* Z32

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## 1 Introduction

Tourism industry is information intensive and highly depends on ICT; thus, it seems logical that the phenomena of *smartness* is increasingly important also in tourism. Due to technological orientation of the tourism services supply through global distribution systems and online reservations systems as well as demand side of the sector (e.g. use of mobile computers and smart phones, widespread social media adoption etc.), *smart tourism* (ST) can be seen as a logical progression from traditional and from e-tourism (Gretzel et al., 2015b).

One of the cutting-edge technologies that may be one way how to address challenges of the new era of data processing in ST is *blockchain* (BC). BC started initially as a “technological backbone of cryptocurrency Bitcoin” (Savelyev, 2017, p. 117). Recently, it has gained a significance of its own and been used more broadly (e.g. for transferring the digital assets or representation of a physical offline assets etc.). Therefore, it has already attracted the interest across a wide span of industries: finance, healthcare, utilities, real estate, governmental sector (Cristidis and Devetsikiotis, 2016), including tourism (Tourism, 2017; Wroten, 2017; Varsheny, 2018; Fes, 2018).

The prominent use for BCs is to enable *smart contracts* (SC). SCs are defined as “the self-executing coded contracts running on BC networks” (Sprule, 2018) or “self-executing digital transactions using decentralised cryptographic mechanisms for enforcement” (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017, p. 1). Due to the higher functionality of this kind of contract compared to its paper-based ancestor, Szabo (1994, 1996) coined it as *smart*.

With the hype of BC and bitcoin SCs, both topics have recently regained the interest of academia and practitioners (Sprule, 2018). They have become hotly debated topic in the tech as well as legal community, among policy makers, industry stakeholders and academia (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017). The examples of use of SC (on permissioned BC) in different industries are the following: in banking - R3 Corda, Ripple, in public health - ModelChain, in supply chain - Everledger. Their goal is to propose specific solutions to particular problems (ibid).

The current environment in which tourism operates is conducive to SCs. Almost all transactions among airlines, hotels, service providers and travel agencies are carried out through closed Global Distribution Systems - GDS. There are several companies that offer GDS for the tourism sector (Altcoins Analyser, 2018). The use of these networks is essential to be competent in today's tourism market: it allows potential travellers and guests to make reservations of airline tickets, rooms, service in real time. The problem is, however, that an oligarchy of providers has been formed preventing small tourism businesses entering those networks, causing additional costs for the users and enabling providers to control prices. The few intermediaries that dominates tourism supply market are Amadeus, Sabre, Booking.com, Airbnb (Altcoins Analyser, 2018).

BCs and SCs could present solution to above mentioned situations and problems. Tourism sector innovators are considering their use to enhance the service quality as well as to offer additional services. Some predict that this technology could thoroughly disrupt tourism business (Tourism, 2017). Yet, the current stage of implementation of BCs and SCs in tourism is still rather unknown since the use of SC and BC in tourism has not yet been the topic of thorough research. This paper tries to initiate the research by looking into how BCs are and SCs implemented in tourism sector. The paper aims to contribute to further academic and professional debate around both topics.

The nature of the research topics in the context of ST requires some introductory definitions and explanations. They are presented in the theoretical background section, followed by methodology for empirical research, and major findings on implementation of BC and SC in tourism sector. The paper ends with discussion on some major issues related to the emerging BC and SCs project trying to shed lights on need for further research.

## 2 Theoretical background

From the nineties on, the word *smart* implies connectivity and intelligence (Gretzel et al., 2015b). The concept of *smartness* is increasingly getting attention across different fields and has made its way to tourism (Koo et al., 2016).

The term ST has appeared in relation to *smart cities* and *smart destinations*. According to Gretzel et al. (2015b) ST describes the increasing reliance of tourism destinations, providers of tourism services and tourists on emerging forms

of ICT and other cutting-edge technologies that allow massive amounts of data to be transformed into a value proposition. The concept of digital business ecosystems has become more relevant also in tourism (Del Chiapa and Baggio, 2015). Some research papers even claim, that in 2017, the share prices of some corporations in USA rose primarily because they used the word BCs (Kaminska, 2018a).

