The impact of blockchain technology on hotel booking systems

Submitted to Horst Treiblmaier, PhD

Michael Katschnig

61900606

Vienna, 31. May 2022

Affidavit

I hereby affirm that this Bachelor's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

The thesis proposal was not submitted in the same or in a substantially similar version, not even partially, to another examination board and was not published elsewhere.

Date

31. May 2022

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1 Introduction

Tourism in particular often undergoes changes over time, and especially since 1980, with the introduction of the internet, there have been many changes (Walton, 2009), but one in particular this paper wants to outline: In the way we can see specific features is in the way we choose our rooms, that is, what standards we expect, and through which means we finally book our accommodation (Luo & Zhou, 2021).

Since the commercialization of the Internet in the 1990s, e-Tourism has developed and a new era of bookings and reservations has emerged. Besides, tourism has evolved into a highly information-intensive industry that significantly relies on information and communication technologies. For some time now, a new direction of tourism has been developing, smart tourism, which entails the move from the digital sphere into a combined digital and physical sphere. Smart tourism applications rely mostly on sensors, big data, open data, new ways of connectivity and exchange of information (Luo & Zhou, 2021). The blockchain is just another stage in this long process of technological advancement, and it not only opens up new possibilities but also poses a severe danger to a number of established stakeholders (Rashideh, 2020).

This paper will pay special attention to the different applications of blockchain technology in the booking industry and how they affect a the consumer as well as the provider both positively and negatively. Furthermore, I will explain the technology of Blockchain in general but try not to focus too much on technical details.

Basically, a blockchain is a decentralized database. This database has the advantage that it is always transparent, unaltered and traceable. Therefore, we will focus on the characteristics of the Blockchain that would be beneficial for the hotel industry and less on direct examples of Blockchains. Because we have so many potential applications of the technology behind blockchain today, it is often difficult to make a clear distinction between applications that are directly related to hospitality and

tourism and those that have only an indirect impact (Treiblmaier, 2021). One particularly beneficial use of blockchain, is in identity management. This could be an aid to help tourists abroad if they have lost their travel documents. Using the same technology that is currently used to exchange Bitcoin and the like, hotels could help guests and not have to rely on passports or ID cards to verify the identity of a guest. Furthermore, the general tokenization of hotel rooms would be a big step towards smart tourism. It would be possible to purchase a token for a hotel room via decentralized booking sites, whereby exact prices, booking periods, etc. would be determined via smart contracts (Veloso et al., 2019). These tokens could offer a guest the possibility to access a hotel room, and no one would ever have to check the guest in or out as the authentication would also be available via the Blockchain technology. Smart contracts would take effect in the event of cancellations or other irregularities, thus saving high costs on the part of the provider as well as on the part of the consumer. The biggest difference for both hotel providers and customers would be the price that could be saved by bypassing huge booking sites like Booking.com and still delivering the same quality to the customer. Hotel providers are often totally dependent on these booking sites and have no choice but to pay the high agency fees to them.

As a matter of course, there are already studies and publications that address this topic. However, I will focus specifically on the booking process in connection with blockchain technology, since it has often not yet found its way into them, and the potential is therefore very large. Especially in the Austrian region, where tourism is one of the fundamental economic sectors, reliance is often still placed on heavily outdated systems.

1.1 Aim of Research

The aim of this thesis is to evaluate, describe and test the various use cases of blockchain technology in relation to hotel bookings and other tourism services through a quantitative survey. The main research questions guiding this work were formulated as follows:

RQ 1: Will potential end users embrace the benefits of blockchain integrated booking systems?

- Is gender a significant factor in the adoption of blockchain technology?
- To what extent does the level of education and knowledge about blockchain influence the potential adoption of cryptocurrencies?

RQ 2: How do already established traditional online travel agencies differentiate from already blockchain integrated booking platforms?

To ensure that these research questions can be answered scientifically and as accurately as possible, in the following work a detailed literature review will first be carried out. Next, a survey will be conducted in the course of the research in order to capture the current attitude and opinion of potential consumers as accurately as possible, on blockchain based products. In order to describe research question 2 properly, a careful internet search will be carried out and selected representatives of the industry will be approached.

2 Literature Review

To get a common understanding of blockchain technology and the possibilities of its implementation in tourism, a methodological literature analysis was carried out in points 3.1 to 3.8. Certainly, this analysis mainly refers to the basic principles of blockchain, tokens, smart contracts and to what extent these technologies represent an additional benefit for Hotel Booking services and tourism at all.

2.1 Blockchain Technology

To understand how blockchain technology can best be used in the hotel booking system and other tourism businesses, the author explains the basic ideas of this technology in the following sections.

The synonym Satoshi Nakamoto is symbolically used for the creation of the cryptocurrency Bitcoin, as he/she/they was/are the first to find an electronic solution for the transfer of values. Underlying Bitcoin is a new technology called the blockchain (Nerurkar et al., 2021). However, the term blockchain is often used too

broadly to make it easier to explain. Specifically, the technology is based on linked timestamping, digital cash, proof-of-work, Byzantine fault tolerance, asymmetric cryptography, and smart contracts. The creators of Bitcoin were the first to combine these aspects and make the technology commercially viable (Treiblmaier, 2020).

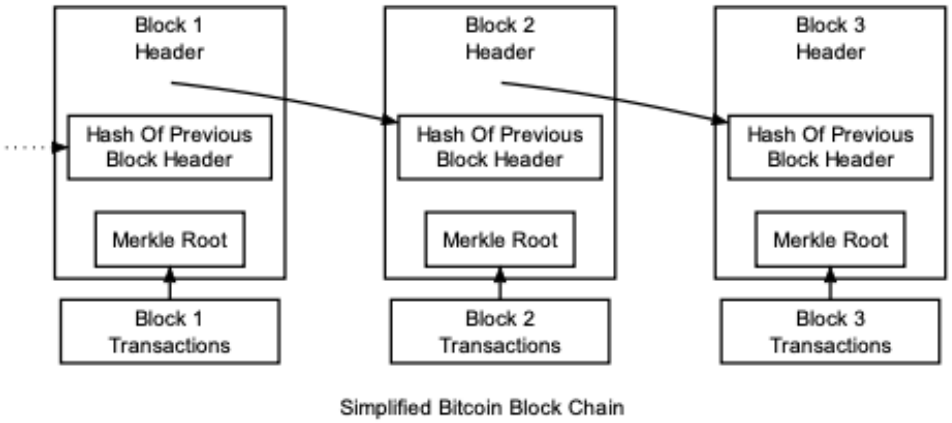
In the years that followed, the wide-reaching potential of blockchain technology and its areas of application were recognised by many industries and in some sectors have already been applied (Treiblmaier, 2018).

Blockchain technology is basically a kind of distributed database on which data is usually stored in a decentralised, transparent and permanent manner. This data usually consists of transactions that are then individually converted into hash values, then collected and stored on a specific block that has been provided with a unique hash value, also known as a Merkle root. Hash functions are compression functions that make it possible to convert messages or data of any length into a bit string with a fixed character length. Alongside the use of the public key method, the use of hash functions is a central element in the blockchain, as the chaining of the individual blocks is achieved with the help of hash functions.

Each block within the chain has a similar structure. In simplified terms, this can be divided into the two areas of headers and transactions. In the transaction part, transactions that have not yet been confirmed are collected and then combined into pairs (Rutz, 2020, S. 14).

Such blocks are then periodically found by so-called miners, depending on the algorithm involved, and can then be added to the already existing blocks of the chain. In the head of each of these blocks, a timestamp and a nonce number is embedded, which is randomly generated for each new block (Narayanan & Clark, 2017). The so-called mining in terms of most proof of work blockchains represents the computational power that a computer must invested to find a matching nonce ("number only used once") that leads to a matching new hash value for the merkle root. As a reward for the computing power of the miner who found the matching nonce first, there are rewards set by the algorithm (Treiblmaier, 2020). The following figure illustrates a blockchain in more detail using the Bitcoin blockchain as an example.

Fig.1: Simplified Bicoin Blockchain 1



The most distinctive feature of this blockchain system is that the new blocks do not come from a central source since each miner participating in the network has a mathematically equal chance of finding a new block. One of the relevant concepts of the blockchain is decentralisation, which implies that data or code is stored in the same form on a huge number of different computers (nodes) (Nakamoto, 2008). This not only prevents a single authority from gaining control of the network, but it also makes it more difficult to attack it because a huge number of targets would have to be attacked at the same time (Traiblmaier, 2020). From that point of view, this is proof that it is a completely decentralised network, although there are also criticisms that large mining facilities, such as those that exist around the world, would disrupt decentralisation, as that is where most of the computing power is located, making the blockchain system more vulnerable in such places (Eyal & Sirer, 2014). The graphic also shows that each block always has the hash number of its previous block implemented. This structure of the chain ensures that no part of the data chain can be changed afterwards without invalidating all the other blocks that subsequently follow.

An additional big benefit of public blockchain systems is that they are transparent and accessible to everyone (Xu et al, 2017). For instance, it is possible to follow transactions and mining in real time on websites like "www.blockchain.com". User data is encrypted by public keys, but any internet user can view the transaction and

get confirmation of the transaction. The entire publicly accessible Bitcoin blockchain is currently about 340 gigabytes and contains all transactions since the start of the network in 2009 (Statista 2021c).

Unlike public blockchains, there are also private blockchains where access can be restricted to extern persons. Private blockchains can usually have a much higher rate of transactions since they do not have to wait for the authorisation of multiple blockchain participants, as in the bitcoin network (Yang et al, 2020). To validate transactions on the bitcoin network, there is a so-called Proof of Work (PoW) consesus system that has to validate every block and transaction. Another difficulty with public blockchains is limiting the number of people who can upload data. For example, there is no way to stop someone in the system from uploading sensitive material into the public system (Treiblmaier, 2020).

2.2 Trust and privacy in blockchain systems

When booking a hotel or a trip, it is especially important to handle the user's personal data with special care. This starts with the booking, continues with the payment and ends with the check-in on site and the filling out of the guest sheet for the obligation to register.

