

Implementation of blockchain technology into the Dutch real estate rental process.

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MANAGEMENT SUMMARY

Blockchain is a new, emerging technology that has great potential to be implemented in multiple areas of our life. Blockchain is a peer-to-peer public ledger, supported by a decentralized network of computers that does not require the central authority or third party intermediaries. New blocks in the chain are formed with the help of miners. Transactions that are carried out internally in the network are recorded in blocks, and then, multiple miners verify their authenticity and perform calculations on the block. If all the data is correct, the miner, who completes these calculations faster than anyone else, closes the block and receives a reward. Each block contains information about when and in which sequence the transactions took place. In other words, blockchain is a database of unaltered information with the timestamp on each transaction replicated on various servers around the world.

After conducting several interviews with field professionals and thorough research, it was concluded that the Dutch real estate rental market is still operating in a traditional and not automated way. All the rental process steps are extremely time-consuming, expensive, and require a lot of manual work.

The rental process involves the exchange of numerous documents between multiple participants. Now, the information exchange is far from perfect and requires multiple checks and coordination between concerned parties. Rental agents and property owners spend hours on verifying and validating the authenticity of the provided papers. Only the process of screening a potential candidate might take up to four hours. Besides that, capturing and transferring information is time-consuming and prone to human errors.

The new technology described in this research can solve some problems with the real estate rental process. The blockchain technology in the form of smart contracts meets the need for more automation, efficiency, and reduces the risk of human errors. The smart contracts eliminate the need for rental agents to verify the provided information's authenticity because the blockchain network guarantees it. It significantly reduces the time needed to check one candidate and therefore increases efficiency. The process of preparing and signing the rental agreement becomes almost fully automated, decreasing the risk of human errors.

Of course, the blockchain cannot solve all the problems at this point because renting out a house is still a very manual process. To automate it even further, we will need to turn to artificial intelligence or have robots on the spot who can help us, for example, by arranging a viewing of the apartment.

CHAPTER 1

1.0 INTRODUCTION

Finding a place to rent in the Netherlands can be a challenging task. Rental estate moves very quickly, and fine apartments in the suburbs or the city center are being snapped up almost instantly.

The Netherlands, like many other countries, has both social and private housing. About 70% of all rental properties are social housing, which comes at a fixed rental price. People who are living in those subsidized houses are paying not more than €737.14 per month.

Mostly, foreign students and working professionals are browsing through the web and looking at various websites to see all the rental opportunities. Every new website they visit asks for a relatively high monthly fee, which must be paid to see what this particular website has to offer. Before you know, you spent your monthly allowance for rent on getting access to all the offers that are out there on the market.

When you finally chose the apartments you would like to visit, the next step is to reach out to the rental agency, which will contact the broker, who is consequently going to get in touch with the landlord and arrange the viewing date. Since the real estate market does not have a global standard or public ledger where all data is registered, the industry is facing the need for third parties to process and verify the data more than once. All additional validations result in higher transaction costs.

In most cases, renting a property involves an intermediary or, in other words, the real estate agent. If you choose to use the rental agent's services, you will be liable for a commission payment. The fee usually equals a one month's rent plus 21% VAT and often becomes a bit of a con.

1.1 GOAL AND PROBLEM DEFINITION

Currently, the way the real estate rental market operates is traditional and not automated. It is time-consuming, expensive, not perfectly transparent between equal parties, but is, instead, impaired with information asymmetry with numerous intermediaries who significantly increase prices.

Some flaws of the real estate sector are closely related to non-transparency of its data (Deloitte, 2017). Because there is no global standard or public ledger where all data can be stored and registered, the industry is facing the need for third parties to validate the data multiple times. Banks, financial authorities, auditors, rental agents, owners, and appraisers personally have to verify all the data they receive. Every additional validation leads to higher transaction charges in the brokerage, recording, banking fees, etc.

Field experts agree that there is a need to establish standardized, interoperable data structures. In the upcoming years, technological innovations might improve transparency and diminish information asymmetry (Deloitte, 2017).

Hence, the rental market is a likely candidate for blockchain-based disruption. Blockchain is a peer-to-peer network that does not require a centralized authority or a trusted third party. It adds information to the database only after joint verification of the accuracy of data. Blockchain can be thought of as a global distributed ledger that helps moving digital assets around the world in seconds, with comparatively low transaction costs. As long as the assets are digital, they can contain any sort of value (Froystad and Holm, 2015). Blockchain technology is very promising for the real estate market because it enables process optimization and accelerates disintermediation in a sector that has been “molested” by middlemen (Ngo, 2016).

Several experts are assured that blockchain technology is able to provide an exhaustive platform for a life cycle of an estate, as well as replace intermediaries with peer-to-peer transactions. Brokers, lawyers, homeowner associations, escrow companies, and other supporting parties can be replaced with smart contracts, time-stamped encrypted data, digital tokens and cryptocurrency (Lifthrasir, 2016).

All the findings mentioned above lead to the problem statement of this research paper. Blockchain is an emerging technology with great potential to intervene with the existing real estate rental processes. This technology has the highest chance to reorganize the existing process, defined by inefficient operations and filled with intermediaries.

1.2 RESEARCH QUESTION

Consequently, the main research question that will be answered in this research is:

How can the blockchain be used in the real estate rental process to increase efficiency and therefore reduce costs?

The main question can be answered by answering the following sub-questions:

1. How is the current process organized?
2. Which parties are involved?
3. At which point costs have to be made by which party?
4. What is blockchain?
5. What are current examples of blockchain implementations in Real Estate?
6. Where can blockchain be used to replace current processes? (analyze from your side)
7. How would this impact the cost?

1.3 METHODOLOGY

This research paper aims to answer the question of how the blockchain technology can be used in the real estate rental process in order to increase efficiency and reduce costs. Because this study has the explorative nature, the qualitative method of collecting data was used.

Research sub question	Type of research	Source of data
<i>How is the current process organized?</i>	Desk and Field	Qualitative method: <ul style="list-style-type: none"> • Official government websites • Structured interviews with rental agencies representatives
<i>Which parties are involved?</i>	Desk	Qualitative method: <ul style="list-style-type: none"> • Dutch rental websites • Government websites • Structured interviews with rental agents
<i>At which points costs have to be made by which party?</i>	Desk and Field	Qualitative method: <ul style="list-style-type: none"> • Government laws and regulations regarding rental process • Government website • Rental agencies websites <p>Make calls to multiple housing agencies asking to describe the process of renting a property and the incurring costs</p>
<i>What is blockchain?</i>	Desk	Qualitative method: <ul style="list-style-type: none"> • Scientific articles and publications • Books • Journal articles
<i>What are current examples of blockchain implementation in real estate?</i>	Desk and Field	Qualitative method: <ul style="list-style-type: none"> • Reports of companies currently implementing blockchain • Master theses about blockchain implementation in the real estate • Journal articles <p>Semi-structured interview with field professionals</p>
<i>Where can blockchain be used to replace a current process?</i>	Desk and Field	Qualitative method: <ul style="list-style-type: none"> • Company reports currently implementing blockchain technology • Scientific articles <p>Semi-structured interview with field professionals</p>
<i>How would this impact the costs?</i>	Desk and Field	Qualitative method: <ul style="list-style-type: none"> • Interview with field professional • Own experiment: calculate money which can be saved by an individual if the blockchain technology is implemented

1.4 LITERATURE REVIEW

In this research, the problem of inefficient real estate rental market that is still operating in a traditional way is addressed. The rental market is flooded with multiple middlemen whom you must interact with in order to rent a property in the Netherlands. The process of renting a house is time-consuming, paper-driven, and has certain complexities when managing ongoing lease agreements, property operations, and cash flows (Deloitte, 2017).

In order to get an insight into how a current rental process in the Netherlands is organized, several field professionals were interviewed, and government websites were analyzed to get a better picture of what are the rules and regulations which government imposes. The official government website is an excellent source of reliable, credible, and current information.

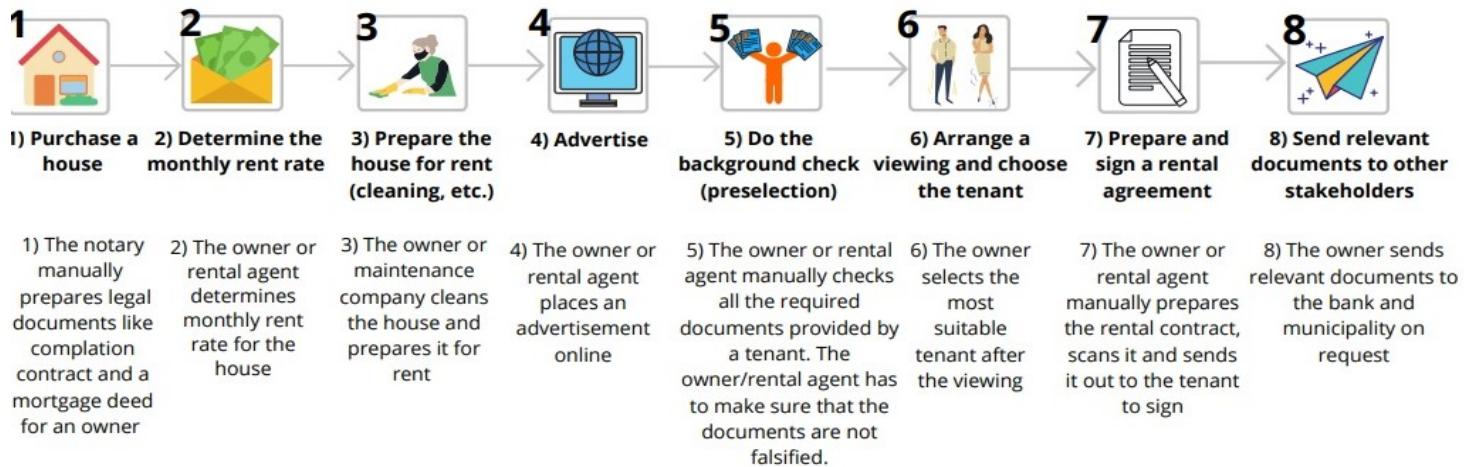
As well as government websites, the journal articles and rental agency sites were investigated.