According to Gretzel et al. (2015b), theory on ST is behind many of the government and industry-led projects. Trying to define ST, researchers involve multiple components and layers of *smart* supported by ICT: smart experience, smart business ecosystem and smart destination.

BC technology is one of the distributed ledger technologies (DLT). The well-known application of DLT is the management of bitcoin and other cryptocurrencies (Grant, 2018). It is mostly described as peer-to-peer network, that uses a cryptographic keys, distributed ledger storage and consensus mechanism. A distributed ledger is a consensus of replicated, shared and synchronised digital data geographically spread across multiple sites. There is no central institution behind it (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017).

There are different kinds of BCs: public BCs (fully decentralised), consortium BCs (partly decentralised) and private or centralised BCs (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017). In private BCs, all the computers in the network are controlled by one organization or individual; there is no free access (e.g. Riple, ModelChain, EverLedger, R3) and BC could be shut down anytime. On the contrary, everyone can join public BCs, such as Bitcoin or Ethereum; any computer can become a node in this network and can participate in consensus mechanism named proof-of-work (ibid). Moreover, anyone can read a content of a block. Not even its creators can shut it down (Tnooz, 2016).

Apart creating decentralised currencies (like Bitcoin) BCs enable the creation of intelligent assets that can be controlled over the Internet (smart property/assets), new governance systems with more democratic decision making, decentralised autonomous organisations (DAO) that can operate over network of computers without any human interventions and self-executing contracts - SC (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017).

SC was first defined by Szabo (1994, 1996) as “computerized transaction protocol that executes the terms of a contract”. The basic idea of the SCs was to transform some contractual clauses (like liens, bonding, and delineation of property rights) in the hardware and software with the objective of reducing enforcement and other transaction cost as cost of fraud loss and arbitration (ibid).

After Szabo in early nineties, there was little scholarly and practitioners’ debate about it. The topic caught more attention in the last few years, with the “hype” of BC and bitcoin SCs. 2018 supposed to be “the year of the smart contracts” (Sprule, 2018).

Today, SC are understood as agreements written in computer code and placed on a decentralised virtual infrastructure (self-executing agreements based on BC technology). Computer protocols are there to verify and execute the clauses and performance of the contract without need of human activity. Since technology itself enforces the terms of the contract, some traditional contractual activities related to the enforcement of the contracts become unnecessary (Eenmaa-Dimitrieva and Schmidt-Kesse, 2017). SCs can also be regarded as “pieces of software not contract in the legal sense” (CFO Insights, 2016, p. 2).

SCs can use any blockchain; however, Ethereum is usually the first choice since it offers huge processing capability. Figure 1 shows an example of a code for a basic SC written on the Ethereum BC. The contract stipulates that the creator of the contract gets 10,000 Bitcoins (Blockgeeks, n.d.). The creator of the contract include the compiled code of puzzle in a contract creation transaction.

```

/* Allow another contract to spend some tokens in your behalf */
function approve(address _spender, uint256 _value)
    returns (bool success) {
    allowance[msg.sender][_spender] = _value;
    return true;
}

/* Approve and then communicate the approved contract in a single tx */
function approveAndCall(address _spender, uint256 _value, bytes _extraData)
    returns (bool success) {
    tokenRecipient spender = tokenRecipient(_spender);
    if (approve(_spender, _value)) {
        spender.receiveApproval(msg.sender, _value, this, _extraData);
        return true;
    }
}

/* A contract attempts to get the coins */
function transferFrom(address _from, address _to, uint256 _value) returns (bool success) {
    if (balanceOf[_from] < _value) throw; // Check if the sender has enough
    if (balanceOf[_to] + _value < balanceOf[_to]) throw; // Check for overflows
    if (_value > allowance[_from][msg.sender]) throw; // Check allowance
    balanceOf[_from] -= _value; // Subtract from the sender
    balanceOf[_to] += _value; // Add the same to the recipient
    allowance[_from][msg.sender] -= _value;
    Transfer(_from, _to, _value);
    return true;
}

/* This unnamed function is called whenever someone tries to send ether to it */
function () {
    throw; // Prevents accidental sending of ether
}

```

Figure 1. An example of SC on Ethereum  
Source: Ethereum, 2019

Technology leaders envision that SCs provide the next opportunity to streamline and automate many routine transactions and provide many of its applications (CFO Insights, 2016).