Distributed ledger systems are differentiated specifically by the fact that they build a trust chassis on processes that cannot trust each other, without a third control authority that would be responsible for faults (Völter et al., 2021).

In fact, no directly identifying personal data such as first and last names, telephone numbers or similar are stored on blockchains, but only the hash sums of the transaction data (Völter et al., 2021). Hash functions are compression functions that make it possible to convert messages or data of any length into a bit string with a fixed character length (Rutz, 2020, S. 15). The only identifying element stored is the public key of the sender and the recipient. This address of a transaction is an ID that does not allow any direct conclusions to be drawn about the person in question. The combination of the public key with the private key ultimately creates cryptographic identities that are entitled to the authority to control the value items represented on the blockchain. However, in order to protect digital assets from theft and fraud, the

private key must never be made public, since only those who know it are in a position to allow transactions. To ensure that decentralised blockchain systems remain verifiable and fully transparent, they are never completely anonymous, but rather pseudonymised through the use of public and private keys. Although the exact data of a person is never released on the blockchain, this initial anonymity can nevertheless be revealed quickly when it comes to the topic of e-commerce. For example, if a hotel is booked in one's own name and then paid for with Bitcoin, it is often easy to link the public key to the real purchaser (Peitz, 2020, S. 125–137).

Not only for private users of public blockchains can the high transparency become a problem, but also companies could have a competitive disadvantage against competitors if they can see the trading strategies and thereby develop counterstrategies.

An approach that has already emerged from the Bitcoin blockchain is called Unspent Transaction Output (UTXO). In this way, when person A wants to make a payment to person B with Bitcoin, the amount is transferred to person B's wallet and the remaining amount on person A's wallet is also overwritten to a new address at the same time. This process works automatically on the Bitcoin blockchain and enables extended anonymity (Rutz, 2020, S. 27–32).

But trading platforms for cryptocurrencies are usually credit or financial services institutions that have to fulfil internal due diligence obligations with regard to their customers and identify them and prevent anonymity, both for tax reasons and for reasons of data protection (Peitz, 2020, S. 128–132). To solve this anonymity „problem", some players on public blockchains use various methods to enhance privacy, such as anonymising their own internet protocol address by using various VPN services or concealing their own transaction history by using mixer services on the internet (Rutz, 2020, S. 24-26).

In order to trade with cryptocurrencies and other services of the public blockchain, no further intermediaries are required. Once you have created a wallet, you can participate directly in the network (Peer 2 Peer).

However, there are differences in the wallet providers offered. If you use an offline wallet, you are well protected against online hacker attacks, but if the private key is lost or forgotten, there is no way to recover the data on the memory medium. While offline wallets already have a high inherent security risk, the potential risk of a hacker attack is significantly higher for customers of today's more popular online wallets because they bundle the private keys of numerous users in one place and therefore become an increasingly attractive target for hacker attacks. Online wallet provider platforms such as Binance, Coinbase.com, Crypto.com or BitPanda and countless other crypto exchanges make it as easy as possible for customers to open accounts on their platforms and trade cryptocurrencies and other blockchain assets. These crypto exchanges are also there for customers to exchange their fiat currencies into cryptocurrencies and tokens. However, by expanding the range of functions, wallet providers are contributing to an increasing centralisation of public blockchains (Rutz, 2020, S. 24–32).

In addition to the above mentioned concerns, blockchain technology can also provide a potential solution to identity theft. When flying or checking in at a hotel, identification documents usually need to be presented in order to pass through security checks or to consume any alcoholic beverages. To avoid the possibility of identity theft by the controllers and other people present, it is in the interest of the customer to replace important identification documents such as passports, birth certificates, etc. with digital identities. Not only would the customer be better protected against the loss of the document or the theft of their data, but also the travel provider, airline, etc. can ensure that the data is internationally valid (Davidson et al., 2016). Also, another potential benefit of a publicly accessible blockchain would be that hotels and restaurants that need to report to the police or immigration authorities could simply report the guest's arrival or departure to the blockchain, so that the authorities could automatically retrieve the required reports from the blockchain itself (HTNG, 2018).

2.3 Token economy

As the global awareness of what a blockchain can do in addition to transferring currency units grows, so does the token economy. Ethereum is a particularly

important part of this, as it was the first platform to allow hundreds of smart, contract-based decentralised apps (DApps) to be executed on it and the associated token to be issued. Providers of these tokens are free to decide what rights and obligations are associated with the token. Often more importantly, companies can raise significant funds by selling their own tokens without having to give up membership, information, control or voting rights (Adam, 2022, S. 161–163).

Basically, what is important for tokens is that they can be transferred quickly, cheaply and that they are interchangeabel. The purpose of a token can be divided into the following (Adam, 2022, S. 162):

1. Digital currency
    - Has a measurable value and can be used as a means of payment
    - Is not issued/controlled by any central authority
    - Can be stamped
2. Security token
    - Comparable with securities
    - Company share
3. Utility token
    - Specific right of use for real economic benefit
    - Access and currency within a network
4. Asset backed token
    - represents a real, external value such as collectables, real estate, etc.

Tokens serve a variety of purposes, including granting eventual legal rights to their owners, promoting value exchange, allowing access to a platform or services (toll), enriching user behavior (function), facilitating seamless transactions (currency), and ensuring a fair redistribution of value (revenue) (Mougayar, 2018). Most token, unlike a currency, is controlled by a smart contract that runs on top of a blockchain. (Lee, 2019)

Table 1. Token classifications 1

Class	Payment token		Utility token		Investment token	
Role/purpose	Right	Value exchange	Toll	Function	Currency	Earnings
Representation	Digital	Physical		Virtual	Legal	
Supply	Fixed			Schedule-based		
Incentive system	Enter platform		Use platform		Stay long-term	
Fungibility	Fungible			Non-fungible		
Layer	Blockchain (native)		Protocol (non-native)		Application (dApp)	

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These are just a few applications that are believed to bring a new level of efficiency to markets. In addition, tokens mostly offer incentives to enter and use a particular platform (Treiblmaier, 2020).

In terms of their exchangeability, tokens can be divided into fungible ("identical") and non-fungible tokens. Non-fungible tokens in particular are attracting special attention in 2021. These so-called NFTs (Non Fungible Tokens) represent unique products and assets that cannot be replaced or exchanged. Particularly in the case of art or music, these tokens sometimes achieve top prices in the tens of millions (Kucera, 2021).

2.4 Non fungible Tokens in respect to tourism

Non-fungible tokens, or NFTs for short, are an additional product of blockchain technology that is defined, for instance, by the ERC721 (Ethereum Request for Comments 721) standard (Adam, 2022, pp. 161-169). As already mentioned, they are mainly used to unambiguously store the ownership and originality of both physical and digital assets on a blockchain. Just as the crypto market as a whole is often criticised by critics as a method of money laundering, tax fraud or as blandly fuelled by many celebrities, NFTs are also often criticised. However, they represent a significant milestone on the way to Web 3.0 as well as a key element for the metaverse (Borri et al., 2022).

Unlike cryptocurrencies such as Ethereum or Bitcoin, however, NFTs are only ever unique and cannot be exchanged in a "like for like" scheme. Consequently, an NFT becomes unique and is not exchangeable. It is precisely this feature that is responsible for their success, especially for collectors of digital collectibles such as playing cards, art or other high-value assets (Vidal-Tomás, 2022). The value of an NFT depends primarily on the asset value of the asset it represents. The unique identity makes it possible to create excess demand in the market, which is reflected in significantly higher prices per token (Adam, 2022, pp. 161-169).

While the most popular NFTs revolve around debatable arts, sports and luxury goods, the trend is also moving towards travel and tourism. Especially after the tough economic years in tourism that Corona has brought, tourism companies are more open to new technologies to recover their losses (Whitmore, 2022).

During the Expo 2020, the Arab airline Emirates had already announced that it would invest several tens of millions in new technologies and experiences for its guests in the coming years and would now like to be involved in the NFT collectables and utility - based Market. Emirates is expected to incorporate NFTs into its rewards system in the future. For example, frequent flyers who earn a certain number of miles could be rewarded with an NFT to increase customer loyalty. It is not surprising that a step towards blockchain technology comes from a company based in UAE (United Arab Emirates), as the UAE government plans to transfer 50% of government transactions to blockchain technology as early as 2021. The new technology is expected to save effort and resources, as well as help citizens conduct their transactions more easily (Emirates Blockchain Strategy 2021 - The Official Portal of the UAE Government, 2022).

The OTA (online travel agency) Travala.com, founded in 2017, has now also launched its first NFT collection. The collection is a total of 1000 of so called Travel Tigers utility NFTs, of which only 900 will be sold as the remaining 100 will stay with the company for marketing and further funding of the programme. Travala was already considered very blockchain and crypto-friendly even before their NFT collection, as they have already started accepting over 80 different cryptocurrencies as well as fiat currencies for payment. They have also been using their own token, the AVA, for

various SMART reward programmes, discounts or other buyer incentives since the beginning. If you own a Travel Tiger utility NFT, you can benefit from Travala's Diamond Membership (Travala, 2021). This gives the owner various advantages when booking via the Travala homepage, such as increased Loyalty Rewards or access to random so-called Travel Drops which promise special experiences. The purchase of a Travel Tiger also buys access to exclusive events in the Metaverse (Travala.com, 2022).

Furthermore, in an NFT it is often used to give special rights to the holder. For instance, an NFT is usually accompanied by a smart contract that automatically gives the holder special rights if the required conditions are fulfilled. As an example, the previously mentioned Travel Tiger from Travala.com would be applicable. The smart contract of the Tiger utility NFT states that the owner is entitled to special royalty programmes or the right to participate in Metaverse events. But smart contracts can do even more.