The inefficiencies and high costs of the real estate rental market can be eliminated using a new, emerging technology – blockchain. To find out more about the concept of blockchain, the literature study was conducted. Various books and scientific articles that describe blockchain technology were investigated. To define blockchain technology Melanie Swans' book called "Blockchain – Blueprint for a new economy" was examined. She describes in detail the concept of blockchain and its benefits. In 2016 the Goldman Sachs Group issued the equity report in which described the anatomy of blockchain technology. To answer the question of what cryptocurrency is and how it was invented, several scientific papers written by Satoshi Nakamoto (2008) and Jan Veuger (2017) were investigated. They provided a good insight into how and when the Bitcoin was invented, and which problems it intends to solve. The reports of Evry (2020) and the European Union Agency for Cybersecurity (ENICA, 2016) gave a valuable insight into smart contracts and its advantages over traditional contracts. Those reports also gave an overview of different types of consensus protocols and their characteristics. Books and articles written by field experts provide the most credible and correct data.

In order to find examples of blockchain implementation in real estate, multiple websites were researched. On the Rabobank website, an interesting article about the development of a working prototype of the real estate portal was found. As well as the article, a comprehensive video explaining how the portal operates was discovered, which was helpful for the research.

CHAPTER 2

2.6 HOW IS THE CURRENT PROCESS ORGANIZED?



This chapter describes the current process of renting a property in the Netherlands. In order to portray the process in detail, several field professionals from different parts of the Netherlands were interviewed.

The procedure for renting a property consists of several steps: buying a property, preparatory work, writing and publishing an advertisement online, the viewing, preparation and signing of the rental agreement, and handing over the keys.

At first, a landlord or the rental agency has to purchase a house. As soon as the house was bought, the new owner has to go to the notary's office and sign the completion contract. This contract is necessary to change the ownership of the property. Usually, the mortgage deed has to be signed as well.

Secondly, the correct value of the apartment is determined. The rent must be adequate and correspond to the class of the rented apartment. If the monthly rental rate is higher than the average market rate, there might be a lack of demand. In the opposite case, underestimating the value of an apartment will lead to a loss of money. The primary source of information that can be used while determining the rental costs is an inspection of prices on similar houses. Comparison of the apartment to competitors is made by the following criteria: location, transport accessibility, number of rooms, apartment size, and rental period.

One more important task for an owner is to arrange the cleaning. After all actions to prepare an apartment for renting were taken, the next step is to advertise. Primarily, the text for an advertisement is created. In the description, the rental agent states the essential characteristics of rental property like address, number of rooms, additional facilities in the form of furniture, kitchen equipment, satellite TV, and the Internet connection, as well as the amount of rent and payment for utilities. It is necessary to add pictures of the rooms, made in a favorable angle, and with proper lighting. It is important to mention any restrictions if there are any. For example, whether it is allowed

to smoke or have pets in the apartment. Next, the advertisement is placed online on various rental estate websites. The most common ones are “funda.nl”, “pararius.nl”, “directwonen.nl” or “huurwoningen.nl”.

After the advertisement is published, calls and emails from interested tenants begin to arrive. A rental agent asks a couple of questions during a phone call and concludes how suitable the candidate is. Most of the time, the questions are asked to determine what kind of person it is and whether he/she can afford to rent a specific dwelling. If the initial conversation went smoothly, then it is time to do a tenants’ background check. This is a time-consuming procedure because the rental agent has to ensure that the documents provided by a tenant are not falsified. The potential tenant has to provide a copy of a passport, a copy of a working contract, a copy of three recent bank slips with salary information, the landlord statement, and the filled-in application form.

After a thorough background check, which might take up to four hours, the next step is to schedule a viewing. When a tenant has seen the apartment and made up his decision, the rental contract is prepared. Mostly, rental agencies are using ROZ contracts.

The contract is sent to a tenant to get it signed. Once the contract is signed and sent back, the next step is to hand over the keys. The rental agent makes an appointment with a tenant to conduct a final check of the apartment. During the final check, the rental agent is taking pictures of all rooms to avoid any misunderstandings related to damage or loss of furniture, household equipment, and other property.

One of the last phases is payment. The tenant has to pay the deposit and the monthly rent either by bank transfer or with cash. After that, the rental agent hands over the keys to a tenant.

The last step is sending the relevant information to other stakeholders. The property owner has to send documents to the bank and municipality on request. Usually, the bank would like to get the documents proving the ownership, and the municipality often ask for the rental agreement.

2.1 WHICH PARTIES ARE INVOLVED?

This chapter describes which parties are involved at each step of the rental process.

At the first stage, when the property was just acquired, three parties are involved – the notary, the buyer and the seller. Primarily, the notary has to make a pre-sale agreement and arrange for the buyer and seller to sign it. Then, the notary prepares a completion contract that must be signed to change the ownership of the property. In most cases, the mortgage deed has to be made as well. Next, the notary has to check the public records to verify data, ensure there are no unexpected debts, and the property may legally be transferred. He also has to take care of the registration of the necessary papers in the public records. The buyer becomes the owner of the property only after registration.

The second stage is determining the amount of monthly rent. During this stage, only the owner and the rental agent are involved. If an owner is not going to turn to the rental

agency for help, then he should determine the monthly rental rate by himself. In other cases, the rental advisor is defining the amount due.

Throughout the third stage, the owner or the maintenance company has to arrange the spring-cleaning of the house and prepare it for the potential tenants to move in. Sometimes the dwelling requires some repair work that has to be done. For example, whitewash the ceilings, paint the walls or re-glue the wallpapers, repair the wiring and plumbing equipment, and replace the light bulbs.

The fourth step is to advertise. An owner or the rental agent creates an advertisement for the property. One of them has to take pictures of each room in the house and write an appealing description highlighting the main features; when the ad is ready, the rental agent posts it online.

During the fifth step of the rental process, a thorough background check is done. Three parties are involved through the stage – a tenant, an owner, and the rental agent. The tenant manually collects all the required documents like a copy of an ID, a copy of an employment contract, a copy of three recent bank slips with salary information, the landlord statement, and the filled-in application form. After collecting the documents, the tenant has to scan and send them out to the rental agent for a checkup. The rental agent goes through each document individually and tries to verify them. The background check process takes a considerable amount of time for each tenant.

Sometimes, the rental agent has to contact the tenant's employer to confirm that he works at the company and has a steady income.

The sixth step is to arrange a viewing and select the best-suited tenant. During this process, three parties are involved – a tenant, an owner, and the rental agent. The rental agent arranges a viewing date and shows everything around. When the owner selects the tenant, a rental agent takes pictures of a house and checks the electricity and gas meters. The pictures are taken to avoid any miscommunications regarding broken furniture or household equipment.

The seventh stage is the preparation and signing of a rental agreement that requires a lot of manual work. The rental agent or an owner manually prepares a rental contract, scans it, and sends it to the tenant for a signature. The tenant receives the document, prints it out, signs it, scans it, and sends it back. The rental agent and an owner have to store the digital rental contract in one of the folders on their computer.

The final step is providing other stakeholders with relevant documents on request. During this stage, three parties are involved – the owner, the bank, and the municipality. An owner has to send the contract proving ownership rights for the property that he is currently renting out to the bank. If requested, the owner also has to provide a rental agreement to the municipality.

2.2 AT WHICH POINT COSTS SHOULD BE MADE BY WHICH PARTY?

This chapter illustrates the costs incurred during each step of the rental process described in previous sections. The focus is set on the fees related to the preparation of different documents.

The first stage is buying a house and registering the ownership rights at the notary. The notaries have the right to set their fees. The fees might fluctuate depending on the sale price of the property and the amount of financial loan. It is possible to negotiate the fees charged by a notary, and therefore it is better to visit more than one professional to find the most favorable rates. When purchasing an existing property in the Netherlands, the notary has to manually prepare a transfer deed (Dutch: akte van levering). This contract gives ownership right from a seller to the buyer. When combined with the mortgage deed's preparation, the notary costs vary between 1,000 to 2,000 euros.