### 3 Methodology

BCs and SCs research are still in early, formative stage, focusing mostly on defining the terms, explaining the processes and presenting the case studies. Therefore, the choice of exploratory type of research in this paper was appropriate to achieve our research goal.

The data collection and processing were conveyed in the systematic research procedure in the period from January to August 2018. Two main research databases - Google, Google Scholar - were used to search the relevant data in documents from the internet. The process of identification of relevant documents consisted of the following steps: key phrase identification, document identification, quality assessment, data extraction and data analysis.

Within the first step, key phrases (words) were identified for the document identification carried out in the second step. In the second step, key phrases were used to identify the documents on the selected topics. Google was used to query the key phrases. The documents presented on the first three result pages were chosen for further selection. Search results on Google Scholar database were used to identify the further relevant sources. The document identification resulted in a wide data collection from databases: academic studies, online media articles, online publications and blogs from IT professionals (corporations and individuals).

The third step focused on the quality assessment of the selected documents. Due to fairly new nature of BSc and SCs, the publication time was used as an important criterion in assessing the relevance of information (2015 and on).

The fourth step was concentrated on data extraction. A thematic content analysis was carried out in which bottom up coding scheme was adopted. The identified codes were deduced from the analysed content. The second level comprised a more in-depth approach.

Data extraction and data analysis within the context of this research were intertwined

In continuation of the research, data from secondary sources collected in the data extraction phase was thoroughly analysed. The combination of description, comparison and compilation methods were used to design the paper.

## 4 Results

Findings start from broader to more specific examples of BCs and SCs in tourism, whether those are still projected or already executed.

*Firstly*, the results of the study indicate that BC and SC in tourism sector lag behind the other sectors, e.g. finance, healthcare, real estate etc. In tourism, BC has become a new buzzword that most people are still unfamiliar with or associate it only with cryptocurrency Bitcoin (Wroten, 2017).

*Secondly*, innovators in the tourism industry are considering using BC and SCs to enhance the tourist service quality but also to provide additional services. Some market participants view BCs and SCs as the solution that enables tourism service providers to cut intermediary costs and travel agents' fees (Tourism, 2017). Others are more aware of the meaning of the decentralized nature of the BC and the fact, that information can never go 'offline' or is lost (Revfine, 2018). Here are some examples of potential use of BC and SCs in tourism:

- BC technology together with the mobile and biometrics can reduce check-in times, or queues in airports, as a simple fingerprint or retina scan can replace showing documents (Revfine, 2018). On BC, all information about the traveler is encrypted and therefore completely safe. The processes are simple, while the control of the data remains safely in the user's hands (Froyd, 2018).
- BC can be valuable for tracking the movements of luggage, especially in international travel. In many cases, a customer's luggage changes hands multiple times over the course of their journey (Revfine, 2018). Traditional luggage tracking involves many participants in highly fragmented and non-integrated systems, which results in 2,300 million of EUR cost for lost luggage every year. With help of BC, all operators will share a centralized network. The information on lost luggage can be shared by BC, and it is evident where it happened and who should be in charge for the items' safety (Froyd, 2018). The Winding tree platform is supposed to be one of the foremost present-day example of baggage tracking via BC (Revfine, 2018).
- Probably the most important use of BC within the hotel and travel industry relates to payments. BC applications can range from serving as a global ledger, making bank payments simpler and secure, to allowing travel companies to accept payments using Bitcoin and other cryptocurrencies (Revfine, 2018). At present, there is no seamless and centralized settlement process between hospitality companies. BC technology is, therefore, useful for intercompany settlements, such as arrangements between a hotel company and an airline company in which the airline company buys blocks of hotel rooms or for settlements of corporate cards or corporate-level trade cards. That could eliminate fees along with simplifying the process (Wroten, 2017).
- In hospitality, BC could fundamentally change how data are validated and access authorized by individuals and/or systems. BC can affect several key areas of the hotel industry as the distribution of authoritative descriptive information, images and video, rates, inventory and availability rules, SC for transient, corporate, group, wholesale and consortia agreements; and contracts for procurement and service-level agreements. BC can also come into play for guest profiles and loyalty programs (Wroten, 2017). Yet, the hotel business is still learning about BCs and how it can help with operations (Wroten, 2017).
- As many travel companies run customer loyalty schemes, BC can simplify the process with allowing customers to easily access information about their loyalty points and allowing tokens to be distributed. It can also help to combat fraud in this area (Revfine, 2018). Trippki is an example of a customer loyalty reward system. Customers and hotel chains get in direct contact. Eligible customers are allocated TRIP tokens for

staying in a hotel and these tokens are permanently recorded in the BC, meaning they do not expire and can be used at any time (ibid).