2.5 Smart Contracts

In essence, smart contracts involve checking the occurrence of certain previously agreed legal conditions, such as the fulfilment of a service or environmental conditions, and then automatically enforcing the legal consequences attached to them. This process takes place according to the scheme "if - then". However, when we talk about smart contracts in general, it is important to understand that they are not legally binding contracts, but rather self-executing, immutable contracts coded in programming language. The blockchain is not only known for its ability to securely execute transactions, but also in the context of the automatic execution of smart contracts. These are intended to guarantee the exact exchange of services and goods as well as other assets in an automated and secure manner and thus contribute significantly to transaction processing (Peitz, 2020, S. 27–30). Most importantly, they do not rely on a third party and can be enforced more quickly and easily (Bitpanda, n.d.). The principle of an automated legal process such as a smart contract does not necessarily require the use of blockchain technology, but it still requires a trusted and independent party to execute the smart contract. The blockchain can potentially function as this independent party (Peitz, 2020, S. 27–30).

For instance, blockchain-based smart contracts enable automated insurance claims, travel and hotel bookings, transparent and efficient supply chains, more efficient corporate governance.

AXA, an insurance company based in Paris, for example, started implementing smart contracts in the context of aeroplane delays as early as September 2017. At that time, AXA was responsible for managing about 80% of all compensation payments for delayed flights (Vigliotti & Jones, 2020, S. 140).

If a flight is delayed beyond the contractual terms (mostly 2 hours), the customer is automatically compensated. The advantage of this is that both the customer has to go through less paperwork to get his refund, but also the airline can be sure that there is no insurance fraud. The system works in such a way that the travel insurance for the eventual contractual compensation is paid in advance of the flight, this payment is then stored tamperproof on the Ethereum Blockchain and the contract is simultaneously signed (Vigliotti & Jones, 2020, S. 139–141). This smart contract is linked to global flight databases and can thus automatically recognise if a flight is delayed. In the event of a delay, the previously booked compensation payment is automatically paid out. To simplify the payment process, all payments are made in fiat currencies. The airline and AXA also rely on an independent network and can therefore better exclude human error or other sources of error (AXA goes blockchain with fizzy, 2017).

2.6 Implementation of blockchain in tourism

Based on the current state of research into blockchain-based decentralised databases, the expected future of blockchain applications in all kinds of industries is enormous (Hashimy, 2021). Considering that Bitcoin was the first usable online blockchain in 2009, however, the industry as well as the population only noticed this development technology in 2015, it is only possible that most research is still in its beginnings (HTNG, 2018). As with most new achievements in technology, it often takes a long time to make such complex new systems suitable for mass use. The current general lack of literature is also due to the rapid development of blockchain-based systems (Treiblmaier, 2020).

In parallel with the growing awareness and rapid development of Bitcoin, Statista published a survey on "Have you ever read or heard of Bitcoin?" in 2013, 2016 and 2018. Each time, around 1.000 people from Germany aged 14 and over were surveyed and analysed. In the survey, the number of people who had heard or read about Bitcoin in 2013 (14%) increased by more than 4.5 times in the following 5 years (64%). At the same time, the number of people who have never heard of Bitcoin decreased from 85% to 33% (Statista, 2019).

In order to implement this rapidly developing technology in the hotel booking sector as well as in tourism in general, different potential use cases can be distinguished. One large sector, for example, is inventory management. In order for a customer to book a hotel, flight or other service, it is essential that different stakeholders have equal access to information such as available dates or available inventory. In the hospitality sector, the implementation of blockchain-based solutions makes it possible to effectively replace proprietary property management systems and to interact more directly and efficiently with customers (HTNG, 2018).

Moreover, in connection with the management of personal data, there are often costs for the inventory owner which could be avoided (HTNG, 2018). Blockchain technology gives us the possibility to connect suppliers of inventory directly with costumer facing sales, thus bypassing intermediaries and costs (Treiblmaier, 2020)

In addition, there are countless other possibilities for using blockchain-based networks to design the hospitality sector, as well as other sectors of tourism in general, more efficiently, which would, however, exceed the limits of my paper. However, it is important that instead of just referring to a blockchain-based solution, tourism researchers should therefore describe a particular applications (Treiblmaier, 2020)

2.7 Blockchain technology in regards to payment processes

Currently, the most prominent application of blockchain technology is still payment via cryptocurrencies. Because cryptocurrencies are widely and mostly easily accessible in 2021, online booking sites like Travala.com have decided that you can now pay for bookings on their website with over 80 different cryptocurrencies.

Travala even offers its own token, AVA, which is linked to certain customer reward programmes or other sales strategies (Travala Whitpaper, n.d.).

Currently, the most prominent application of blockchain technology is still payment via cryptocurrencies. Although, most hotel bookings are still paid by credit card, but the trend could change towards cryptocurrencies in the future. Credit card companies charge up to 2.5% per transaction, but in return they give both the provider a payment guarantee and the buyer protections that are enforced by credit card companies (HTNG, 2018).

With cryptocurrency payments, it is potentially possible to reduce the costs of traditional payment transactions, but customers would first have to acquire special currency tokens, which is a significant barrier at the moment for most customers. In addition, customers can no longer rely on the overall protection of large banking institutions and have to trust the travel provider or hotel operator. Although these are also subject to the generally applicable consumer protection laws, these are not equally strong everywhere and can only be pursued with difficulty. Another problem is the high volatility of cryptocurrencies, which makes them difficult to plan and calculate (HTNG, 2018).

There are also some implementations of payment tokens on smaller island communities for both locals and tourists. In addition, blockchain networks offer the possibility of cross-border transactions without exchange fees or long banking processes (Treiblmaier, 2020). In general, the tourism market is currently very much influenced by intermediaries and other parties, who of course all get their commissions, which ultimately increases the final price. With the introduction of payment tokens, this offers the opportunity to introduce more attractive customer loyalty programmes and to save commission fees (Treiblmaier, 2019).

3 Methodology

The scope of the research in this thesis focuses on evaluating, describing and testing the different use cases of blockchain technology in relation to hotel bookings and other tourism services through a quantitative survey and a profound literatur review. Therefore, two research questions on this topic have been created and will be investigated by means of comprehensive literature, a quantitative survey and a precise internet research. The first question, "*Will potential end users embrace the benefits of blockchain integrated booking systems?",* aims to be primarily investigated through the survey and elaborated with relevant literature. Whereas the second question, "*How do already established traditional online travel agencies differentiate from already blockchain integrated booking platforms?",* explores the differences between already established OTAs that already work with blockchain technology on the one hand and those that refuse to implement it so far. Especially since the end of 2020, the news regarding innovations in blockchain technology has been coming in weekly, this topic has become the daily bread for many people. Evidently, cryptocurrencies and their extremely volatile market are the main focus for the masses, but the underlying blockchain technology is also becoming increasingly important for both companies and individuals. Blockchain can not only be used for the creation and inheritance of cryptocurrencies but can also provide an advantage in several other areas of application. As the methodology is the backbone of the research for the author of this paper, it is particularly important that a well thought-out design for it is created in advance, which can then be analysed and interpreted (Creswell, 2014).

In order to achieve an excellent collection of primary data, it was important that the intended research method be carried out precisely. It is important to pay particular attention to the research method chosen for your work. For this purpose, there are 3 different ways to collect primary data: Qualitative research, quantitative research and the mixed method. The quantitative method is traditionally referred to as research with surveys, online questionnaires and experiments. It is mostly used to analyse relationships between independent dependent variables (Creswell, 2014). To avoid bias, a sample size of at least 60 experiment and/or survey participants is considered.

Since the primary data collection for this work was primarily carried out through an online survey, a quantitative approach was chosen.

Surveys are conducted as it is easier to get a large amount of data from the audience and to get a deeper insight into the public's perception of cryptocurrencies and hotel booking behaviour and what opportunities this opens for travel suppliers. Additionally, the quantitative approach was chosen in order to reach a larger number of respondents in a more cost-efficient way in a digital space. Not only is this a help to reach more participants, but also in times of the still ongoing Covid 19 pandemic, it is preferable to avoid direct contact of people in large groups.

Furthermore, so that the actual offer of already existing OTAs that use blockchain technology and those that reject it can be compared, a precise internet research was conducted that tests the companies Travala, Locktrip, Webjet, Expedia and Booking.com. To get a deeper awareness of these OTAs, they were briefly described and their advantages for the end consumer were analysed. Subsequently, they were tested with a fictitious booking in three different cities (Lisbon, Vienna, Beijing). In addition, direct contact was made with the travel provider Locktrip to gain a better awareness of the company.

3.1 Data collection & analysis

While the survey was designed to gain an understanding of how respondents would adopt the potential benefits of blockchain in hotel booking systems and online travel agencies, it also aimed to understand the current booking behaviour of respondents in terms of preferred travel providers and preferred payment methods.

The survey is divided into three major sections; 1. Demographics of the respondents in terms of gender, age measured in seven consecutive intervals, current highest academic degree and recent employment, 2. General hotel booking behaviour of the respondents and the importance of trust and privacy in the booking process and 3. Preferred payment methods and prior knowledge about blockchain and cryptocurrencies, in this section additional questions are asked about the potential benefits of blockchain integrated systems. In order to make the survey easy to understand and not too technically detailed, only the potential impact of blockchain

integrated systems was asked and tested. The survey primarily contains close-ended questions which are to be answered on a Likert scale of 1 - 5. Participants will be able to complete the survey in English and the questionnaire will be created and designed using the online survey tool Google Forms. In order to achieve a large enough sample size, the survey was distributed via various channels such as Instagram, What's App or email from 14th of April 2022 until the 20th of May. After the sample of n>= 60 is collected, the data can be downloaded and put into a data analysis program. The data obtained will be exported to the statistical analysis programme Jamovi, which will be used for further analysis and testing of hypotheses and data.

3.2 Theoretical Framework and Hypotheses Development

Studies over the last decade have shown that women often have a lower interest in financial instruments and consequently a more limited basic knowledge than men in comparison. At the same time, however, it has become increasingly easy to invest in various assets via several mobile phone brokers or other quick and uncomplicated channels. In order to be able to invest in different assets successfully, however, prior knowledge about these financial assets is particularly important. This is the only way to best calculate possible risks and potential opportunities (Bannier et al., 2019).