In case the property owner decides to use the rental agency services, it will usually cost him around 8% of an annual rental fee (the range varies from five to ten percent). The costs occur because a rental agent is serving as an intermediary between the landlord and a tenant. The rental agent is going to search for candidates for a home on behalf of the owner, arrange the viewing and show the potential candidates the property, negotiate the rental price and further contract terms, provide the house key, and so forth.

The costs that incur during cleaning and preparing the house for rent stage are not relevant to this research.

The costs related to advertising the property are usually included in the rental agent's fees. However, if the property owner does not use the rental agency services, he has to pay a certain amount to advertise his property on different websites. Some of the sites are free, but some of them require an individual membership fee, which usually does not exceed 40 euros per month.

Number	Provided service	Fee	Costs incurred by tenant/landlord
1	Notary prepares legal documents	Between €1000 to €2000	Landlord (property owner)
2	Rental agent fee	Between 5 to 10 percent of annual rent	Landlord (property owner) Tenant might have to pay contract fees
3	Advertising	Usually included in the rental agents' fee	Landlord (property owner)
4	Screening of the candidate	Usually included in the rental agents' fee; around €200 per client	Landlord (property owner)
5	House viewing	Usually included in the rental agents' fee; between €45 to €60 per hour	Landlord (property owner)
6	Preparation of housing contract	Usually does not exceed €250	Landlord (property owner)

During the next stage, a rental specialist performs a screening of the candidate. The background, identity, multiple credit checks are carried out. The manual research is conducted into past incidents and the identity papers. Then the assessment is done to see whether there is a credit risk with the relevant candidate. In this way, the risk of

damage, criminal activities, and payment arrears is minimized. On average, the background check costs are around 200 euros per client.

The next phase is arranging a viewing and choosing the right tenant. The rental agent has to make an appointment with candidates to show the houses. The rental agents' hourly fees vary between 45 to 60 euros per hour, according to "mijnzzp.nl."

The final stage is the preparation of a housing contract. The costs that landlord incurs to draw up the contract usually do not exceed 250 euros per contract.

2.3 WHAT IS BLOCKCHAIN?

Modern technology gave an opportunity for people to communicate directly with each other. Video calls, emails, pictures, and instant messages travel directly from person A to person B, upholding trust between individuals, even if they are miles apart. When it comes to transactions involving money, people have to trust intermediaries to complete a transaction. During the last few years, a major technological innovation known as blockchain technology was introduced as a potentially disruptive technology. Blockchain provides a decentralized, transparent ledger for any transaction engaging value: money, property, votes, and goods. It creates an authentic record that can be verified by every member of the transaction.

This chapter provides an in-depth overview of the concept of blockchain and how does the technology work.

What is blockchain technology?

Over a decade ago, Satoshi Nakamoto (2008) published a paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System," where he described how the blockchain technology, a decentralized peer-to-peer linked-structure, could become a solution for the problem of double-spending and maintaining the order of transactions (Nakamoto, 2008). The system generates computational proof of the consecutive order of transactions. Satoshi Nakamoto transformed this idea into virtual currency and named it "Bitcoin", which can be used for peer-to-peer transactions without the necessity of a trusted third party.

Simply put, blockchain technology is a distributed ledger technology. Melanie Swan (2015) defined blockchain as a transparent, decentralized ledger with the transaction records. This database is shared by all network nodes, monitored by everyone, updated by miners, and owned and controlled by nobody. The technology can be compared to a large interactive spreadsheet that everyone can access. It confirms and updates that the digital transactions aimed to transfer funds are unique (Swan, 2015).

Most people know that the blockchain is an underlying technology for Bitcoin. However, the virtual currency is just the first of many potential applications of blockchain (Evry, 2020). In the core, blockchain technology is a tool for managing information, focusing on managing the records of transactions. What makes blockchain a transformative innovation is that each node on the network has a complete or partial copy of the blockchain and all historical transactions. In a blockchain, the timestamp is placed on every transaction, which makes it immutable and trustworthy. It ensures that a user is

unable to manipulate the data fraudulently and erases the need for a centralized database (Spielman, 2016).

In 2016, the Goldman Sachs Group published equity research about the blockchain technology. They described the anatomy of blockchain as follows:

“BLOCKCHAIN IS:

A database (with copies of the database replicated across multiple locations or nodes)
of transactions (between two or more parties)

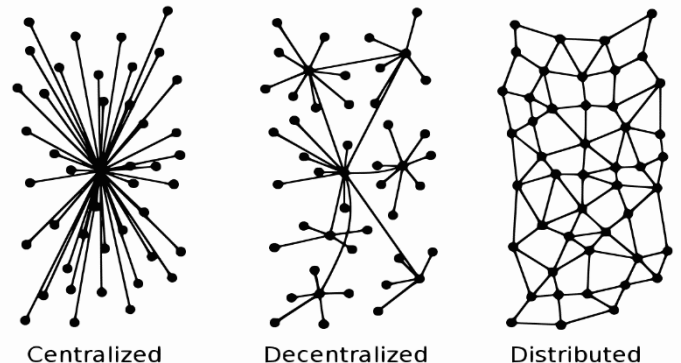
split into blocks (with each block containing details of the transaction such as the seller, the buyer, the price, the contract terms, and other relevant details)

which are validated by the entire network via encryption by combining the common transaction details with the unique signatures of two or more parties. The transaction is valid if the result of the encoding is the same for all nodes.

and added to the chain of prior transactions (as long as the block is validated). If the block is invalid, a “consensus” of nodes will correct the result in the non-conforming node” (Goldman Sachs equity research, 2016).

The blockchain technology is built on a cryptographic protocol, which enables any two willing participants to make transactions directly with each other without the necessity for a trusted third party (Nakamoto, 2008). It becomes beneficial for the consumer because the entire system's future does not rely on an intermediary that examines each transaction for proving ownership.

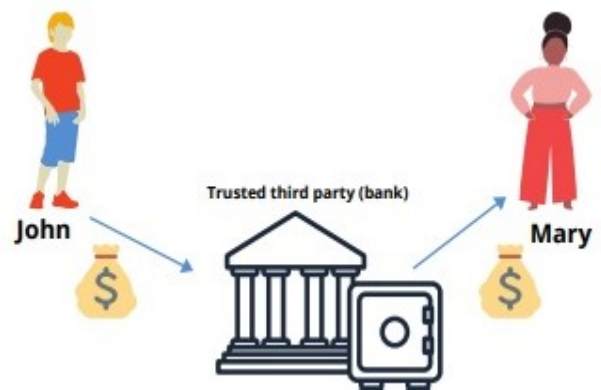
The transactions conducted on a blockchain network are stored in the database, or in other words, a ledger. The database of a blockchain network differs from a centralized database. Blockchain technology is a decentralized, transparent ledger, and a network of computers manages it (Swan, 2015). The ledger with all recorded transactions is continuously updated by miners, shared by all the network nodes, monitored by everyone, and controlled and owned by no one (Swan, 2015).



How does it work?

To simply explain how the technology works, the example of a double-spending problem is described (Custodio, 2013).

The process of exchanging assets, like money, between two parties is pretty straightforward: person A, let us call him John, gives the asset to person B (Mary), which implies that Mary is now in hold of the asset. However, at the moment of transaction, only John and Mary were physically present there; therefore, they are the only people who know that the operation occurred and asset was exchanged.



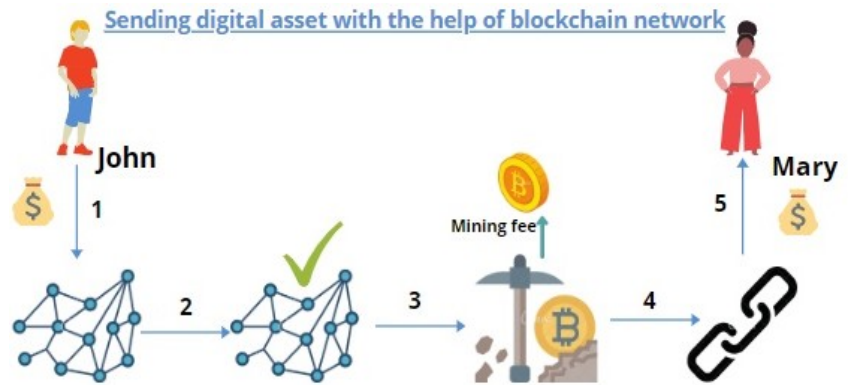
The whole situation is going to differ once John and Mary start exchanging digital assets. The main question that arises is how to know for sure that John did not use or spend the digital asset before transferring it to Mary? Before the invention of blockchain technology, the double-spending problem was solved with a trusted third party that employs a centralized ledger. In our example, John is sending a digital asset to Mary. The trusted third party, in this case, a bank is going to verify whether John owns the asset and checks whether that digital asset can be transferred to Mary. After the bank made all the required checks and verifications, the transaction is executed. Conclusively, it is registered on the centralized ledger within the bank, and is not accessible to others. Blockchain technology uses a decentralized ledger and therefore eliminates the need for a trusted third party. With the help of blockchain, everyone can check whether John owns the asset before he carries out the transaction.