*Thirdly*, despite such a current situation there are strong indications that new technology can disrupt tourism business. Certain projects and business models in the travel industry have already demonstrated the potential of the BCs and SCs in tourism (Revfine, 2018). The other project and plans indicate development towards the future (Fes, 2018).

*Implemented BCs and SCs projects in tourism:*

- The most obvious evidence of current use of BCs and CS in tourism is accepting cryptocurrencies as a form of payment for travel and accommodation (How Blockchain, 2017). Some of the tourism services suppliers or intermediaries already accept cryptocurrency payment. For flights, there are e.g. CheapAir.com, Expedia, BTCtrip.com, California's Surf Air, Latvia's air Baltic etc. Most of the travel agencies that allow booking flights with cryptocurrency also allow to book accommodation. The number of businesses supporting cryptocurrencies has increased greatly in the last two years (Varshney, 2018).
- French airline AXA takes flight parametric insurance to the BC; if the flight is delayed more than two hours (this period serves as parameter), the passenger's application is automatically notified with compensation choice. The compensation money is then transferred directly to the passenger's credit card (PolySwarm, 2018).
- The tourism company TUI has been implementing its own internal BC, Bed Swap (Wroten, 2017). It should optimize the control of hotel beds and transnational transaction processes (Fes, 2018). The company is able to move inventories between different points of sale and flex selling margins, in real-time, based on the level of demand that is present at that time (Revfine, 2018). It is an internal process to optimize yield across the group as well as to better learn how to use the technology. The plan is to use blockchain to generate smart contracts with hoteliers and improve the company's hotel inventory (Wroten, 2017).
- LockChain operates as a direct marketplace for hotels and hospitality companies looking to rent out property. The platform covers payment, property management and various other aspects of the booking process (Revfine, 2018).
- BeeToken or Beenest is a home-sharing platform. Technology puts customers in touch with hosts directly for arranging the stay and pay for it. There is no commission, while payment, reputation and arbitration protocols are keeping users safe (Revfine, 2018).

*Examples of BCs and SCs tourism projects in-course:*

- In 2017, Spanish BC start-up Amadeus released a whitepaper that outlines four possible use cases for the BC and SCs: optimizing customer loyalty programs, real-time baggage tracking, simplifying contracting in tourism and improving the identity of a person during a trip (Fes, 2018).
- Austrian-Hong Kong aviation start-up Avinoc is planning a booking platform on BC for the optimization of empty flights. Some airlines (e.g. German low-cost carrier Eurowings, some companies in the Middle East) have already expressed their interest in this project (Fes, 2018).
- Winding Tree, a decentralized database based on BC, intended to act as a B2B distribution network for tourism services (Fes, 2018). It is not classing company but a DAO. It is supposed to be the next Booking.com. Financing takes place by means of a specially created cryptocurrency, called LIF. Winding Tree has been planning to create a decentralized marketplace where hotels, airlines or tour operators can meet customers directly with their own, BC-based applications. It does not strive for power and profit maximization; thus, it would act opposite to major players such as Booking, Expedia or Airbnb. The partners hope to gain their independence from intermediary platforms and to be able to offer their offers and services directly to the consumer (ibid). Winding Tree is trying to solve one of the biggest problems that airlines and hotels have, the intermediaries (Altcoin Analyser, 2018).