In order to evaluate the hypotheses 1, *Men are more willing to use blockchain-based systems than women*, more precisely, the following evaluation will compare question number 1 "What is your Gender?" with the questions "Paying for my hotel room in bitcoin or another cryptocurrency would be a useful option for me", "When booking a hotel, which of the following payment options do you prefer? (1 = least; " and "I believe that cryptocurrencies will play a more important role in the future". This way the author is able to get a better knowledge of how much the gender of the respondents plays a crucial role in the adoption of blockchain based systems.

Another component of my theoretical framework is hypothesis 2 that respondents with prior knowledge about blockchain are more willing to pay in cryptocurrencies. This can be crucial in determining how and where certain OTAs that advertise blockchain should position themselves in order to experience a particularly high resonance.

Hypothesis 3, *participants with a higher level of academic education are more open to blockchain-based applications*, also relates to the academic background of my respondents. According to Ante et al. the typical crypto investor is male, has an above-average income and usually at least a university degree. In order to test this hypothesis in conjunction with hotel booking behaviour, we tested the level of education with the questions: "Paying for my hotel room in bitcoin or another cryptocurrency would be a useful option for me." and When booking a hotel, which of the following payment options do you prefer? (Cryptocurrency).

RQ 1: Will potential end users embrace the benefits of blockchain integrated booking systems?

- Is gender a significant factor in the adoption of blockchain technology?
- To what extent does the level of education and knowledge about blockchain influence the potential adoption of cryptocurrencies?

H1: Men are more willing to use blockchain-based systems than women.

H2: Participants with prior knowledge of blockchain would prefer payments with cryptocurrencies.

H3: Participants with a higher level of academic education are more open to blockchain-based applications.

RQ 2: How do already established traditional online travel agencies differentiate from already blockchain integrated booking platforms?

H4: Online travel agencies that already use blockchain technology offer cheaper rates for hotels.

3.3 Ethical considerations

When performing the quantitative online survey, special attention was paid to the data protection of the participants as well as to a general code of conduct. Due to the fact that the data is collected anonymously, I do not need any further permission to use the data for my scientific work. It is considered problematic that the survey only

took place online and therefore groups of people who are not so activly engaged in the internet might be less represented in the results.

Table 2. Survey Questions and Sources 1

Survey Question	Source
I feel comfortable booking a hotel online without engaging with a member of staff.	(Nasir, J., M., Li., 2015)
I want my personal privacy to be protected as much as possible during the booking process.	(Nasir, J., M., Li., 2015)
It is important to me that I can trust a travel provider.	(Nasir, J., M., Li., 2015)
When booking a hotel, which of the following payment options do you prefer?	(Fujiki, 2020)
I would like to have more transparency in the online booking process regarding my payment.	(Nasir, J., M., Li., 2015)
I currently own or have owned cryptocurrencies in the past.	(Fujiki, 2020)
I have already used cryptocurrencies for making payments.	(Fujiki, 2020)
I have already heard the term blockchain and have a basic understanding of it.	(Steinmetz et al., 2021)
When booking a hotel, I have NO concerns about providing my payment information online or sending it to the hotel in another way.	(Nasir, J., M., Li., 2015)

I would prefer to pay for my hotel booking anonymously.	(Nasir, J., M., Li., 2015)
Paying for my hotel room in bitcoin or another cryptocurrency would be a useful option for me.	(Steinmetz et al., 2021)
I believe that cryptocurrencies will play a more important role in the future.	(Steinmetz et al., 2021)

4 Data Results and Analysis

In the following section of this Bachelor Thesis, the results of my research will be described, both in the literary context by means of fundamental internet research, and especially the results of the study I conducted. Furthermore, the data collected through the study conducted on Google Forms will then be tested and analysed through statistical evaluation methods so that the hypotheses created can be tested in order to answer the research question: *Will potential end users embrace the benefits of blockchain integrated booking systems?* Survey participants were also asked to express their responses in the form of a likert scale of 1 - 5. This scheme was used for the majority of the questions to ensure good comparability for the subsequent analysis. The Likert scale was designed so that 1 meant Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree. Another reason for using a Likert scale was that it is better suited for a t-test for evaluation. In order to achieve valuable results in the following analysis, some of the answer variables have been combined. In other words, the responses of "Strongly Agree" and "Agree" were combined into "Agree" and "Strongly Disagree" and "Disagree" were also combined into "Disagree". This leaves only variables with "Agree", "Neutral" and Disagree for the evaluation. A complete list of the data in unprocessed form can be found in the appendix.

4.1 General Descriptive

The following data from the Google Forms survey "Hotel Bookings with regard to Blockchain applications" was collected in the period from April 2022 to May 2022 and

a total of 72 valid responses could be extracted. The participants of the survey were invited to take part in the survey via various channels such as Instagram or What's App. It is a convenience sampling method, which can be seen in the question about the current age in Table 5. 75% of the participants, i.e. 54 people, stated that they were between 18 and 24 years old, which also describes my age. This means that a large proportion of the respondents are people of the same age. Table 3 also shows that all Shapiro Wilk test results have a p <0.05 and are therefore not normally distributed.

Table 3. Survey Questions and Sources 2

	Gender	Age	Academic Success	Occupation
N	72	72	72	72
Missing	0	0	0	0
Mean	1.56	1.42	2.07	2.57
Std. error mean	0.0590	0.110	0.122	0.110
Median	2.00	1.00	2.00	2.00
Mode	2.00	1.00	2.00	2.00
Standard deviation	0.500	0.931	1.04	0.932
Variance	0.250	0.866	1.08	0.868
Skewness	-0.228	2.84	0.788	0.544
Std. error skewness	0.283	0.283	0.283	0.283
Kurtosis	-2.00	8.07	-0.161	-1.01
Std. error kurtosis	0.559	0.559	0.559	0.559
Shapiro-Wilk W	0.632	0.500	0.842	0.765
Shapiro-Wilk p	< .001	< .001	< .001	< .001

4.1 Frequencies Demographics

Table 4. Frequencies of Gender 1

Levels	Counts	% of Total	Cumulative %
Female	40	55.6 %	55.6 %
Male	32	44.4 %	100.0 %

This first question is particularly important for hypothesis No. 1, because it is intended to investigate whether men are more willing to use blockchain-based systems than women? The analysis of this will take place in a further section, but it can already be seen that among the 72 participants, 40 were women with a relative share of 55.6% and slightly fewer men, namely 32, took part in the survey. No participants were registered who stated their gender as "diverse".

Table 5. Frequencies of Age 1

Levels	Counts	% of Total	Cumulative %
18 - 24	54	75.0 %	75.0 %
25 - 34	13	18.1 %	93.1 %
35 - 44	1	1.4 %	94.4 %
45 - 54	1	1.4 %	95.8 %
55 - 65	3	4.2 %	100.0 %

For the category of the survey "age", as already mentioned, most of the participants, 75% of them, or 54 participants, stated that they were between 18 and 24 years of age. The second largest group in the category was the 25 - 34 year olds with 18.1% and a total of 13 people. In the age category 55 - 65 there were 3 participants with

44.2% and in the last two categories 35 - 44 and 45 - 54 there was 1 participant each, or 1.4% each.

Table 6. Frequencies of Academic Success 1

Levels	Counts	% of Total	Cumulative %
Highschool graduate	25	34.7 %	34.7 %
Some university credits, no degree	27	37.5 %	72.2 %
Bachelor's Degree	11	15.3 %	87.5 %
Master's Degree	8	11.1 %	98.6 %
Professional Degree	1	1.4 %	100.0 %

Table 6 lists the academic level of the survey participants at that time. The largest group is made up of those who already have university experience and credits but have not yet completed a degree. This group represents 27 respondents or 37.5%, and the next largest group is all high school graduates with 25 respondents and 34.7%.

In descending order, there are following: Bachelor's Degree 15.3% (11 participants), Master's Degree 11.1% (8 participants) and Professional Degree 1.4% (1 participant).

Table 7 Frequencies of Occupation 1

Levels	Counts	% of Total	Cumulative %
Full time employed	18	25.0 %	25.0 %
Not Employed	4	5.6 %	30.6 %
Part time employed	9	12.5 %	43.1 %
Student	41	56.9 %	100.0 %

Table 7 presents the employment status of the respondents at the moment. The largest group here is Students with 56.9% and 41 respondents. The group of Full-time employees is the second largest category with 18 people and 25% of the total number

of respondents. Following this comes the Part Time Employees with 12.5%, 9 people, and in fourth place are the Unemployed with 5.6%, 4 people.

4.2 Analysis of the variables

4.2.1 Variable: Preference of cryptocurrencies when booking

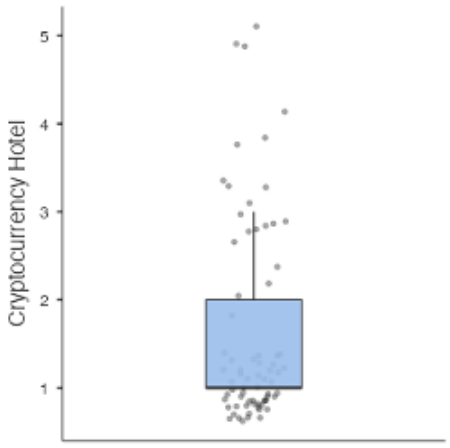
Table 8. Descriptives Variable one 1

	Cryptocurrency Hotel
N	72
Mean	1.65
Mode	1.00
Standard deviation	1.14
Shapiro-Wilk W	0.624
Shapiro-Wilk p	< .001

For variable one, "Cryptocurrency Hotel", the likert scale was constructed in such a way that 1 would be the least popular for payment and 5 the most popular. The variable is therefore built on the same scale as the following variables.