Furthermore, let us assume that John would like to send Mary an asset using the blockchain network. The transaction is going to be executed as follows (Evry, 2020; Swan, 2015; Custodio, 2013):

1. John creates a transaction and transmits it to the network (the transaction message contains details of the value of the transaction, receiver's public address and a cryptographic digital signature which serves as a proof of authenticity of the transaction)
2. Various nodes (users/computers) of the network receive the message and confirm its validity by decrypting the digital signature. The nodes are checking whether John owns a digital asset and whether he double-spent it. The transaction is validated only after the consensus was reached in the network.
3. The consensus is achieved with the help of modern mathematical principles of transactions verified by the so-called "miners" who maintain the ledger. Mathematical principles ensure that the nodes automatically and continuously coordinate the current state of the ledger and any transaction in it (Jarosciak, 2016). Therefore, when someone tries to alter the transaction, the nodes will not reach the consensus and refuse to add the transaction in the blockchain. After

the miner solves the cryptographic puzzle, he receives a transaction fee together with the particular cryptocurrency.

4. When the node approves the transaction, it is "chained" into the blockchain network as a "block." After the block is added, it cannot be removed or altered.
5. After the transaction was validated, it will be executed, and Mary will get the digital asset sent by John.



Different blockchain networks are using different validation techniques (Evry, 2020). The mining process to validate and add blocks to the blockchain, which was described in the example above, is called the Proof-of-Work method. This consensus mechanism requires tremendous computational power to solve mathematical puzzles and validate new blocks of data (ENISA, 2016). To engage in the scheme, participants are required to collate transactions within a single block and then apply a hash function with the use of some additional metadata (ENISA, 2016). The block will be viewed as valid and broadcasted to the rest of the network as a valid submission only after the resulting hash falls within the acceptable range set by the current complexity parameters (ENISA, 2016). The Proof-of-Work mechanism is used by multiple tokens like Ethereum, Bitcoin, Dash, Dogecoin, SiaCoin, Zcash and Monero (Swan, 2015).

The other type of consensus protocol is called Proof-of-Stake. To have an opportunity to take part in the validation process, the individual nodes called validators are simultaneously voting on valid blocks and posting collateral. In contradiction to Proof-of-Work, Proof-of-Stake mechanism relies on proving the user is invested in the underlying token of the value of the network being mined rather than being the owner of a large amount of computing power (ENISA, 2016).

Research of the European Union Agency for Network and Information Security (ENISA, 2016) distinguishes two more main consensus protocols in use – Ripple protocol and Proof of Elapsed Time. To validate the transaction, the Ripple protocol servers are combining transactions into a “candidate list”. After that, all participants have to vote on valid transactions in order for them to get included in the ledger. The transactions that meet the minimum of 80% “yes” votes are included in the following last closed ledger state (ENISA, 2016).

The Proof of Elapsed Time (PoET) is a new consensus mechanism, designed by chip manufacturing company Intel in 2016. It was invented primarily for permissioned blockchain networks and is intended to improve upon Proof of Work consensus. The PoET mechanism focuses on decreasing the energy inefficiencies related to Proof of Work’s mining intensive process (Curran, 2018). Intel developed a means of establishing the validation lottery that takes advantage of its CPUs to produce a timestamp

cryptographically signed by the hardware. The participant who has the soonest timestamp in the chain decides which transaction is going to be a part of the next block in the chain (ENISA, 2016).

There is a wide variety of applications that can be built using blockchain technology. The applications are named Blockchain 1.0, Blockchain 2.0, and Blockchain 3.0. The following sections describe each of the applications mentioned above.

Blockchain 1.0 – Cryptocurrency

Cryptocurrency is a digital asset that uses a highly advanced encryption type named cryptography to regulate the creation of new currency units, as well as validate and secure transactions. It was invented to work as a decentralized medium of exchange; in other words, it does not depend on any financial institution or any other central authority (Murphy; Seitzinger, 2015). Without a doubt, a Bitcoin is the most known cryptocurrency. Nevertheless, there are other significant types of cryptocurrency like Litecoin, Ethereum, Ripple, and Bitcoin Cash.

In January 2009, an unknown computer programmer Satoshi Nakamoto introduced a new digital currency called Bitcoin. The new electronic payment system was based on cryptographic proof instead of trust, and it allowed participants to conduct transactions between each other directly, without a necessity for a third trusted party. Like the U.S. dollar, the Bitcoin does not have an intrinsic value; it cannot be redeemed for another commodity, like an ounce of gold. A Bitcoin does not have a physical form and is not backed up by most legal entities or governments (BDO USA, 2019). Bitcoin is a mixture of four individual components: cryptography, a peer-to-peer network, an open-source protocol, and a shared ledger (Veuger, 2017). The first element is cryptography. It can be compared to banks and is used to secure the transaction traffic. The second element is a peer-to-peer network. This is a network of parties, called miners that validate transaction register all around the world. There is no exclusive right to the network, and it is impossible to switch it on or off at a particular location. The network is connected with the third element (an open-source protocol), and as a result, the underlying software is entirely publicly available. This allows everyone to see how the software is programmed (Veuger, 2017).

Blockchain 2.0 – Smart contracts

Blockchain technology outlines an innovative way to track payments and transfer funds, but it also has the potential to make contracts smarter. The primary purpose of implementing smart contracts is to lessen the need for individuals to process and verify an agreement. The blockchains' distributed ledger allows tracing a sequence of events in chronological order with 100% accuracy (Kaplan, 2016).

The smart contract can be defined as a piece of software that stores rules for negotiating the terms of a contract, checks the contract, and automatically executes the agreed terms (Kallam, 2018). As a result, two participants who do not trust each other can conduct transactions using smart contracts. They are trustless, autonomous, and self-sufficient (Evry, 2020). Smart contracts are making their creation and performance more

efficient, cost-effective, and transparent. The great advantage of code-based contracts is the transactional efficiency of automatically generating contracts based on patterns and syntax agreed in advance, which is something unlikely to happen in our current environment of contract drafting and negotiating (Evry, 2020).

Computer scientist and cryptographer Nick Szabo first introduced the concept of smart contracts in 1993. After a couple of years, he published a paper regarding that topic. Szabo described smart contracts as a set of promises, specified in a digital form, including protocols within which the parties perform on these promises (Szabo, 1996). Nick Szabo outlined three characteristics that feature contractual obligations, which were later described in ENISAs' (2016) report:

- **Observability:** All participants (parties to the contract) can observe each other's performance of the contract, as well as to prove their performance to other principals;
- **Verifiability:** All participants of a contractual agreement are able to prove to an arbitrator that a contract has been performed or breached, or the ability of the adjudicator to find this out in a different manner;
- **Privity:** The principle that knowledge and control over the contents and performance of a contract should be distributed among parties only as much as is necessary for the performance of that contract. A generalization of the universal law principle of contract privity states that third parties should have no say in the enforcement of a contract.

Smart contracts possess multiple advantages when compared to traditional arrangements. The number of benefits is likely to increase in the future as technology is going to improve. The major advantages are described below:

Transaction and legal costs reduction: Smart contracts are self-executed. They do not require any involvement of a trusted third party like banks, notaries, or accountants. The blockchain itself guarantees that the participant, who transfers a specific digital asset, is the actual owner of an asset. The absence of trusted third parties will lead to cost reduction. It might be possible that due to the lower overhead costs, the number of transactions will increase because the entry-level is going to become lower.

Increased efficiency: Unlike regular contracts that are approved by intermediaries, smart contracts are validated by reaching a consensus in the network. The transfers that are made using the blockchain technology are instant and peer-to-peer. Therefore, signing, execution, clearing, and settlement can be done faster because of trustless exchange and disintermediation.

Greater transparency and security: The greater transparency will be achieved because all terms and conditions of the contracts are accessible and visible to all concerned participants. Smart contracts are secure because they use the highest level of data encryption, which is currently available. The personal data is duplicated into a series of copies stored across a network of separate computers. The processing power needed to

corrupt blockchain ledger does not exist today, and that provides more trust and transparency in the system.

Greater trust between participants: While executing a traditional contract, two individuals have to trust each other in order to fulfill their side of the obligations. The benefit of smart contracts is that an autonomous check will examine whether the participants fulfilled their side of the obligation. It eliminates the need for trust because the transaction is executed automatically.

To sum up, several experts believe that smart contracts will take over traditional contracts since they increase efficiency, reliability, and reduce costs. Multiple institutions and processes can adopt smart contracts. Digital assets can be exchanged without the need of two participants to trust each other, with the help of pre-determined rules that have to be fulfilled before execution. Nevertheless, the code should be clearly programmed and readable, since every concerned party needs to be able to read the code.

Blockchain 3.0 – DAOs

DAO, also referred to as decentralized autonomous organizations, is another influential innovation of blockchain technology. A DAO is a corporation that operates without managers, employees, or office buildings. It is created and managed based on the computer code incorporated in a smart contract. Smart contracts are further developed at this stage, so they operate autonomously and rely on their own laws (Azqhandi, 2018). The DAO was supposed to serve as a venture capital fund for the crypto and decentralized space. Theoretically, a lack of centralized authority grants more control and access to investors as well as decreases costs. Even though the first DAO firm was hacked and all assets were stolen, DAO still has a massive potential after all technical security problems are eliminated (Azqhandi, 2018).