*Fourthly*, above-mentioned projects indicate that there is a start of global trend to incorporate BC and SCs into the worldwide tourism business. Plans on use of BC technology in tourism have risen in certain countries, e.g. Aruba (Sorrells, 2018). In Aruba, there is a plan to implement a Smart Island Strategy (Parsons, 2017). Officially, Aruba is the

first country that planned in 2018 to apply BC within the tourism distribution platform. The platform would connect small hotels in the country to their customer base. It will be based on Ethereum protocol, which offers the use of public decentralised BC that incorporates SCs. They should offer a more efficient, customisable and secure interface for dealing between customers and vendors (Tourism, 2017). It is a pilot programme, which should dramatically reduce the fees of hotels payed currently to intermediaries (Sorrells, 2018). Subsequently, Aruba believes that its own cryptocurrency (BITT) will help locals to reduce dependency of foreign banks (Parsons, 2017).

*Fifthly*, there are differences in SCs based on public BCs from SCs based on private BCs. As the supply side of tourism sector is controlled by only few major players (e.g. Booking.com, Airbnb, Amadeus), it is questionable, what value added can BCs and SCs really add to consumers of a smart tourism services. as the big incumbents try to evolve and maintain their power? Perhaps the very nature of the BCs (open and public) could actually be what this industry really needs - to disrupt itself (Bjoroy, 2018).

*Sixthly*, BCs and SCs has recently kind of peaked in the hype cycle; however, not enough people know the tactical and detailed requirements for its architecture and deployment. It is still generally misunderstood what they can truly do (Wroten, 2017). Furthermore, there are some severe concerns related to the BCs and SCs, e.g. limited scalability, low speed, storage constraints, lack of governance and standards, inadequate tooling, limited privacy, high cost of energy, coding costs, hacking etc. (Kassireddy, 2017; Sprule, 2018; Grant, 2018). Thus, there is a need for BCs developers to be critical and “shift some of the focus away from shiny new ICOs to real technological challenges” of BCs and SC (Kassireddy, 2017).

## 5 Discussion

This paper is about implementation of BCs and SCs in the context of tourism. The systematic process of secondary data collection (thorough internet research) and analysis resulted in six major findings, which subsequently present the answer to the research question.

Although BCs and SCs in tourism lag behind some other sectors, tourist innovators see in them vast opportunities in different directions. New tourism services might occur, tourist might deal with the service providers without intermediary costs and travel agents fees, payment might be seamless, luggage easily tracked, new ways of identification process of tourist could reduce waiting time, accommodation units and plane seats might be managed better etc. Some of the projects have already been in-course (TUI, AXA. LockChain, BeeToken), some are in preparation phase (Spanish Amadeus, Avionnic, Eurowings, Winding tree). Some countries (e.g. Aruba) envisage BCs and SCs to be the part of the tourism strategy. Those projects indicate that worldwide tourism business is about to incorporate BC and SCs. However, some major technological and other general barriers related to BCs and SCs remain that suggest caution.

Two opposite poles were created around BCs and SCs. One “like to insist that it [BC] is a liberating technology that can achieve magical solutions in all sort of fields” (Kaminska, 2018a) despite the fact that they do not know how BC really functions and what problem it might solve (Wroten, 2017). On the other side there is a group of sceptics that understand a BCs for the most part as “just a bundle of pre-existing technologies brought together in a cryptocurrency context to solve a problem that most of the regulated financial system does not have: a lack of trusted intermediaries” (Kaminska, 2018b). For Kaminska (2018b), it is “likely to turn out to be a form of social engineering” that brings “benefit to none but a tiny elite”.

In fact, there are some recent examples that clearly show that the BCs and SCs are still in its infant stage and far from been perfect, e.g. hack in Ethereum platform in 2016; Bank of England that in 2017 ended with settlement system based on BC implemented in 2016 (Skinner, 2018). Furthermore, some start-ups exist that they sell the coins in ICO but they have not used the money for the promised business (Casey and Vigna, 2018). This might be the case also with tourism starts-up based on BSc and SCs.

Even though BC technology is in its infancy, it may still change many industries in many radical ways. By testing different ideas, startups will play the key role in this process. The funds of European Commission in the sum of 340

million EUR available until 2020 for BCs related projects (Ugovšek and Grapulin, 2018) might accelerate the process of separate valuable solution of BCs and SCs in tourism from those that are not. Until then, examples of good practices might have been developed and at the same time a lot of failed occurred. Both of them suggest further study on the topic.

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