On average, however, it can already be seen that most of the respondents are rather pessimistic about payment with cryptocurrencies. The mean is 1.65 and the mode is 1. In addition, the standard deviation of 1.14 is not very large, which means that most of the answers are rallyitv closely around the mean. In Figure 1 you can see with the help of the boxplot where most of the answers are located, shown here as grey dots. In Table 8 you can also see that the value for the Shapiro Wilk test is less than 0.001, which shows that the data are clearly not normally distributed.

Graph 2 Cryptocurrency Hotel 1 1



4.2.2 Variable: Possession of cryptocurrencies

Table 9 Descriptives Variable two 1

	Possession Crypto
N	72
Mean	1.56
Mode	2.00
Standard deviation	0.500
Shapiro-Wilk W	0.632
Shapiro-Wilk p	< .001

This variable asked respondents whether they already owned cryptocurrencies or had owned them in the past, using a nominal scale. Respondents could choose between "Yes" and "No" which were later transformed to 1 and 2. Table 9 clearly shows that the number N did not change and that the Shapirio-Wilk test does not show a normal

distribution. The average is just above the central point, which suggests that a certain majority answered "no" (2). That is why the mode is also 2. Table 10 below shows the exact distribution of the answers. 40 of the 72 respondents have never bought cryptocurrencies and 32 have.

Table 10. Frequencies of Possession 1

Levels	Counts	% of Total	Cumulative %
No	40	55.6 %	55.6 %
Yes	32	44.4 %	100.0 %

4.2.3 Variable: If paying for a hotel with Bitcoin would be useful to me

Table 11. Descriptives Variable 3 1

	Paying Bitcoin useful
N	72
Mean	1.57
Mode	1.00
Standard deviation	0.747
Shapiro-Wilk W	0.712
Shapiro-Wilk p	< .001

The results of the question whether paying for a hotel room with Bitcoin would be useful for you showed that the majority of respondents said no. The average for this variable 3 is 1.57 or in the range of "Disagree" and "Strongly Disagree". Here too, the Shapiro Wilk test indicates that this question is clearly not normally distributed.

In Table 12, the relative and absolute differences in the likert scale are shown in detail before they are summarised into three categories. We can see that the category Strongly Disagree (22 votes) combined with Disagree (20 votes) has 42 votes. At the same time, the Agree and Strongly Agree categories received only 15.3% of the votes, or 11 votes. The Neutral field in the middle received the second most votes at 19.

Table 12. Frequencies of Paying bitcoin 1

Levels	Counts	% of Total	Cumulative %
Strongly Disagree	22	30.6 %	30.6 %
Disagree	20	27.8 %	58.3 %
Neutral	19	26.4 %	84.7 %
Agree	10	13.9 %	98.6 %
Strongly Agree	1	1.4 %	100.0 %

4.2.4 Variable: Cryptocurrencies will become more important in the future

Table 13. Descriptives Crypto Future 1

	Crypto Currency Future
N	72
Mean	2.33
Mode	3.00
Standard deviation	0.769
Shapiro-Wilk W	0.750
Shapiro-Wilk p	< .001

For the statistical analysis, the fourth variable is about how convinced the respondents were that cryptocurrencies will play an important role in the future. The question was based on a 1-5 Likert scale transformed to 1-3, and I came to the conclusion that the participants of the survey are positively inclined towards cryptocurrencies. The mean is 2.33 out of 3 for the maximum approval of the importance of cryptocurrencies in the future. The Shapiro Wilk test also showed that this variable is clearly not normally distributed.

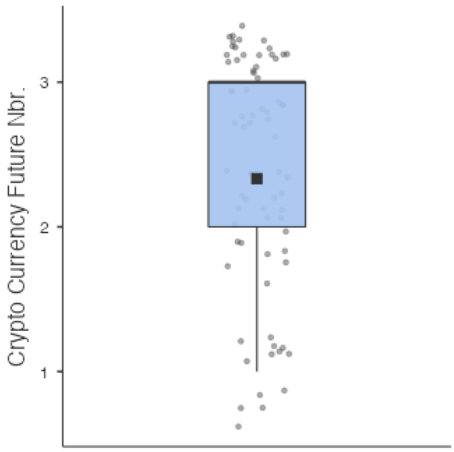
Table 14 and the boxplot in Graph 2 illustrate the results again clearly that the majority of respondents think that cryptocurrencies will still be important in the future.

Table 14. Frequencies of Crypto Currency 1

Levels	Counts	% of Total	Cumulative %
Strongly Disagree	4	5.6 %	5.6 %
Disagree	9	12.5 %	18.1 %
Neutral	22	30.6 %	48.6 %
Agree	22	30.6 %	79.2 %
Strongly Agree	15	20.8 %	100.0 %

The boxplot in Graph 2 shows the mean by marking it with the black square and the individual answers in the form of the grey dots. The blue box corresponds to the area in which the middle 50% of the data lies. It is therefore bounded by the upper and lower quartiles.

Graph 2 Crypto Future



4.3 Testing of Hypothesis One

For the purpose of answering the first research question, three different hypotheses were formulated with the aim of comparing different demographic characteristics and prior knowledge of blockchain-based systems.

In this thesis, the first hypothesis is whether the male gender is more willing to use blockchain-based systems. Therefor, the following three variables; preference to pay with cryptocurrencies in hotels, usefulness to pay with Bitcoin in general and the future of Bitcoin, of the survey were compared with the gender variable by using an independent sample t-test.

In order to evaluate which form of t-test is suitable for the evaluation of the tested variables, appropriate tests were carried out in table 15 and table 16 with regard to the normal distribution by means of the Shapirio Wilk test and to the variance by means of the Leven's test.

In Table 15, the value $p<0.01$ for both the variable "Cryptocurrency hotel", "Paying Bitcoin Useful" and "Crypto Currency Future" indicates that the normal distribution of the answers is violated and therefore another test (Welch or Man-Whitney U) should be performed.

Tabel 15. Normality Test (Shapiro-Wilk) 1

	W	p
Cryptocurrency Hotel	0.714	< .001
Paying Bitcoin useful Nbr.	0.827	< .001
Crypto Currency Future Nbr.	0.765	< .001

Note. A low p-value suggests a violation of the assumption of normality

To test the homogeneity of the variances, a Leven's test was carried out for the variables, which is shown in Table 16. The Levene test is used to test the null hypothesis that the samples to be compared come from a population with the same variance (t-test, chi-square, ANOVA, regression, correlation, etc.). The p-value of Table 16 clearly indicates that the variances do not differ significantly and therefore there is no violation of the homogeneity assumption.

Table 16. Homogeneity of Variances Test 1

	F	df	df2	p
Cryptocurrency Hotel	1.562	1	70	0.216
Paying Bitcoin useful Nbr.	0.475	1	70	0.493
Crypto Currency Future Nbr.	0.751	1	70	0.389

Note. A low p-value suggests a violation of the assumption of equal variances

As a result, I come to the conclusion that the Man-Whitney U test is most suitable for hypothesis 1. This is because the Mann-Whitney U test is used when the requirements for a t-test for independent samples are not met and the data is not normally distributed

Table 17. Independent Samples T-Test 1

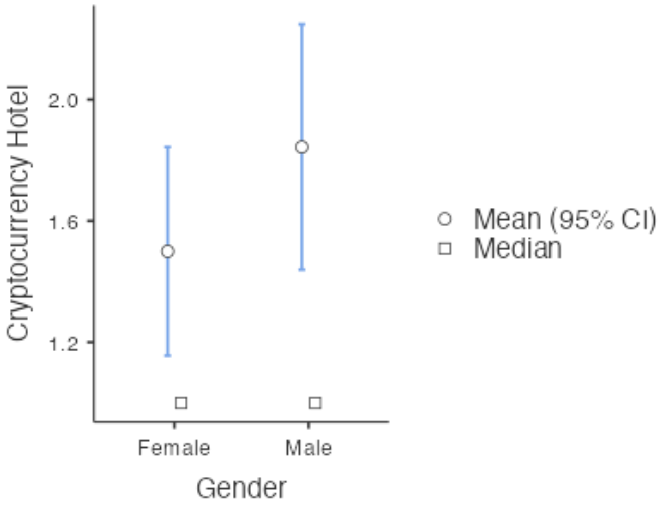
		Statistic	p
Cryptocurrency Hotel	Mann-Whitney U	520	0.089
Paying Bitcoin useful	Mann-Whitney U	481	0.042
Crypto Currency Future	Mann-Whitney U	611	0.723

Table 17 above shows the results for the conducted Man-Whitney U test for hypothesis one. A 95% confidence interval was chosen for the p-value, meaning that all values for p>0.05 are to be applied to the null hypothesis and H1 is to be rejected.

For the first variable "Cryptocurrency Hotel" we get a p-value of 0.089. Therefore, H1 has to be interpreted as not significant and has to be rejected. In other words, there is no significant difference between men and women who prefer to pay for a hotel with cryptocurrencies.

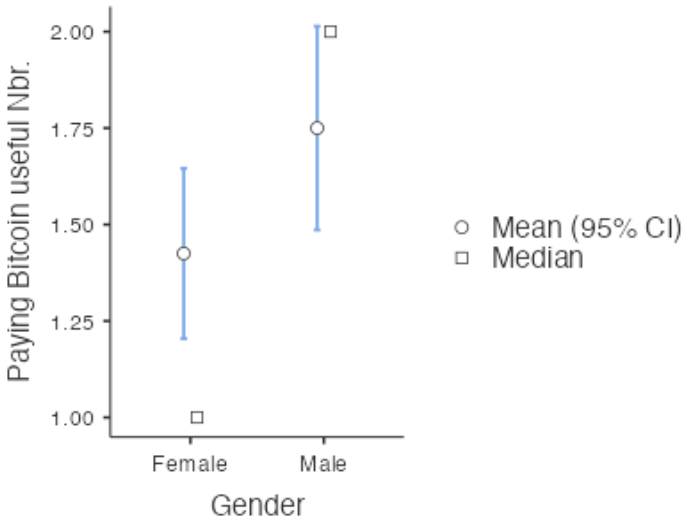
The following graph 2 describes the ratios of men's and women's responses to the first hypothesis.The x-axis shows the genders and the y-axis the responses of the respondents. Since the mean of both genders is still within the confidence interval of the other, the significance of H1 can be rejected by a small margin.