2.4 CURRENT EXAMPLES OF BLOCKCHAIN IMPLEMENTATION IN THE REAL ESTATE

Blockchain is an innovative technology. Therefore, many organizations and people in the real estate business are still not familiar with it and its benefits. There are only a few examples in the Dutch market, where companies implement blockchain to support the core business. This chapter describes three examples of blockchain applications.

Currently, Rabobank is applying its knowledge of blockchain technology to take the rental information on the commercial real estate to a higher level. They developed a working prototype of a portal that helps property owners to capture contracts and rental information quickly and securely (Rabobank, 2018).

In the real estate market, much rental information is being processed, transferred, and stored between multiple parties. As for now, the information exchange is far from perfect. The provided data is not always clear and complete. Multiple checks and coordination between participants are often required. Besides, capturing and transferring all the data is extremely time-consuming and prone to human errors. Mr. Holleman, a senior developer at Rabobank real estate finance, believes that the

prototype meets a need of various stakeholders in the real estate ecosystem, including the bank. It is beneficial for all parties if stored information can be traced back to the original data source. Rabobank developed a prototype, in which rental information is recorded in a structured manner from the moment of origin. The landlord, instead of supplying the information several times to multiple parties, can digitize and standardize this information with the prototype. The landlord can easily and securely share the structured information with third parties such as a bank, appraiser, or accountant. Working with the rental portal can save time for every involved party. Moreover, the information about the rental situation is clear and up to date (Rabobank, 2018).

Another example of an organization implementing blockchain technology is ABN Amro, together with its partner IBM. They are working on a private blockchain experiment that is approaching the commercial real estate market in another way. The application is called Torch and is used for exchanging dwelling related data with the help of smart contracts and blockchain technology. In this application, the concerned parties are able to interact with each other in a secure, efficient, verifiable and transparent way (ABN Amro, 2016). With the help of the Torch app, commercial real estate clients are allowed to enter their lease contracts for properties financed by ABN Amro. The client's relationship manager at the bank is able to validate the transaction. In case the property has to be appraised, the bank employee can use the Torch app to send the required details directly to the appraiser. After the valuation report is done, the appraiser grants access to the information to the bank and a client. The Torch app unlocks additional data from the Land Registry Office, the Chamber of Commerce, and the Dutch Central Bank. The Dutch Central Bank can conduct an audit without the necessity to initiate an extended reporting process first (ABN Amro, 2016). This leads to transparency improvement, more efficient business operation and a higher level of data quality.

The third example is Real Estate Asset Ledger, or REAL. It is a crowdfunded property investment token, which operates using blockchain technology and is governed by Ethereum smart contract (SAM, 2017). The REAL's primary focus is to create the most favorable conditions for real estate investment opportunities. The best investing conditions are achieved by cutting costs related to unnecessary third parties, reducing tax inefficiencies, mitigating the cross-border transactions using a crowdfunding platform, and ensuring transparency and liquidity. According to the REAL (2017), the crowdfunding blockchain application will lower entry barriers for many people who would like to invest in real estate. On this platform, the users will get an opportunity to exchange REAL tokens for the economic rights of a property (REAL, 2017). There is also a room for real estate portfolio diversification since the properties exhibited on the platform are located all around the globe.

The examples were provided to illustrate different opportunities for blockchain implementation in the real estate sector. To sum up, various organizations are researching blockchain technology and the implied benefits of it. Blockchain technology has the potential to be implemented in multiple sectors besides real estate. Several industries are interested in implementing smart contracts or cryptocurrencies, whereas others are striving to use the combination of those two.

2.5 WHERE CAN BLOCKCHAIN BE USED TO REPLACE CURRENT PROCESS?

This chapter will give an overview of where the blockchain technology can be used during each step of the rental process described in section 2.0.

Step 1: The first step of the process is purchasing the property. The notary has to prepare legal documents like transfer deed and mortgage deed manually. During this stage, smart contracts can be used to improve the process. The deed of ownership and the mortgage deed can be made in the form of smart contracts. It will not cut the costs drastically because somebody still has to prepare a smart contract, but from this point on for all the next steps, the owner will have a smart contract, which will save him and all concerned parties much time.

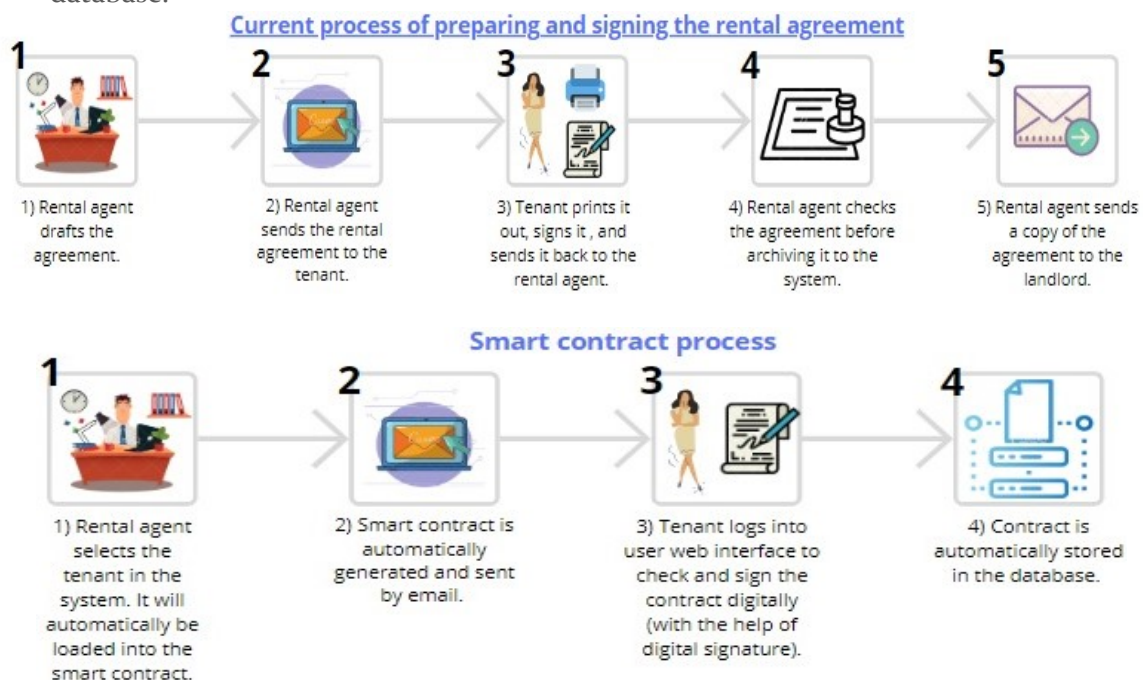
Step 2: The second step is the rental rate determination. In case the owner is using the rental agency services, he has to provide relevant documents for the rental agent to determine the monthly rent rate. Since the owner has a deed of ownership in the form of a smart contract, he can send it directly to the rental agent. The rental agent does not have to verify the authenticity of the document because the blockchain network guarantees it. Consequently, the agents' fee could become slightly lower because he would not have to spend much time checking the provided documents. After receiving the deed of ownership, the rental agent can determine the amount of monthly rent right away.

Step 3 and 4: The process of preparing property for rent and the advertising will stay the same.

Step 5: The fifth step is conducting a background check. The tenant has to provide to the housing agency various documents like a copy of a passport, a working contract, three recent bank slips with salary information, the landlord statement, and the filled-in application form. If all those documents are provided in the form of smart contracts, it will save a rental agent much time and, therefore, money. The rental agent will not have the necessity to verify the provided documents' validity, and it will drastically speed up the screening process. One of the interviewees mentioned that only one candidate's background check might take up to four hours. With the help of smart contracts, this time can be reduced to a couple of minutes.

Step 6: The sixth step is arranging a viewing and choosing the best-suited tenant. The blockchain technology cannot help to save time or money during the process.

Step 7: The next stage is preparing and signing the rental agreement. This step requires a lot of manual actions. At first, either a rental agent or the owner has to draft the rental agreement. Then the rental agent mails the agreement to a tenant. A tenant prints it out signs it, and sends it back. The rental agent checks the contract before archiving it in the system and sends a copy to the owner. All those steps require a considerable amount of time and are prone to human errors. The updated process will require only one manual action from the rental agent. He has to select the specific tenant in the system, and then the information will be automatically loaded into the smart contract. The contract will be generated automatically and sent by email to the tenant. The tenant has to log in to the user web interface to check and sign the proposed contract digitally (with the help of a digital signature). Then the contract will be automatically stored in the database.



Step 8: The last step of the process is sending relevant documents to other stakeholders. The bank and municipality often require the ownership deed and the rental agreement from the landlord. If the owner has both of those documents in the form of smart contracts, he can grant access to those documents, which will save him time.

2.6 HOW WOULD THIS IMPACT THE COSTS?

This section describes how blockchain technology's implementation into the real estate rental process will affect the incurred costs.

Step 1: During the first step, the new owner of the house incurs notary costs. The fees are negotiable and depend on the size of the house and so forth. Some notaries charge a percentage of the house value (around 1%-1,5%), others charge by the hour of work. The notary has to prepare two primary documents relevant for this research: the deed of conveyance and the mortgage deed. The fees for the preparation of each document vary from €500 to €1,000.

Let us assume that John bought a house for 100,000 euros. Then he incurs 1,000 euros in notary costs plus 21% VAT (210 euros), in total €1,210. If the documents are made in the form of smart contract, it will save the owner some time in the future, but will not affect the notary costs, because notary still has to prepare the smart contracts.

Step 2: After John bought a house, the rental agent fees have to be determined. Mostly, rental agencies charge from 5 to 10 percent of yearly rent. Let us assume that after receiving the deed of ownership in the form of a smart contract from the owner, the rental agent determines the monthly rent rate that equals 700 euro ($12 * € 700 = € 8,400$). Consequently, if the rental agent charges 8 percent of the monthly rate, his fees equal €672 ($€8,400 * 0.08$). Blockchain technology can help save the rental agent's time while determining the monthly rental rate because he will not have to check the authenticity of the provided documents. In case we assume that the rental agent charges his clients by the hour of work, then the costs of determining the rental rate will decrease because the rental agent will not have the necessity to validate the documents. For example, a rental agent charges 50 euros per hour and spends two hours verifying the documents and determining the monthly rent rate. If the owner provides the documents in the form of the smart contract, the agent has to spend only one hour determining the monthly rent. Hence, the costs decrease from 100 euros ($€50 * 2$) to 50 euros.

Step 3 and 4: Throughout the process of preparing the property for rent and advertising, no changes will occur.

Step 5: The fifth step of the rental process is conducting a background check. The current process is very time-consuming; each document provided by the potential tenant must be checked for falsification. As mentioned before, the screening process might take up to four hours per candidate. If the rental agent charges 50 euros per hour and has to spend four hours checking one candidate, the costs will equal 200 euros ($4 * €50$). If the potential tenant provides all the required documents in the form of smart contracts, the need for performing additional checks to validate the submitted documents disappears. Therefore, instead of four hours, the rental agent can spend a couple of minutes going through the documents. Consequently, the costs are reduced from 200 euros to almost zero.

Step 6: The sixth step is arranging a viewing and choosing the right tenant. The costs are not going to be affected because the blockchain technology cannot be implemented here.

Step 7: The process of preparing and signing the rental agreement requires a lot of time and manual work. The rental agent has to draft a contract, send it to the tenant, wait for the email with the signed contract, double-check it, and store it in the database. The costs of preparing one agreement equal to 250 euros. With the help of smart contracts, the process becomes almost entirely automated. The rental agent has to spend time only on selecting the right tenant in the system. All the following steps will be executed automatically. Hence, the process becomes more efficient, less time-consuming, and not prone to human errors. The costs can decrease from 250 euros to almost zero because the time and effort spent on preparing one contract reduces drastically.

Step 8: The final step of the rental process is sending the required documents to other stakeholders. The landlord has to send the deed of ownership to the bank, and the rental agreement to the municipality. No costs are incurred during the process. With the help of smart contracts, the owner can grant access to the documents for all the concerned parties, which will save him time.

CHAPTER 3

3.0 CONCLUSION

We carried the investigation, the primary purpose of which was to answer the main research question of how blockchain technology can be used to increase efficiency and therefore reduce costs. To answer this question, the current process of renting a dwelling, the involved parties, and incurred costs were investigated. The concept of blockchain, its benefits, different applications, and current examples of implementation were explored.

The current process of renting out a house is highly manually organized. There is much information being processed, exchanged, transferred, and stored between all kinds of parties. The information exchange process is not perfect because the provided data is often incomplete and not clear. All the concerned participants are forced to conduct multiple checks and reconciliations between each other. Besides, the process of capturing and transferring information is time-consuming and prone to human errors.

The absence of public ledger, where all the data can be registered and stored between various participants, forces the industry to rely on trusted third parties to verify the provided information multiple times. Banks, rental agents, landlords, municipalities have to individually validate the documents, which results in higher transaction costs.

We researched how the implementation of blockchain technology can eliminate some inefficiencies of the current process for the future. Now, there are many examples of companies trying to adopt the blockchain technology in their core business. For example, Rabobank developed a working prototype of a portal that helps commercial real estate property owners to capture contracts and rental information quickly and securely. Another Dutch bank ABN Amro was working on the application called Torch that allows users to exchange the housing-related data with the help of smart contracts.

The blockchain technology and smart contracts, in particular, can be used to improve some steps of the rental process. When the owner purchases the house, he needs to go to the notary to get the ownership deed and the mortgage deed. Both of those documents can be prepared in the form of smart contracts by the notary. It will not significantly reduce the costs of this operation, but from this point on will save the owner and all concerned parties a considerable amount of time. When the owner wants to rent out his dwelling, he needs to provide relevant documents to the rental agent for determining the monthly rental rate. If the ownership deed is provided in the form of a smart contract, it eliminates the need for the rental agent to verify its authenticity.

Consequently, the rental agent spends less time determining the rental rate, and therefore the process becomes more efficient and less costly. The background check of potential tenants is the most time-consuming process. Like was mentioned before, the screening of one candidate might take up to four hours. If the documents provided by the candidate are in the form of smart contracts, it omits the necessity to validate its legitimacy because the blockchain guarantees it. Therefore, the process becomes more efficient because instead of four hours, the rental agent has to spend a couple of minutes checking the documents. The costs of performing the screening by the rental agent should also reduce because instead of four hours, it now takes a couple of minutes. With the help of smart contracts, the process of preparing and signing the rental contract becomes almost fully automated. The only thing that the rental agent has to do is to select the right tenant in the system. After that, the smart contract will be automatically generated and sent to the tenant for signature. Hence, the process becomes less time-consuming, more efficient, and not prone to human errors. The costs of preparing one contract can decrease because the time and effort needed reduces drastically. The last step of the rental process in which the blockchain technology can assist is sending documents to other stakeholders. The owner can send the ownership deed and the rental agreement to the bank and municipality in the form of smart contracts. It will not affect the costs but will save the owner and other parties some time.

3.1 ADVICE

After conducting thorough research, I advise the real estate rental sector to implement the blockchain technology in the form of smart contracts into the process.

As was shown in the research, big Dutch banks are already working on adopting the blockchain into their core business. According to Mr. Holleman, a senior developer at Rabobank real estate finance, the real estate portal prototype meets a need of multiple stakeholders in the real estate ecosystem. The stored information can be traced back to the original data source, which is beneficial for all the involved parties. The Rabobank made a prototype in which, from the moment of origin, the information is recorded in a structured manner. With the help of a prototype, the landlord can digitalize and standardize information and easily share it with multiple third parties, instead of sending information multiple times to several parties. Working with the prototype can save all the involved parties much time, and therefore increase the efficiency. Another big bank ABN Amro was working on the application that allows users to exchange the housing-related data with the help of smart contracts. In this application, all the participants can interact with each other in a secure, efficient, verifiable, and transparent way.

The implementation of blockchain technology in the form of smart contracts meets the industry's need for more automation, efficiency, transparency, and diminishes the risk of human errors. The smart contracts eliminate the need for all concerned parties to verify the authenticity of the provided information because the blockchain guarantees it. The implementation of smart contracts significantly reduces the time needed for performing certain tasks in the rental process.

In order to successfully implement blockchain technology into the real estate market, it is essential that notary will use the smart contracts because this is the foundation for the rest of the process. The notary has to prepare the ownership deed and the mortgage deed in the form of smart contracts because the owner can use it further in the process, and it will save him time.

The owner can provide a smart ownership contract to the rental agent. It will save time while determining the monthly rent because there will be no need to validate the provided documents.

The background check process of a potential tenant will become easy and will not require much time because the blockchain guarantees the authenticity of the documents. The tenant will not be able to send falsified documents because it is impossible to forge records in the blockchain.

The process of preparing and signing the rental agreement will become almost entirely automated. The rental agent will only have to perform one manual task, which is selecting the right tenant in the system. Everything else will be done automatically with the help of a smart contract. Such innovation will significantly reduce the risk of human errors, increase efficiency, and reduce the time needed for performing this task.

The owner can share the required documents with the bank and municipality using smart contracts. It will be beneficial for all parties because less time is needed to perform the task.

It is crucial for all the parties involved in the rental process to use smart contracts. Otherwise, the desired level of efficiency, automation, and cost reduction will not be achieved.

CHAPTER 4

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4.1 APPENDICES

APPENDIX A – INTERVIEW PROTOCOL: STRUCTURED INTERVIEW

- Interview length: 30-40 minutes

Name of rental agency	
Name of interviewee	
Job title	
Province	

- Goal of the interview: Determine the current way of working by Dutch rental agencies. Identify possible inefficiencies they might encounter during the process of renting out a dwelling.

- Interview questions:

1. What is your role in the organization?
2. Can you describe the current process of renting out a property? (step by step)
3. What is your role in the process?
4. Which parties are involved? (f.e. banks, government, etc.)
5. Which kind of contracts and documents do you use?
6. Which steps does your housing association take, once a tenant agreed to rent a specific dwelling?
7. What supporting documents regarding a new tenant will need to be provided?
8. How much time does the whole process of renting out a house take?
9. Which problems within the process you are currently encountering?
10. Do you consider using new technology?
11. Where, in your opinion, can you save money?

- Closure: I would like to thank you for taking your time and participating in the interview. It was a pleasure to talk to you. Thank you for your answers and valuable information. Would you like to receive a transcript of our interview? If you wish, I am willing to send you a copy of the final report of my research. Once again, thank you for participation and your kind help.

APPENDIX B – INTERVIEW TRANSCRIPT (BMV MAKELAARS)

Name of rental agency	BMV Makelaars
Name of interviewee	Bas Bosman
Job title	Rental advisor
Province	Gelderland, Arnhem

1. What is your role in the organization?

The name of our organization is BMV Makelaars, we are selling and buying houses, renting out apartments, office space and shops in the mall. Our organization is pretty

big, in Arnhem we are the biggest agency. I am responsible for the department that is offering rental houses and apartments.

2. Can you describe the current process of renting out a property? (step by step)

I am working for about 40-50 companies (companies that are investing in houses and apartments), and all those companies ask for a slightly different approach. So for me there is no standard procedure for all the houses, but I will try to explain the most regular one.

At first, we are placing all the available houses on our website or funda.nl or pararius.nl. We are adding photos, videos, floor plans and description of the property. If a potential tenant would like to rent out one of our houses, he/she should reach out to us: send us an email or give us a call. After that, the potential tenant is going to receive an email from us with a detailed information about the procedure of renting a house, the terms and conditions and a list of required documents. Then it is up to a tenant to think about the house and to collect documents, like pay slips, landlord statements, copy of a passport, our own application form, etc.

And they need to apply for the house, they have to do it with a lot of financial documents. If they send all the documents to us, we will check them and if it is complete then we will invite the tenant for a viewing. When the candidate has seen the apartment and decided to take it, we send his documents to the owner of the property. Then it is up to the owner to decide whether he would want to rent out his house to the candidate. If the owner agrees to rent out the house, then our company is going to make a rental contract. Then we send it to the candidate and let him sign it. When the contract is signed we make an appointment for the check in (the day that a tenant gets his keys). When the check in is done we will make a report of that with a special form, with pictures of the apartment and send it to the owner and a tenant. So everybody will know in which state the tenant received the apartment.

3. Does the tenant have to collect and send out all the documents before the viewing? (additional question)

Yes, exactly. I am responsible for my department in our agency for 8 years already and only for the last 2 months with the Corona crisis I cannot arrange the viewings. Because usually we receive around 10-20 reactions on one apartment and before the Corona, I used to invite 10 candidates for the viewing just in 1 hour. But now I cannot do it anymore. Before the Corona crisis people first got a viewing and after the viewing they delivered all the required documents. But now because of the coronavirus I cannot arrange that. So now tenants have to send the documents first and then I will arrange the viewing. But when the Corona crisis is over I will go back to the normal procedure (you can see the apartment first and then send out the documents).

4. What is your role in the process?

I am responsible for everything that will happen. I am searching for new investment possibilities, for what they need to build, what is the rental price, how they need to make an apartment, what they need to add, finding new tenants, good rental contracts that fit every house. I am responsible for the whole procedure in our company.

5. Which parties are involved?

The parties that are involved: the owner and sometimes the property manager. I do not get in touch with the government myself because I am only responsible for making an advice for the investor (owner) and with that advice, the owner goes to the government. I am only helping the owner.

And if somebody wants to invest in the apartment, then I am preparing my advice on how they need to make the apartment, what is the amount of rent they can get for it and with that advice the investor goes to the bank to get his money.

6. Which kind of contract and documents do you use?

Most of the times (around 80%) we use ROZ model, sometimes the owner delivers to us his own rental contract.

7. What supporting documents regarding a new tenant will need to be provided?

Copy of a passport, copy of 2 recent bank slips with salary and address information, copy of last 2 pay slips (or retirement papers), copy of your permanent working contract, landlord statement and our application form (where a tenant tells a story about himself, explains why does he want to rent a house).

8. Which steps does your housing association take, once a tenant agreed to rent a specific dwelling?

Explained in question two.

9. How much time does the whole process of renting out a house take?

In my department there are 3 people in total, two of them are working full time and one is working part time. We rent out 350 housing units a year. So about one house a day.

10. Which problems within the process you are currently encountering?

Tenants are not always sending out the complete set of required documents that is stated in the email and it creates a delay.

11. Do you consider using new technology?

Yes we do, but we are not going to make the process fully automated because our clients value the opportunity to call and text us whenever they need to, because it creates the connection between client and a rental agent. We are a rental agency with clients who have an income above average, so we would like to provide the most convenient and pleasant service we can.

12. Where, in your opinion, can you save money?

Our system is already pretty efficient and cost saving so I cannot think of any flaws.

APPENDIX C – INTERVIEW TRANSCRIPT (SNELDER ZIJLSTRA MAKELAARS)

Name of rental agency	Snelder Zijlstra Makelaars
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Name of interviewee	Melissa Kuiphuis
Job title	Rental advisor
Province	Overijssel, Enschede

1. What is your role in the organization?

We have a department that rents out houses and I am the only person in the department. I am doing everything within the process, from making pictures of the apartment to giving the keys to a tenant. I am also the in between person for bigger companies like “Domain” or “De woonplaats”.

2. Can you describe the current process of renting out a property?

When we place a house ad online we get a lot of reactions and I try to be honest with our clients about what is possible. So the first person who reacts on the ad gets an opportunity for a viewing. At first, we are asking on the phone what their income is, do they have a permit contract, are they going to live alone or with somebody. And a lot of people are dropping out because they don’t read the text carefully in the advertisement (for example students call us, but we do not rent to students). When we had a good conversation over the phone and I have a positive feeling about a potential tenant then we schedule a viewing. After the viewing, if a tenant is interested in renting that apartment out, he can let me know by email and then we send to them our request form. The tenant needs to fill in the request form and also send us some documents like copy of passport, an employee statement, three most recent pay slips, three most recent bank account statements (so we can verify that the pay slips and the bank account statements coincide), the landlord statement in case they are currently renting out an apartment. All the documents provided by a tenant are going to be sent out to the owner of the property, and then he needs to give his approval. Afterwards, our agency is going to prepare a rental contract, which needs to be signed. Then we are making an appointment to deliver the keys to the tenant. We are also making pictures of every room in the apartment, writing down the numbers that the electric meter displays. So in case the tenant brakes anything while living in the apartment he cannot blame it on somebody else since we have proof of how the property looked when the tenant moved in. That is the last step in which we are involved. In case tenant is experiencing any maintenance or financial problems, he should ask the owner for help.

3. What is your role in the process?

I am doing everything by myself. Therefore, I am involved in each step of the process.

4. Which parties are involved? (f.e. government, banks)

We only report to the landlord himself. We are sending our tenants to the government to take their BSN number and to the bank to take their bank statements.

5. Which kind of contracts and documents do you use?

We use the ROZ contract in all the cases.

6. Which steps does your housing association take, once a tenant agreed to rent a specific dwelling?

Like I mentioned before, we are asking for all the documents like copy of a passport, employee statement, landlord statement, bank statement, last three pay slips and our application form. If it looks good, we send it to the landlord for his approval. After that, we are preparing a rental contract and let both parties sign it. And the last step is handing over the keys.

7. What supporting documents regarding a new tenant will need to be provided?

Our own application form in which the tenant has to fill in his name, address, phone number, email, birthday date, etc., the employee statement, three salary slips, copy of a passport, BSN number, landlord statement, bank statement and the BRP.

8. How much time does the whole process of renting out a house take?

We can do it in one day if a client would like to rent very fast. But most of the time it will take around 5 days to get all the documents ready.

9. Which problems within the process are you currently encountering?

Sometimes people are trying to falsify the documents. For example, one man made an employee statement himself in excel and thought that it would work out, and we will not notice it. We have to check very thoroughly whether all the provided documents are legit. Sometimes people do not send us all the required documents in one time, and therefore the whole process is taking longer because we have to send them an additional email asking to send us a complete set of required documents.

10. Did you consider using a new technology?

Yes we did, and we did a step back from it. We had an online platform where people can upload their documents by themselves, so they did not have to send it to our email. For our tenants it was very easy, but for us it created additional difficulties. We did not have an opportunity to download our tenants' documents because of the privacy policy. I had to screenshot all the documents page by page and after that had to send it to the landlord. It was taking so much time that we decided to go back to our old way of working.

11. What was the name of the platform you used? (additional question)

It does not exist anymore, but the name was "QII".

12. Where, in your opinion, can you save money?

We do not spend a lot of money. For example, when we place an ad about the house online the landlord pays for the advertisement.

APPENDIX D – INTERVIEW TRANSCRIPT (REAL ESTATE OWNER/INVESTOR)

Name of rental agency	Owner of a company that rents out and renovates apartments and commercial property
Name of interviewee	Aloys Bruggeman
Job title	Real estate owner/investor
Province	Zuid-Holland, Rotterdam

1. What is your role in the organization?

I am an owner of the company that rents out and renovates apartments and commercial property. I do not employ anyone, but I have a team of self-employed staff. I sourced out most of the building work, and all of the rentals I do myself.

2. How many housing units do you own?

Not that many, around 25. These are single-standing houses, a few apartments, restaurants and office buildings.

3. Can you describe the current process of renting out a property?

First, I have to evaluate the market value. To do so, I have to look at other properties, at similar houses, at what I have rented out, at what the competitors are renting out. I am making an evaluation, and I look at the threshold for social housing in the Netherlands because most of my houses are below the threshold. Based on that, I determine how much I can ask for an apartment.

The next step is to have good pictures. I have my professional camera equipment and go to the houses to take pictures, the hardest part is to photograph the toilet because it is small, but I have a special lens for that. Then I make pictures of the whole house and edit them in the particular app.

After that, I go to several websites like directwonen.nl or huurwoningen.nl. I advertise the houses on the Internet, and I get many emails from potential tenants. I have to make sure that those people are not criminals who want to rent the house to produce drugs. Therefore, I have to ask them a few questions to find out what kind of people they are and whether they have a steady job. This takes a lot of time to investigate. First, I am asking whether they have a job and what their income is; after those questions, at least 40% of people do not email me back. Then I have a few people who do email me back, but many people lie. For example, they do not have jobs, or they do not have an income, or they got fired recently, but they just want to look at the house.

Therefore, the next step is to do a background check. I rent out a house in Amsterdam, which is very expensive, and I get many crooks who lie to me. The last one had 20 companies on his name that went bankrupt and all the documents that he showed me were falsified. Hence, I have to do a thorough background check and it takes the most time. It might take me from 3 to 4 hours of plain work to do a good background check. Next, I have to scan all the documents from a tenant and have them AVG proved (those are Dutch privacy laws). Once I collect all the data, I can make a rental contract. The contract is a word file, I fill it in, then I send it to a tenant, they send it back and what I do usually is I go there to have it signed, or I have a lady who works for me who can go there to have it signed. When the contract is signed, I have to scan it and save it on my computer.

4. What is your role in the process?

I do everything involved with the financial and rental side. I do everything except for maintenance.

5. Which parties are involved? (f.e. banks, government)

Banks are involved, and sometimes the government is involved. I have to have all the documents for the banks because if I want to apply for the new loan, I have to supply the bank with all the rental contracts once a year. If they ask me, I have to provide it annually. So I have this digital file that I send to them with all the documents. So this is also separate bookkeeping I have to do.

Another party is the government. If you rent to a migrant worker, sometimes the municipality comes and checks because people do not like people from other countries and are complaining. The government then comes to check how many people are living in the house, if every inhabitant is registered.

Sometimes the insurance company wants to have a contract. They would like to know the purpose of the house (is it a normal family house, is it a shared house with individual contracts, is it a commercial property and what kind of commercial property).

The owners' committee can also ask for the documents.

So I have to supply all these documents to different parties.

6. Which kind of contracts and documents do you use?

I use the ROZ contracts. If you want to use different contracts, you have to have a lawyer who will check whether it meets the Dutch laws.

7. Which steps does your housing association take, once a tenant agreed to rent a specific dwelling?

We discussed it already, the tenant has to send copy of a passport or an ID, working contract, salary slips for the last three months, current address, telephone number, email and some credentials.

8. How much time does the whole process of renting out a house take?

It can take a day but it can also take a month. After the viewing, it usually takes a week. It could take at least 16 hours of real working time.

9. Which problems within the process you are currently encountering?

Sometimes the problem is to get documents in a readable format. For me, organizing all the digital files takes quite a long time. Because you have to scan them, make sure that it is in a good, readable format, and then you have to put them into files. Sometimes those documents are written in language I do not understand. So this is the biggest problem. The background documents check are also taking a long time, because if somebody sends me something, I have to check whether it is falsified. It does happen, as I told you. So sometimes, I have to establish the existence of contracts.

10. Do you consider using a new technology?

Yes, I use it. I use document imaging; it is reasonably new. There is a software for signing a contract digitally, I have thought of using this, but I did not use it that often because I noticed that my tenants are not so good at using this software.

I tried to make small films, I have good filming equipment and I montage those films so that people can look at the house and already have an idea of how the house looks like before they come for the viewing. This helps to screen many people already.

11. Where, in your opinion, can you save costs?

I would like to expand my business, and if I want to do that, there will come the time when I will have to hire someone. And I don't want to have somebody at my office who does all the work because it would cost me at least 800 euros a month. I think that it is a lot of money, so I only hire people who deliver the keys to the tenants, so I do not have to physically go there.

I could save even more time with the smart contracts.

I would like to make a background check process a bit faster. Because if three people are coming, I do three background checks sometimes. Since you want to have a bit of certainty about who is the best tenant because tenants quite often lie to you and I want to know who is telling the truth, what is a good story. So I have to do this process quite often.

Digital contracts can be signed digitally and stored digitally. The process of scanning files and putting them in a binder is extremely time-consuming, and I would like to save time here.

It takes a lot of time to make one contract, and you have to do the same job repeatedly, which is not handy.

APPENDIX E – INTERVIEW TRANSCRIPT (TWENTS VAST)

Name of rental agency	Twents Vast
Name of interviewee	Anne Timmerhuis
Job title	Rental advisor
Province	Overijssel, Enschede

1. What is your role in the organization?

We are a small company of only two people. We both are responsible for all kind of work at the company. We are responsible for check-in and checkout of the tenant, arrangement of viewings, preparation of documents like rental agreements, etc., arranging a repairperson, buying and selling houses, so all kind of work.

2. Have many housing units does your housing association have?

Something around 300 units. We rent rooms, studios, houses and apartments.

3. Can you describe the current process of renting out a property? (step by step)

At first, people call or email us. We ask what they are looking for, for which period they would like to rent, whether they have pets (because we do not allow pets), whether they are working or studying, what their monthly income is, etc.

After the conversation, they have to fill in the application form and send it by email.

Next, we show our clients the available options and help them find something suitable for them. When the client chose an apartment he liked, we are arranging a viewing. In

case a tenant is not in the Netherlands and cannot attend the viewing, we can book an apartment for him via email.

After viewing, if a tenant agreed to rent it out, we prepare a rental contract, which can be signed in our office or by email. Once the contract is signed, a tenant has to pay the deposit within seven days, and on the day of check-in, he has to pay the rest of the money (monthly rent) by bank transfer or in cash.

During the check-in, together with a tenant, we are checking how clean the house is, and whether the inventory list is complete. In case a tenant needs to connect gas, electricity, water, etc., we can help him with it.

We are renting out furnished and unfurnished accommodations. Most of our clients are international workers and students.

4. What is your role in the process?

I am involved in each step of the process. In case our clients have any problems with maintenance of the property, they can call or email us for help.

5. Which parties are involved? (f.e. banks, government, etc.)

We are renting out houses from our own company and from other people who own the property and would like to rent it out but do not want to do the work themselves (so we rent out houses on their behalf), for dwellings that our company owns we have a mortgage.

6. Which kind of contracts and documents do you use?

We use ROZ contracts together with general provisions. The Dutch law obliges this. We also have some house rules and cleaning tips for our tenants.

7. Which steps does your housing association take, once a tenant agreed to rent a specific dwelling?

They need to send us documents like: copy of an ID or passport, working contract, salary slips for the last three months, current address, telephone number and an email address, student card if they are students. We check the documents to make sure that they are valid.

8. What supporting documents regarding a new tenant will need to be provided?

Answered in question number seven.

9. How much time does the whole process of renting out a house take?

It can be fast. Depends on how fast we communicate by email. If it is necessary, it can be done in one day.

10. Which problems within the process you are currently encountering?

Due to the Corona crisis, some people were moving back to their home countries. Some of our apartments became available at the time of the year when there are not that many people searching for new houses.

11. Do you consider using new technology?

Yes, we are always looking for a way to do things faster and easier.

12. Where, in your opinion, can you save money?

At the moment I do not know because we always try to save money.

APPENDIX F – DECLARATION OF PERSONAL WORK



Saxion
Academic Finance, Business &
Management

Declaration of personal work

Undersigned student(s):

Name student/ Names of students:

Lizunova Yelyzaveta.....
.....
.....
.....

Declare(s) without any doubt that,

- 1) The following report is his/her own work and that he/she did not invade the copyright of another individual.
- 2) All resources used are provided with the proper acknowledgements, according to APA guidelines.

Course: International Finance and Accounting

Project/ Assignment: Research and Advisory Report

Year of studies: 2015-2020

Place: Enschede, Netherlands

Date: 27th of June 2020

Signature/ Signatures:

[Signature].....
.....
.....
.....

N.B. Violation of this "Own work declaration" becomes an irregularity considered as referred to in Article 19 of the EER.

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