Graph 2 Cryptocurrency Hotel 1



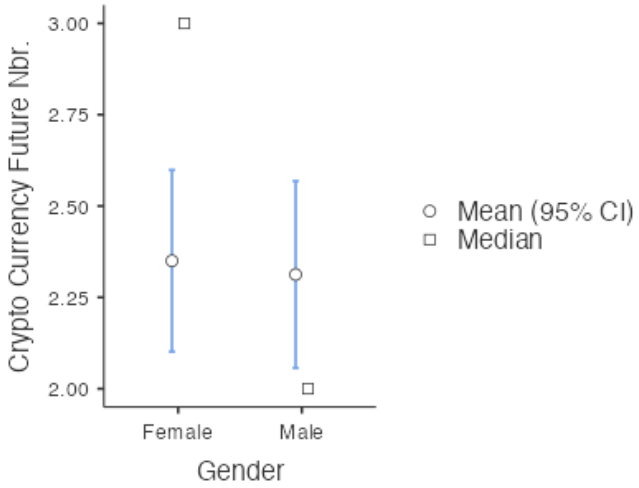
The second variable tested in relation to the first hypothesis was the (Paying in Bitcoin useful) question of the survey. The p-value here is 0.042, which is below the defined significance level of 5%. As a result, the null hypothesis can be rejected, or there is a significant difference in whether men would prefer to pay with Bitcoin than women. This is also made clear again in graph 3, because the mean of the respective other does not lie in the confidence interval of the other.

Graph 3 Bitcoin Paying Useful 1



For the third tested variable regarding hypothesis 1, the p-value in Table 17 shows a significance level of 0.723, which corresponds to a very high p-value. Therefore, the H1 in this case is clearly deflectable, as both men and women seem to have a similar view of the future of cryptocurrencies. This is particularly evident in Graph 4, where the confidence intervals and the averages are almost at the same level. Both genders have their mean at around 2.32 out of 3, indicating that they are convinced that cryptocurrencies will continue to be important in the future.

Graph 4 Crypto Currency Future 1



4.4 Testing of Hypothesis two

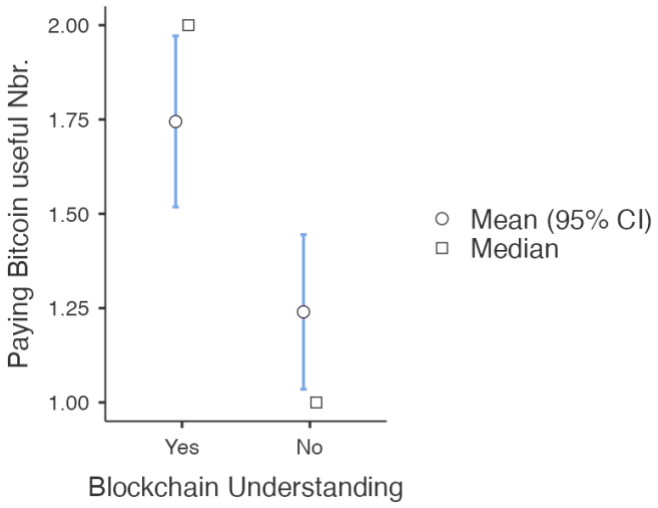
Hypothesis two investigates whether respondents with prior knowledge of blockchain would prefer to pay with cryptocurrencies. For this purpose, the prior knowledge of blockchain was used as a grouping variable and the question in the survey asking whether payment by bitcoin would be useful for a hotel room was inserted as a dependent variable.

Table 18. Independent Samples T-Test 1

		Statistic	df	p
Paying Bitcoin useful Nbr.	Student's t	2.86	70.0	0.006

For testing the hypothesis "Participants with prior knowledge of blockchain would prefer payments with cryptocurrencies", the t-test was used here. Table 18 shows the result of this and is clearly illustrated again in graph 4. The p-value for this test run is 0.006 which represents a very high level of significance. Consequently, it is evident that participants in the survey who already have prior knowledge of blockchain are also more likely to prefer to pay with cryptocurrencies. As before, the degree of freedom df is also 70 (N-1). The comparatively low result of the p-value indicates that the null hypothesis can be clearly rejected and that the relationship between the variables in the tested sample is not random.

Graph 4 Blockchain Understanding



Graph 4 shows the test again graphically to clarify the result. The x-axis represents the general blockchain knowledge and the y-axis ranges from 1-3 (Disagree-Neutral-Agree). The average of the two "Yes/No" groups is significantly different, i.e. 1.74 for "Yes" and 1.25 for "No" on a scale of 1-3.

4.5 Testing of Hypothesis three

The third and following hypothesis tests whether there is a statistical relationship between participants' academic degrees and their openness to blockchain-based systems. For this, the demographic section of the survey asked about the current academic degree and the third section included questions about whether the respondent owns cryptocurrencies. To test this possible dependency as best as possible, I decided to use a chi square test. The conditions for the chi-square independence test are that the observations come from a random sample and that the expected frequencies per cell are greater than 5. To meet this requirement, the following academic levels were combined: "No diploma", "High school graduate" and "Some university credits, no degree" became number 1 (Table 19) and "Bachelor's degree", "Master's degree" and "Professional degree" became number 2 (Table 19). The other test variable related to whether the respondent owns or has owned cryptocurrencies, which was queried with a yes/no answer.

In Table 19, the summarised data are finally presented and the excpected values are checked. The rows show the summarised education levels and the columns show the answer whether or not cryptocurrencies are owned. In total, 72 valid answers were evaluated.

Table 19. Contingency Tables Chi square 1

		Possession Crypto		
Academic Success Nbr.		**No**	**Yes**	**Total**
1 (No University)	Observed	32	20	52
	Expected	28.9	23.11	52.0
2 (Finished University)	Observed	8	12	20
	Expected	11.1	8.89	20.0
Total	Observed	40	32	72
	Expected	40.0	32.00	72.0

With a selected α-level of 5% and a degree of freedom of 1, the table of chi-square values yields a critical value of 3.841. Since table 20 shows the calculated chi-square value of 2.71 is smaller than the critical value, there is no significant difference in this example. The calculated p-value of 0.099 for the hypothesis also indicates that there is no significant statistical relationship between the two compared variables. However, it is better to use Cramer's V and Phi coefficient for static comparability, because the p-value can change with the sample size used. The effect size of Cramer's V and the phi coefficient in this test is 0.194 and can thus only be described as very small.

Table 20. χ^2 Tests Results 1

	Value	df	p
χ^2	2.71	1	0.099
N	72		
Phi-coefficient	0.194		
Cramer's V	0.194		

4.6 Comparison of Online Travel Agencies (OTA)

The second part of the empirical section is a comparison of already established hotel booking sites that are based on blockchain technology or do not use it at all. To match this, the second research question was chosen: "How do already established traditional online travel agencies differentiate from already blockchain integrated booking platforms?

Since price is usually the decisive criterion for the end consumer, hypothesis four was also formulated as follows: "Online travel agencies that already use blockchain technology offer cheaper rates for hotels."The online travel agency sector was chosen as the study context because the product is fairly standardized at different service levels, which may allow us to observe discrepancies and nuances between these platforms.

In order to gain a better understanding of the differences between various online travel agencies, I have compared one hotel in each city across five different OTAs in the following three tables. Starting with Lisbon, which is generally considered a crypto-friendly city, and a night at the Mariott Hotel at the end of August. As a Central European example, I have chosen Vienna, Austria and the Hilton Plaza in order to have

a more crypto-neutral city represented. And finally, the rather crypto-critical city of Beijing, China was also included in the comparison (Handelsblatt, 2021). To ensure that the comparisons are fair for each city and each booking platform, a room for 2 people and one night from Friday to Saturday (26 August to 27 August 2022) was chosen for the booking. Care was also taken to ensure that all local taxes and other charges were included in the final price. For hotel bookings, there can be differences in price, especially when the booking is made and from which hardware or software the hotels are booked (BBC News, 2012). In order to avoid any differences in the results, all price comparisons were made on the same day (14 May 2022) and from the same Macbook.

The OTAs used (Travala & Locktrip) are considered two highly decentralised OTAs that accept crypto payments. Also, Webjet is one of the OTAs that already allows payment with cryptocurrencies, at least in some destination countries, and also uses blockchain technology itself to handle booking processes more efficiently. Expedia, which has approached cryptocurrency payments in the past but does not currently offer them, and Booking.com, which is a traditional online travel agency.

The commissions in the table refer to the amount of the fee that an accommodation operator has to pay to the respective agency for a successful booking via one of the OTAs. These are average values which have been somewhat published by the companies. The commissions often vary with regard to the countries and locations of accommodation providers, which is why it is difficult to determine a uniform value. Travala already describes (2021) in their White Paper v 4.0. that they consider a general average commission of about 10% for marketing, listing the accommodation and other services to be appropriate. A similar high commission is also demanded by Webjet, although there is no official statement, but the profit of the platform can be used to calculate how high the commission payment is (Walsh, 2022). Although Locktrip is now part of Webjet, the company advertises that they are a completely decentralised booking platform that charges 0% commission for their services (Krietemeyer, 2019). Expedia is similar to Booking.com, both platforms are among the largest in the world and charge different levels of commission depending on the location and turnover of the accommodation provider. According to the head of Booking.com Europe, these are supposed to be around 11 - 16 percent, but there are

many accusations that these are much higher in some cases ("Booking.com rejects criticism of too high commissions", 201-07-08).

4.6.1 Travala

As already explained in 3.4 and 3.7, Travala.com is a blockchain-based travel booking platform on the NEO blockchain. They are known for marketing incentive programmes for customers linked to their own token, the AVA, as well as offering up to 40% cheaper prices on bookings than mainstream travel providers. However, these discounts are usually only available if you have enough AVA tokens or are a Travala Tiger NFT owner. According to the company's official white paper, Travala sees 10% of the revenue from bookings as a fair share for the company to continue offering low prices. In addition, Travala offers a best price guarantee that allows customers to have the difference credited to their next stay. The condition for this is that the same offer under the same conditions can be found cheaper with another provider (Travala.com, 2022).

4.6.2 Locktrip

Locktrip or formerly Lockchain is an online travel portal based in Sofia, Bulgaria. What makes Locktrip special is that with 0% commission costs for hotel providers, it is the cheapest platform in our comparison (Krietemeyer, 2019). The platform operates as a fully decentralised network on the Ethereum blockchain and can therefore provide a direct peer 2 peer bocking system. Consumers can pay for hotel stays in multiple currencies or in the in-house currency LOC. LockTrip also offers its own decentralised public blockchain, the Hydra chain, powered by the HYDRA coin. The principle behind Hydra is to create attractive blockchains for both hotel providers and developers with the help of critical economic features while utilising proven technology for data transmission. A particularly important aspect of this is the principle that Hydra offers fixed transaction fees in USD, which are dynamically calculated in Hydra based on market prices (LockTrip BlockChain Manifest v0.9, 2018). In the comparison of the three platforms, Locktrip was always able to offer the best price.

4.6.3 WebJet

The Australian travel provider Webjet was chosen as another participant in the comparison. The company is one of the leading OTAs in Australia and New Zealand, but flights, hotels, cars or entire holiday packages can be booked worldwide via Webjet. According to the Australian OTA, profit margins as measured by the total revenue flowing through the company will settle at 9 to 10 per cent for the booking site (Walsh, 2022). Like Locktrip, Webjet uses its own blockchain, the Rezchain, to optimise many transaction and booking processes. The rezchain structure is built on a private Ethereum blockchain and, with the use of smart contracts, allows the data of the two parties (vendor and customer) to be matched, verified and stored directly during the booking process, if the conditions stored in the smart contract are met. Rezchain enables companies like Webjet to share booking data in order to address mismatched information (Microsoft, 2018).

As Webjet and Locktrip share a very similar approach to optimising the booking processes of OTAs, Webjet announced on 18 March 2021 that it will acquire 25% of Locktrip and retain the option to potentially acquire 51% of Locktrip in the future. Webjet hopes that this will primarily lead to faster and better development of both companies' own blockchain applications. The possible merger of Locktrip's Rezchain with Hydra may also give Webjet an advantage in the sense that Hydra solves many of the issues that prevent wholesale adoption of blockchain as a commercial platform. of the issues that prevent the wholesale adoption of blockchain as a commercial platform (Investment in Locktrip, 2021).

4.6.4 Expedia

The Expedia Group is currently one of the largest travel agencies in the world. The US American company from Washington sells hotels, flights, car rentals and complete travel packages. Also part of the Expedia Group are platforms such as TripAdvisor, Trivago and Hotwire (Yirui Shen, 2018). In comparison, Expedia became involved in the figures mainly because it is one of the most important OTAs in the world, but also because it announced in 2014 that it would accept payments with Bitcoins, in the US in particular (Bernhardt, 2020). This step towards new technologies and payment methods is intended to establish Expedia as something of a middle ground between

the more traditional travel agencies such as Booking and the more modern, decentralised ones such as Locktrip or Travala. Since then, the payment process with cryptocurrencies has been terminated in June 2018, but in 2020 a new partnership with the already described Travala was announced, which is a new step towards the introduction of cryptocurrencies.

4.6.5 Booking.com

Booking.com ("Booking.com") operates an online booking service where hotel accommodation, private accommodation, flights, cars or other Experiences can be booked. In this way, Booking acts as a traditional agent between the guest and the hotel/flight/car provider. Providers pay a fixed commission for the use of the online booking platform on all confirmed overnight stays as well as for all cancellations that are processed via the platform (Kommission verstehen, 2022). Since commissions can vary depending on the country and location of the accommodation, it is difficult to determine a general percentage, but a statement by the Booking.com Europe boss, Peter Verhoeven, to the "Kurier" in July 2016 indicates that Booking charges an average of 11 - 15% commission. However, this value is to be seen as critical, as Booking.com has to fight against many accusations and apparently charges, in some cases, up to 40% commissions („Booking.com weist Kritik an zu hohen Provisionen zurück“, 201–07-08). Apart from that, Booking.com presents itself as the largest digital travel company with over 28 million registered accommodations worldwide. Compared to the other OTAs listed, Booking.com presents the absolute largest European travel booking market (Booking.com: Die größte Auswahl an Hotels, Ferienhäusern und Ferienunterkünften, 2022).

Table 21 OTA Compar. Lisbon 1

Lisbon Marriott Hotel **2 Person/Night** 26.08 - 27.08.22	Travala.com	WebJet	Locktrip.com	Expedia.at	Booking.com
Price inc. Tax	143 Euro	147,25 Euro	135,57 Euro	165 Euro	165 Euro
Comission average	~10 %	9-10%	0%	10% - 30%	~20%
Krypto availability	Yes and own AVA Token	Not in Austria	Yes and own LOC Token	No	No
Decentraliced Plattform	Working on Neo BC	Yes	Working on ETH (Hydrachain)	No	No

In Table 21, the first destination chosen for comparison was the crypto-friendly country of Portugal, Lisbon. On all the platforms used, it was possible to obtain comparable offers for one night at the Marriott Hotel Lisbon and, above all, to ascertain the price differences. The offer from Locktrip with 135.57 euros was only 82% as expensive, i.e. 18% cheaper than the offers from Expedia and Booking.com with 165 euros. The other two crypto-friendly booking sites Travala and Webjet were also able to offer an average of 145 euros, which is about 13% cheaper than Expedia or Booking.com.

Table 22 OTA Compar. Vienna 1

Vienna Hilton Plaza Hotel **2 Person/Night** 26.08 - 27.08.22	Travala.com	WebJet	Locktrip.com	Expedia.at	Booking.com
Price inc. Tax	195,73 Euro	196,55 Euro	186,84 Euro	196 Euro	196 Euro
Comission average	~10 %	9-10%	0%	10% - 30%	~20%
Krypto availability	Yes and own AVA Token	Not in Austria	Yes and own LOC Token	No	No
Decentraliced Plattform	Working on Neo BC	Yes	Working on ETH (Hydrachain)	No	No

In Table 22, the Hilton Plaza Hotel in the centre of Vienna was used for the comparison. After all booking prices have been exchanged into euros, the price difference is not as extreme as in the first comparison in Table 21. Locktrip can still make the cheapest offer at 186.84 euros, but only about 4% cheaper than all the other OTAs compared. Travala, Webjet, Expedia and Booking.com all offer the same service at around 196 euros in this comparison. In order to filter out a suitable offer here, it pays to take a closer look at the possible extra services of the respective OTAs.

Table 23. OTA Compar. Bejing 1

InterContinental Bejing Sanlitun, an IHG Hotel **2 Person/Night** 26.08 - 27.08.22	Travala.com	WebJet	Locktrip.com	Expedia.at	Booking.com
Price inc. Tax	276,74 Euro	277,16 Euro	268,72 Euro	277 Euro	264 Euro
Comission average	~10 %	9-10%	0%	10% - 30%	~20%
Krypto availability	Yes and own AVA Token	Not in Austria	Yes and own LOC Token	No	No
Decentraliced Plattform	Working on Neo BC	Yes	Working on ETH (Hydrachain)	No	No

As a third and final comparison, the five OTAs were tested with their offer in China, Beijing. Here, too, the booking process worked smoothly and the offers could be compared. A night at the InterContinental Beijing Sanlitun was booked cheapest on Booking.com in this comparison. Booking charges 264 euros for the night, which is about 4% cheaper than the most expensive provider Webjet with 277.16 euros. And this despite the fact that Bookin.com charges the highest commissions on average from the hotels and thus could not win in any of the previous comparisons. In second place in Beijing is again Locktrip with 268.72 euros and Travala and Expedia with 277 euros each on the price ranks 3 and 4.

To get a better awareness of why Locktrip did not have the best offer in this comparison, I contacted the company via their customer support by email. The content of my enquiry was whether they could give me reasons why it is possible that in Beijing (a supposedly crypto-critical city (Handelsblatt, 2021)) the OTA Locktrip, which originates from the USA, is only more expensive than Booking.com.

5 Conclusion

The main reason for this thesis was to gain a better and more detailed understanding of the needs and preferences regarding hotel bookings of the end consumer and the advantages of some OTAs compared to others. The data was collected and compared via precise literature research, an online survey and targeted internet research. Table 24 below summarises the results of the hypothesis analysis.

Table 24 Hypothese 1 1

Research Question: Will potential end users embrace the benefits of blockchain integrated booking systems?		
Hypothese 0: There is no difference in willingness to use Blockchain based systems between men and woman. Hypothese 1: Men are more willing to use Blockchain based systems.	p-Value	significant/not significant
Test 1: Gender / Preference to pay with crypto currency in a hotel	0,089	not significant
Test 2: Gender / Paying in Bitcoin would be a useful option	0,042	significant
Test 3: Gender / Believing in cryptocurrencies in the future	0,723	not significant

For the first hypothesis, three different variables were compared with the gender variable in order to get a more detailed awareness of whether men actually prefer to use blockchain-based systems. The Man Whitney U test was used for all three as the normal distribution and homogeneity of variances were violated. The p-value of the first test was 0.089 and was thus only just above the significant level of 0.05, namely only 3.9%. Statistically, therefore, hypothesis 1 must be rejected and the null hypothesis applied.

The second test examined whether the participants of the survey would consider paying with Bitcoin or another cryptocurrency to be useful. The result was that the

null hypothesis had to be rejected in this case and hypothesis H1 could be proven that men tend to use blockchain-based systems. Graph 3 also confirmed that men in particular would find it useful to be able to pay with cryptocurrencies.

In a third test, we determined whether there were statically relevant differences or correlations between the gender of the respondent and their opinion of whether cryptocurrencies will still play an important role in the future. The p-value was 0.723, indicating that there was no static difference between men and women on the question of the importance of cryptocurrencies in the future.

Table 25 Hypothesis 2 1

Research Question: Will potential end users embrace the benefits of blockchain integrated booking systems?		
Hypothese 0: Participants with prior knowledge of blockchain have no preferences to pay with cryptocurrencies Hypothese 2: Participants with prior knowledge of blockchain would prefer payments with cryptocurrencies	p-Value	significant/not significant
Test 1: Prior Blockchain knowledge / Paying in Bitcoin would be a useful option	0,006	Significant

The second hypothesis: "Participants with prior knowledge of blockchain would prefer payments with cryptocurrencies" was evaluated using a Student's t test. For testing, the variable whether the respondent already has a prior knowledge of blockchain technology was asked how useful it would be for him/her to be able to pay with Bitcoin. The result was a very strong significance level of p=0.6% or 0.006, indicating a strong correlation between the variables tested. The null hypothesis can therefore be rejected in this case and H2 can be considerd as very significant. The graph illustrates the result once again. The average of the two "Yes/No" groups is significantly different, i.e. 1.74 for "Yes" and 1.25 for "No" on a scale of 1-3.

Table 26 Hypotheses 3 1

Research Question: Will potential end users embrace the benefits of blockchain integrated booking systems?		
Hypothese 0: There is no relation to a higher academic education and the openness to blockchain-based systems Hypothese 3: Participants with a higher level of academic education are more open to blockchain-based systems.	p-Value	significant/not significant
Test 1: Academic education / openness to blockchain based systems	0.099	Not significant

For the third hypothesis, we analysed whether there is a possible connection between the academic level of the respondents and their openness to blockchain-based systems. Since the academic level in the questionnaire had insufficient expected values in in two categories, all results were combined into two new categories (1 = without university degree & 2 with university degree). The independent samples chi square test was then carried out and the results analysed. For the Chi square value, a value of 2.71 was calculated, which is clearly below the critical value of 3.841, respectively a non-significant result. In addition, the p-value of 0.099 indicates that the variables do not have a strong static significant relationship. However, in order to indicate the exact effect strength, attention should also be paid to Cramer's V and the Phi coefficient in the Chi Square test. For values < 0.2, the result is weak. Although the result is statistically significant. For values from 0.2 to 0.6 the result is moderate and > 0.6 means that the variables are strongly related (Cramér's V, o. D.). In my example, a Cramer's V of 0.194 was determined, which means that the variables are only very weakly associated with each other.

5.1 Research Question two

In order to deal separately with already existing OTAs, five different providers in three different places in the world were tested and compared with each other. For this purpose, three travel agencies were chosen that already work with blockchain

technology, or two that have already announced a completely decentralised structure. Travala and Locktrip already use their own token for payment and other customer incentive programmes. The hypothesis I have put forward relates mainly to the price factor of the offers. And by comparing the prices including taxes and converted into euros, the booking sites that already work with blockchain were usually able to offer the cheapest price. Especially Locktrip was able to offer the cheapest price by far in 2 out of 3 comparisons. Only in the third comparison in Beijing was Locktrip slightly undercut by Booking.com. To get to the bottom of this, the support team of Locktrip was contacted, but they are still waiting in vain for an answer. Nevertheless, the hypothesis can be confirmed that blockchain-implemented online travel agencies offer cheaper prices in this comparison.

5.2 Limitations

Despite the clear results of the study, it is important that certain limitations are taken into account when reading the thesis. Starting with the sample size of the survey, although enough participants were interviewed to reach a statically significant level and to meet the requirements for a quantitative bachelor's thesis, the sample size of 72 comparative respondents is still small and some values had to be combined for analysis.

Another very important point of the limitation is that the research topic of blockchain/cryptocurrencies is a highly topical subject on which the news has been piling up in the past few months. It was possible to see that the news at the beginning of 2020 to winter 2021 was mainly positive with rising market valuations of cryptocurrencies, and that the mood of the population towards blockchain was also very positive. However, with falling prices in the last few months and ever more frequent scandals such as the failure of cryptocurrencies like Solana or Terra, the positive mood of the population is also declining. My survey was conducted during a period when the mood of the media and many crypto stakeholders was at a very low point. This probably also contributed a lot to why many participants answered rather critically. However, like the price of many cryptocurrencies, the mood of the media and the population is very volatile towards blockchain technology.

Besides, the survey relied purely on social media conveniece sampling. This means that participants were not randomly selected and there is a risk of under- or over-representation of the population and/or that the results are biased, due to the reasons why some people choose to take part and some do not.

As a final limitation of the empirical research, it should be noted that due to the predominantly used five-point likert scale in the questionnaire, participants often tend to simply tick the value in the middle (neutral).

5.3 Résumé

In conclusion, through the research I conducted on blockchain technology in connection with hotel booking systems, important new data were identified and already existing hypotheses were confirmed. What was particularly striking was that this very new and current topic had extremely quickly found its way into our society. A very large proportion of the respondents now hold cryptocurrencies and many more have already used them for payment. Although the connection between blockchain-based decentralised booking systems and traditional booking is not immediately obvious to everyone, many are already interested in using this new technology. Blockchain has the potential to streamline many of our current booking processes and make them more secure. There is great potential to increase efficiency both on the side of the hotel booking provider and on the side of the customer.

However, it is important to note that with the growing popularity of cryptocurrency, NFTs, decentralised finance and other decentralised systems, blockchain technology is also gaining more awareness. For companies of all kinds, the question is whether it makes sense to implement such a decentralised distributed system. Moreover, tourism expenditure in Austria has almost doubled since 2000, from 20 billion in 2000 to 38 billion in 2019 (Statista, 2021). The corona pandemic halted this trend for a short time, but rising tourism expenditure is also expected worldwide in the future (Statista, 2021). Looking at the results of the survey in this paper may have a direct impact on the way hospitality services are delivered in the future.

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7 Appendix

7.1 Email to Locktrip

The email: Dear Locktrip Team!

My name is Michael Katschnig and I am currently writing my bachelor thesis for my Bachelor's degree at Modul University Vienna.

The subject of my thesis is to explore and evaluate the potential benefits of blockchain technology and cryptocurrencies in connection with hotel booking systems and online travel agencies (OTA). In order to show actual examples, I decided to compare your platform Locktrip with other OTAs like Travala, Webjet, Expedia and Booking.com.

To address my actual question, I would like to ask you firstly how it is possible that you pursue a 0% commission model with your platform or respectively which revenue model you pursue instead?

My second question relates to a comparison of a price offer from your platform with that of Booking.com. For one night and 2 persons at the Intercontinetal Hotel Bejing Sanlitun from 26 August - 27 August 2022, you charge the equivalent of 268.72 euros whereas Booking.com only charges around 264 euros (including taxes).

In all other comparisons before in Vienna or Lisbon Locktrip could mostly be 4% - 18% cheaper than Booking.com.

How can it be that you cannot offer the cheaper offer in this case or which factors play the most important role in the calculation of the price?

I hope you can help me with this question, as I really appreciate your platform and got to know it well in the course of my work.

Expecting your valued answer, I remain with best regards!

Michael Katschnig

7.2 Survey

What is your gender? *

- Female
- Male
- Diverse

What is your age? *

- 12 - 17
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 65
- 66 or older

What is the highest degree or level of school you have completed? *

- ○ No diploma
- ○ Highschool graduate
- ○ Some university credits, no degree
- ○ Bachelor's Degree
- ○ Master's Degree
- ○ Professional Degree

What is your current occupation? *

- ○ Not Employed
- ○ Student
- ○ Part time employed
- ○ Full time employed
- ○ Self employed

Which booking options do you use? *

	Never	Seldom	Occasionally	Often	Always
Online Travel A...	☐	☐	☐	☐	☐
Traditional Trav...	☐	☐	☐	☐	☐
Direct booking ...	☐	☐	☐	☐	☐
All-Inclusive Tr...	☐	☐	☐	☐	☐

I have booked a hotel in the last 12 month.

- ○ Yes
- ○ No

During the booking process, I compare prices from different providers.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

When booking an entire trip, I like to book all stops from one booking agent (flight, hotel, rental car, return flight, etc.).

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I feel comfortable booking a hotel online without engaging with a member of staff.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I want my personal privacy to be protected as much as possible during the booking process.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I typically book travel insurance with my hotel stay.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Reviews play an important role for me in the booking process.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

It is important to me that I can trust a travel provider.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I would like to have more transparency in the online booking process regarding my payment.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

When booking a hotel, which of the following payment options do you prefer? (1 = least; 5 = most) *

	1	2	3	4	5
Credit Card / D...	☐	☐	☐	☐	☐
Direct Bank Tra...	☐	☐	☐	☐	☐
Cryptocurrency	☐	☐	☐	☐	☐
Cash payment ...	☐	☐	☐	☐	☐
Pay Pal	☐	☐	☐	☐	☐
Cash payment ...	☐	☐	☐	☐	☐

I currently own or have owned cryptocurrencies in the past.

- ○ Yes
- ○ No

I have already used cryptocurrencies for making payments.

- ○ Yes
- ○ No

I have already heard the term blockchain and have a basic understanding of it.

- ○ Yes
- ○ No

When booking a hotel, I have NO concerns about providing my payment information online or sending it to the hotel in another way.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I would prefer to pay for my hotel booking anonymously.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

It would be more comfortable for me if I could skip the check-in process at the reception and open my hotel room directly with my mobile phone.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Paying for my hotel room in bitcoin or another cryptocurrency would be a useful option for me.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I would appreciate having an online digital identity, also for services other than hotel bookings.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

I would prefer an automated procedure for cancellation hotel room cancellations. *

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

I believe that cryptocurrencies will play a more important role in the future.

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree