Blockchain Adoption is an Evolution – not a Revolution:
Advantages and Challenges of Blockchain in Real Estate Transaction in Sweden

LUDWIG DJURSÉN AND THEO BJÖRK
**Master of Science thesis**

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Abstract
The real estate sector has a large impact on the economy and a significant impact on financial market stability. Several unique features characterize the real estate market assets; these are stable cash flow, a stable demand, and low volatility, contributing to the underlying value. However, the industry is considered illiquid due to a lack of transparency, information asymmetry, and difficulty in quickly executing a trade. Tokenization, smart contracts, and digital identities are some of the applications of blockchain, which are regarded to be one revolutionary technology that has the potential to change the real estate market. However, it is not clear how these technologies would impact real estate transaction processes in the future.

Previous research has looked at the blockchain as a financial tool and how it connects to real estate as a legal instrument and a transaction market application to improve transparency and liquidity. However, the previous research has not considered the main risks and challenges with a blockchain adoption in the Swedish residential real estate market. Therefore, this thesis looks at how blockchain technology can be used in the residential real estate sector. The dissertation has been answered through a structured qualitative study with an inductive approach. The empirics has been gathered through a literature study, semi-structured interviews, and a document analysis.

The results illustrate that blockchain can be useful in residential real estate transaction procedures through tokenization, storing ledger, and digital identities. Through our analysis, we could conclude that to adopt blockchain, the industry must take small steps in the direction that the digital evolution wishes to go. It is not possible to drastically implement blockchain in the residential real estate market, rather a successive transaction with the help of innovations and new regulations from the authorities.

The ability to store and validate data has been a primary rationale for using the technology as the industry adjusts to conventional analog business processes that are becoming increasingly digital. Despite that many view blockchain as a technology that quickly disrupts real estate transaction processes, we conclude that blockchain innovation instead progresses incrementally due to many challenges and risks associated with the technology and the industry’s conservative nature. The research contributes to a better understanding of blockchain technology and its possibilities and challenges in the real estate industry.
Acknowledgment

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First and foremost, we would like to thank our supervisor Olli Vigren for guidance and feedback. We also want to show appreciation to the Royal Institute of Technology and our classmates for these five years of education. Finally, we want to thank our friends and family, who have been an encouraging source during our studies.

Stockholm, June 10th, 2022

Ludwig Djursén & Theo Björk
**Examensarbete**

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<td>Blockchain, fastigheter, transaktion, informationsasymmetri, blockchain-implementering, bostadsfastigheter, smart kontrakt, tokenisering</td>
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Sammanfattning


Resultaten illustrerar att blockchain kan användas i bostadsfastighetstransaktioner genom tokenisering, lagring av reskontra och digitala identiteter. Genom vår analys kunde vi dra slutsatsen att en adoption av blockchain måste ta små steg i den riktning som den digerliga utvecklingen vill gå. Det är inte möjligt att drastiskt implementera blockchain på bostadsfastighetsmarknaden, snarare en successiv övergång med hjälp av nya innovationer och nya regleringar från myndigheterna.

Möjligheten att lagra och validera data har varit en primär motivering för att använda tekniken när branschen anpassar sig till det faktum att konventionella analoga affärsprocesser blir allt mer digitala. Trots att många ser blockchain som en teknik som revolutionerar fastighetstransaktionsprocesser, drar vi slutsatsen att blockchain-innovationen snarare bör implementeras stegvis. Detta beror på många utmaningar och risker förknippade med tekniken, samt på grund av branschens konservativa karaktär. Forskningen bidrar till en bättre förståelse av blockkedjeteknologin, samt dess möjligheter och utmaningar inom fastighetsbranschen.
Förord


 Först och främst vill vi tacka vår handledare Olli Vigren för vägledning och feedback. Vi vill också visa uppskattning till Kungliga Tekniska Högskolan och våra klasskamrater för dessa fem år av utbildning. Slutligen vill vi tacka våra vänner och familj som har varit en uppmuntrande källa under mina studier.

Stockholm den 10 juni 2022

Ludwig Djursén & Theo Björk
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1 Introduction

This thesis aims to analyze the potential advantages and disadvantages of blockchain in residential real estate transaction processes. It will be analyzed both from the perspective of a property owner and the potential buyer. Furthermore, the aim is to establish the challenges and the overheads of this implementation and what otherwise time-consuming and costly activities could be improved.

1.1 Background

Blockchain technology has frequently made the news, both positive and negative. Bitcoin and Ethereum are two cryptocurrencies that use blockchain as a core technology in their operation (Vasquez, 2021). However, today blockchain technology is used in other markets than just cryptocurrencies, such as supply chains and logistics, banking, and financial institutions (Marr, 2018). The tech companies IBM, Amazon, Google, and Facebook hope that blockchain will be even further popular and valuable. In 2019 the organizations anticipated investing around $2,9B in the technology (CBInsights, 2021). Blockchain technology is used to store data reliably because of blockchain’s enhanced security, greater transparency, and instant traceability (IBM, 2021).

The real estate market is known as a slow-moving market relating to digitalization. However, the development of innovation and the digitalization pattern have expanded quickly throughout the recent years, including new technology within the real estate sector (Baum, 2017; Vigren, et al., 2022). This could mean that we are moving towards a faster digitalization in the real estate market. One of the many reasons the real estate market has a slower digitalization compared to other sectors is that there is a gap in research and literature writing on the most proficient method to manage changes because of the quick advancement of digitalization (Baum, 2017). This is one of the reasons why it is important to research new possible technologies and provide knowledge and information.

The residential real estate market demand is founded on individuals and companies that want to use areas and premises for particular purposes. The demand significantly impacts the timeframe for premises to be sold (Novy-Marx, 2009). The real estate market is thus characterized by a partial unwanted inefficiency caused by traditional and conservative processes. The procedure of selling a property is a long and complicated process, both for the seller and the buyer. The information asymmetry between the buyer and seller often needs to
be sorted out with a due diligence process, which is a time-consuming and costly procedure for both parties (Gustafsson & Hult, 2019).

1.2 Problematization

Blockchain is a technology on its uprising in many sectors of society and is thus vital for investors and developers (Bronckers, 2021). The technology has its foundation within the bitcoin cryptocurrency and has allowed innovations and solutions to thrive. However, on the other hand, many complications arise in the technology's different implementation and development processes. The implementation has worked out in some sectors, such as cryptocurrencies, finance, and banking. On the other hand, the performances in other sectors, such as digital voting, face a far more challenging implementation in terms of cost, time, and conducting a piece of working digital machinery. This is also the case within the real estate sector in Sweden.

The Swedish real estate sector is struggling behind in implementing a digitalization with blockchain technology compared to other sectors in Swedish society. Furthermore, the problematization and challenges related to blockchain adoption in the real estate sector are not distinctly defined and, therefore, hard to solve. Blockchain has the potential to integrate the real estate sector into a future digitalization. However, it is still unknown to what extent blockchain could improve the transaction process in the market. The literature presented in this thesis indicates a lack of research on the challenges in implementing the technology in the sector. This results in two gaps onto which this thesis aims to target. Firstly, what is the potential of blockchain technology to improve the efficiency of the residential real estate transactions process. To examine the potential of blockchain in the transactions process, it is suitable to state the current phases of a residential real estate transaction process in Sweden. Secondly, the implementation of blockchain has challenges and risks. What are the main risks and challenges of implementing blockchain, and what should developers and investors be prepared for?
1.3 Research questions

The study aims to analyze three sections: the current transaction process, what parts of the process could improve the efficiency in the residential real estate market, and the risks and challenges of this implementation. In addition, it features the impact of blockchain technology in the real estate transaction process with all the overheads, challenges, and advantages. The aim is achieved by answering the following research questions:

RQ1: What are the residential real estate transaction process phases in the Swedish real estate market?

RQ2: What is the potential of blockchain technology to improve the efficiency in the residential real estate transactions process?

RQ3: What are risks and challenges with implementing blockchain technology in real estate transaction processes?

1.4 Research design

This thesis will be conducted in Sweden, where most of the information, interviews, and document analysis will address the Swedish real estate market. The market in other parts of the world is covered by other frameworks that can be separated from the Swedish market, which will not be discussed or compared in this thesis. The real estate sector in Sweden is divided into several submarkets that have different frameworks. To decrease the possibility of the thesis being too general, the thesis is restricted to residential real estate transactions. The aim of the study is to investigate the possibilities for an implementation of blockchain technology in the Swedish real estate sector. The information gathered through a document analysis focuses on existing risks and challenges of an implementation of this sort. Furthermore, through interviews with a property owner and a blockchain-expert, new risks and challenges can be established for the market participants and stakeholders. This thesis will not consider laws and regulations, and these obstacles are left for future research.

Blockchain and its implementation in different sectors are still relatively new, which is why there is a lack of academic research in the area that is substantial for this thesis. Thus, it may be web-based news articles covering ongoing blockchain projects in this thesis to develop a nuanced picture of the ongoing development in the area.
1.5 Definitions and explanations

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<th>Definition</th>
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<td>DD:</td>
<td>Due diligence</td>
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<td>MLS:</td>
<td>Multi listing services</td>
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<td>DLT:</td>
<td>Distributed ledger technology</td>
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<td>IoT:</td>
<td>Internet of Things</td>
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<td>ECDSA:</td>
<td>Elliptic Curve Digital Signature Algorithm</td>
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<td>UTXO:</td>
<td>Unspent Transaction Output</td>
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<td>CAGR:</td>
<td>Compound Annual Growth Rate</td>
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<td>Information memorandum:</td>
<td>A document produced prior to selling your business and essentially functions as an opening pitch to any prospective buyers</td>
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<td>Indicative bid:</td>
<td>Initial bid a potential buyer gives for a property</td>
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<td>Covid-19:</td>
<td>Global pandemic due to coronavirus</td>
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<td>Rights in rem:</td>
<td>A right which rests on an object or good</td>
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1.6 Structure

**Chapter 1: Introduction**

The first chapter introduces the subject that narrows down the research gap this thesis wishes to answer.

**Chapter 2: Literature review**

This chapter provides general information about the real estate market in Sweden. Furthermore, a summarized transaction process and the due diligence process are shown. This is followed by an in-depth study of blockchain, where blocks, the current use of blockchain, and smart contracts are in focus.

**Chapter 3: Theoretical framework**

This chapter will present the theoretical framework on which the master thesis has been based. Firstly, a framework for blockchain adoption will be presented to show how and with what difficulty a new technology can be established within a specific field. Subsequently, the two theories, the Hype Cycle, and the Transaction costs theory, will be presented.

**Chapter 4: Method**

This chapter will describe the methodology used in this thesis. The section will also explain why these methods have been chosen and how the data has been collected.

**Chapter 5: Results**

This chapter presents the answers obtained in interviews with real estate owners and experts within the field and the document analysis.

**Chapter 6: Discussion**

In this chapter, the literature study, the results from the interviews, and the document analysis are being analyzed and discussed.

**Chapter 7: Conclusion**

In the last chapter, the research questions are answered through a conclusion of the result and the discussion.
2 Literature review

This chapter provides general information about the real estate market in Sweden. Furthermore, a summarized transaction process and the due diligence process are shown. This is followed by an in-depth study of blockchain, where blocks, the current use of blockchain, and smart contracts are in focus.

2.1 General information about the real estate market

The real estate market can be divided into two main segments: housing and commercial properties. Housing properties include properties owned by owner-occupied apartments and residential apartments that can, in turn, be divided into rental apartments and housing condominiums. Commercial properties accommodate offices, stores, warehousing, logistics, and industrial premises. That includes the segment of public service properties, such as hospitals, schools, and care. Properties that generate income have a landlord as an owner or capital investor, internal or external assets, and property managers who handle the balance sheet and the income statement, respectively (Runestam & Wiksell, 2018).

The most significant individual motive to invest in properties is to reach the highest possible return on a given risk. The risk depends on the investor’s capital, experience, and preference, leading to different investment strategies. Some choose to invest in commercial real estate, while some prefer residential properties. The yield is generally lower for residential properties than for commercial real estate. The reason is that the rent level and vacancy rate fluctuate less for homes than for premises, which means a lower risk for the property owner (Field, 1997). Thus, investors focusing on minimizing the risk often choose to invest in residential properties. The yield is relatively low, although these investments are stable with few fluctuations, which is attractive in times of recession (Geltner, et al., 2007).

2.2 Current transaction process

Regarding real estate transactions, the process differs depending on the segment in which the acquisition is made and on who the buyer and seller are. The process depends on the number of properties and whether the transfer takes place through a third-party company. Below is a table of an overview of the transaction process.
**Table 1. An overview of the transactions process** (Devaney & Scofield, 2015; Gustafsson & Palm, 2018)

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<td>The first step consists of a decision to sell a property. This is followed by collecting data used for marketing via the production and distribution of prospectuses. A confidentiality agreement is often signed between parties that regulates the dissemination of the information.</td>
<td>In the second step, all interested buyers are invited to present an indicative bid to the buyer. The bids form the basis for the seller's decision on which buyers could take a closer look at the property. The indicative commandments that are made are often not legally binding.</td>
<td>In the third step, the seller has selected which prospective buyers to continue the process with. The buyer then has access to detailed information about the property and/or the property-owning company and is asked to review it.</td>
<td>In the last step, negotiations begin on the design of the transfer agreement and discussions on the price. The seller can then decide on a deduction from the price if new information from the due diligence process highlights risks to the buyer.</td>
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2.2.1 Research and marketing

The first step occurs before the actual transaction process and is often an internal process. In this step, the property manager or the property owners chooses whether they want to sell their property. If that is the case, then a data collection phase is implemented to create a complete overview of the property to be sold (Hordijk & Teuben, 2008). The more information gathered in this phase, the less work is required later in the due diligence phase. When this is done, a real estate consultant or a broker is hired to assist in the next steps of the transaction process. The last part of the preparation period is gathering market information to assess the property value and marketability (Hordijk & Teuben, 2008). Furthermore, lawyers are instructed to identify legal obstacles and other property-specific factors that should be addressed before marketing. This phase is estimated to take one to two weeks to complete (Crosby & McAllister,
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2.2.2 Indicative bid

The next step in the sales procedure is the arrangement of bidding to find a potential buyer. The bidding process could be structured or unstructured (Crosby & McAllister, 2004). A structured process allows a certain number of potential buyers to make an offer within a specific timeframe. An unstructured process means that the seller identifies a potential buyer and negotiates directly with that potential buyer. Regardless of which process is chosen, a confidentiality agreement is signed by both parties. The confidentiality agreement regulates who gets access to the information, how it should be handled, and that the ongoing deal information does not be disseminated to the public (Gustafsson & Palm, 2018). The bidding process is estimated to take three to four weeks (Crosby & McAllister, 2004).

2.2.3 Due diligence

During the process of acquiring assets such as real estate, due diligence is a successful method of evaluating the property and its underlying assets. This is done to reduce the risk of mistakes in the acquisition (Pettersson & Sjöberg, 2016). Due diligence helps gather information and knowledge about the property in a potential acquisition, which requires the management’s strategic design. Furthermore, due diligence is then used to support the decision making whether an acquisition should be completed (Pettersson & Sjöberg, 2016). Different kinds of due diligence are made to illuminate the property in several aspects. Technical, legal, feasible,
financial, fiscal, and commercial. The due diligence can be divided into different stages, as described underneath.

2.2.3.1 Phase 1

The acquire establishes their expectations about the acquisition. For example, are they about to exploit the property? Is there a problem if there are high vacancies? It is important to establish these grounds before the due diligence can start, to be able to focus on specific areas, if desired (Larsson, et al., 2017).

2.2.3.2 Phase 2

The second phase includes the gathering of information which is divided into two parts. The first part is where the seller should provide the information that the buyer require. It is relatively standardized that the purchaser makes a list of what is demanded. Furthermore, it is common that parties write a letter of intent where the seller assures the purchaser not to negotiate with other potential buyers during the due diligent process. Since the due diligence process can be very costly, the parties agree on an indicative bid in the letter of intent and include that all the information transferred during the process remains confidential (Gustafsson & Palm, 2018). This is particularly important if no transfer agreement is reached. Furthermore, the involved parties in the due diligence, list questions in a questionnaire associated with the analysis and review phase. The questionnaire is handed over to the seller, who submits a written answer to the questions. This is important since the parties can get answers to questions that otherwise might not be involved, or if there are ambiguities in the written material. The gathering of information is thorough and sets the basis for due diligence. Lastly, when the information is requested in agreement with the questionnaire, it is customary that the seller states if there is any lack of information or if something is irrelevant.

The second part of the information-gathering phase, which is more described in phase 3, is that the buyer himself gathers information that is publicly added. For example, a property certificate from Lantmäteriet or information regarding the detailed plan from the commune.

2.2.3.3 Phase 3

The third phase includes analyzing the information that is gathered from the due diligence process. All the information that is available through phase 2 from the seller as well as from the publicly published information gets analyzed and condensed. This phase sometimes includes an interview or a presentation of the seller’s trustee and/or the management regarding the property (Larsson, et al., 2017).
2.2.3.4 Phase 4

In the fourth phase, the result of the analytic phase gets compiled in a due diligence report. A due diligence report can look different but usually contains (i) descriptive sections (ii) analytical sections (iii) sections containing deviations (that is, deviations from normal legal conditions), and (iv) sections with recommendations regarding deviations that exist. Furthermore, the report can include other sections, such as a section that accounts for missing information that may be significant (Gustafsson & Palm, 2018).

2.2.4 Contract negotiation

After extensive due diligence, there is an option for the buyer to negotiate the purchase price since the starting price may not reflect the property in question. When the price is set and both parties have signed the transfer, the acquisition is completed (Gustafsson & Palm, 2018).

2.3 Previous research on Blockchain

The concept of blockchain was coined in 2008 with the implementation of Bitcoin when the question occurred about how to make a transaction between two actors without having a middle hand. This was made possible by Satoshi Nakamoto, who developed the first blockchain-based database and then was active in the development of Bitcoin (Nakamoto, 2008). Bitcoin is a digital currency that, with the help of blockchain, enables the coins to only be purchased once, which has been a problem with previous digital currencies. Furthermore, this allows buyers and sellers to be anonymous (Heilman, et al., 2016). The system starts with a genesis block, which is the first block on which each transaction is based. Every block is unique, and when a transaction is made, the new owner digitally signs a hash and the public key, which is verified by the previous owner (Nakamoto, 2008).

Blockchain technology has since then been utilized in several different fields, such as in healthcare (Xia, et al., 2017), the IoT (Novo, 2018), smart cities (Sun, et al., 2016), and a variety of other fields. There has been a lot of research on the potential to streamline the logistics and transport sector (Francisco & Swanson, 2018), drug development (Nugent, et al., 2016), grocery trade (Yiannas, 2018), political choices (Moura & Gomes, 2017), and the banking sector (Cocco, et al., 2017).

In later years there has been a high interest in implementing blockchain technology in the real estate market within numerous application areas. This includes investigating the potential for efficiency in municipal exploration activities (Abrahamsén & Westerberg, 2020). Using a
qualitative research approach with theories like information asymmetry and principal-agent, they concluded that blockchain technology would improve the process of exploration. Still, it would be expensive, and the legal complications that needs to be established for this to work properly are extensive.

Furthermore, the implementation of blockchain technology in the real estate sector comes with many setbacks and challenges. First and foremost, the real estate market is inefficient due to information asymmetry, transparency problems, personal bias, high transaction costs, and slow transaction processes (Shiller, 2014). In a constantly changing market in demand and supply and innovations, it is hard for companies to adapt (Corluka & Lindh, 2017). Although, there are still huge management and implementation challenges related to the subject. Earlier studies state that verification of the identity of the involved parties, control of the legality and effectiveness of the contract (Garcia-Teruel, 2019; Wouda & Opdenakker, 2019), co-ownership and other rights in rem, and the possibility of amending the blockchain are some challenges with implementing blockchain in the real estate market transactions (Garcia-Teruel, 2019). In the process of digitalizing the real estate market, the main question arises on how this is made possible and the main challenges that society faces.

However, previous research has not studied the implementation of how blockchain technology would improve or impede the residential transaction process in Sweden. Furthermore, earlier research does not state the challenges with the implementation of blockchain regarding cost, time, and knowledge. These knowledge gaps are what this thesis aims to answer.

2.4 Blockchain as a technology

Blockchain is a radical new way of digitally handling and storing ledgers. It is based on old systems and was first introduced by Satoshi Nakamoto in 2008. Satoshi made known the digital currency Bitcoin, the first application of blockchain (Cong & He, 2018). In the paper, he introduced the fully digital currency within a technology that did not require any middle hand and where the actors could be anonymous (Nakamoto, 2008).

The old technology is based on systems often related to cryptography, distributed databases, and consensus mechanisms (Jonsson, 2018). In the improved blockchain each block can contain information about ownership rights, medical records, certificates, currencies, identities, transactions, or anything that the applied context requires or desires. Blockchain is built on a distributed ledger technology (DLT), which has made it interesting for financial industries and the academic world. DLT got a lot of attention since it was a handy tool for trading
cryptocurrencies because the technology uses a peer-to-peer system rather than having a trusted third party (Masiak, et al., 2019). Ever since the technology was revealed, many actors in the financial industry have been exploring whether the DLT technology could be applied in the security market. If this technique were used, the market efficiency would improve manifold compared to today’s usage of lodgers in a traditional double-entry bookkeeping way (Priem, 2020).

Even though blockchain is a newly introduced technology, there has been a lot of research and discussion surrounding it from long ago (Yacob, 2021). Many peer-review publications have analyzed the financial approach of blockchain and how it relates to real estate transactions and legal instruments. In addition, it is important for investors and involved actors to see blockchain as an innovation rather than a trend because of the technology’s large potential (Saiz, 2020).

2.4.1 Blocks

A blockchain has its foundation in a chain structure containing blocks. Each block electronically stores information about its current use. The chain starts with a genesis block onto which every block is linked through a hash (Kehrl, 2017). The hash is a code created by a mathematical function that turns information into a string of numbers and letters. Each block has its own hash and stores information about the previous blocks’ hash. When a transaction is made, it is added to the end of the chain, called a ledger. This ledger is shared among all the users. This makes it impossible to transfer more than the specific user owns since every user has a ledger copy. Those who are validating the transactions are called miners.

2.4.1.1 The transaction processes

The first technology that applied blockchain is bitcoin. The transaction process with bitcoin is based on verifications from users that are not involved in the transaction instead of having a third party that verifies the transaction. Every user has two keys, one public key that is shared publicly and is used to allow bitcoin to be locked and received, and one private key that is used as a unique signature that allows bitcoin to be unlocked and sent (Simplilearn, 2019). Following is an example to illustrate how the transaction process works.

Phil wants to send Jack 2 bitcoins. Firstly, he passes the number of bitcoins he wants to send to Jack along with his and Jack's unique wallet address through a hashing algorithm. This is part of the transaction details, which are encrypted using encrypted algorithms and using Phil's private key. This is done by digitally signing the transaction and indicating that the transaction came from Phil. This output is then transmitted throughout the globe using Jack's public key.
Through this, the transaction can be decrypted only using Jack's private key (Simplilearn, 2019).

![Diagram of bitcoin transaction between Phil and Jack](image)

*Figure 1: Illustration of the bitcoin transaction between Phil and Jack* (Simplilearn, 2019).

### 2.4.1.2 Security

For blockchain to maintain a secure and private application, it uses cryptography. The procedure uses encryption to turn the plaintext into ciphertext, the opposite transformation called decryption, which turns ciphertext into plaintext (Sun, et al., 2016). Bitcoin itself does not use encryption because it is an open distributed database. Although, some Bitcoin services and Bitcoin wallets use encryption schemes to remain secret and private. Furthermore, in cryptography, there are hash functions that take any data as input and produce an encrypted output called hash or digest (NMLS, 2021). Hash functions come in many different formats, making them very useful in various fields. The input in a hash function can vary, but the output is always in a certain length, which is specific for each hash function. The hash-functions output is random but always gives the same results if the same input is given (Sun, et al., 2016). But, with the slightest change in the input, the output will change completely.

Adding to the security is the digital signature that needs to be made by both the sender and the receiver. This digital signature is made in three parts, the data being signed, the public key of the signature, and the signature itself. The data could be anything from an image to a contract, and a public key is a form of identity that tells the public that the owner of the corresponding private key has signed this message. Lastly, the signature confirms that the owner of the public key and the corresponding private key signed the same provided data. The system is safe because the signature requires the private key to be created but not to verify it. Anyone can confirm that the signature corresponds to the data provided using only the public key, the signature, and the message. Digital signatures are mostly used in signing contracts or sending bitcoins.
Bitcoin uses a public signature algorithm called ECDSA, which allows a private key to sign any type of message. A piece of a bitcoin, called UTXOs, can be sent to the public key, only the owner with a corresponding private key can unlock it (NMLS, 2021). When a signature is made and published, members of the Bitcoin network can verify the signature, the public key, and the message so that they match, thus adding it to the chain. This design allows bitcoin to be a peer-to-peer system without any third party. The miners, who process the transactions, cannot produce a valid signature for other people’s bitcoins and therefore is the system safe.

2.4.2 Current use of blockchain

Ever since the development of blockchain technology, interest and curiosity have increased. In addition, the technology has opened possibilities for innovation to thrive that is more secure, economically advantageous, and time-saving. In fact, the global blockchain service market is expected to grow from $1.06 billion in 2020 to $1.61 billion in 2021, which results in a growth rate (CAGR) of 52.8% (Linker, 2021). This is due to the recovery faze many companies’ experiences because of the impact of Covid-19. Further, the market is expected to reach $10.45 billion in 2025 at a CAGR of 59% (Linker, 2021).

Below are several examples of industries where blockchain technology may soon help to revolutionize.

2.4.2.1 Ethereum

The first blockchain application is within the cryptocurrency bitcoin and its biggest competitor Ethereum (Hayes, 2022). Ethereum is a software platform that enables smart contracts and decentralized applications to be built and run without fraud or interference from a third party.
The application is run on a specific cryptographic token, Ether, and can be seen as the vehicle for moving around on the Ethereum platform. So, developers are trying to find the application inside Ethereum that is most suitable for financial products. The goal is for anyone to have free access to the platform regardless of esthetical, nationality, or faith (Hayes, 2022).

2.4.2.2 Banking and Payment

The banking and payment sectors have shown a significant interest in blockchain technology. They have shown opportunities for people worldwide that would not be possible if it was not for blockchain. The opportunity arises mainly for individuals in developing nations that do not have readily accessible standard banks. The use of blockchain technology would imply these services because of the easy access. Further, by partnering with digital currencies, this technology would allow transactions between different countries without significant fees and delay times (Reiff & Munchiello, 2021).

2.4.2.3 Voting

It is not only financial transactions that work with blockchain. It is also a great tool in hindering voter fraud. Currently, the voting system is stuck in the last century standards where people must leave their homes and submit paper ballots to the local authority. Estonia brought the voting system online during the municipal election in October 2013. But because of its security vulnerability that could lead to faked votes, it was decided not to be used (Arthur, 2014). Even though substantial security issues exist, an electronic voting system is on the horizon. There are mainly two benefits that are revealed with the use of blockchain. Firstly, the number of votes would increase with easy access to the election. Secondly, the current cost for each vote is between $7 to $25 with all factors considered, while with an electronic voting system, it would result in a cost of $0.5 per vote (Liebkind, 2020).

2.4.3 The opportunities for blockchain in real estate transaction

There are many areas of usage within the aspect of blockchain technology. One aspect that has had a lot of impact and is widely accepted application is in the field of finance. As it gives and ensures valued transparency between the trading parties (Foroglou & Tsilidou, 2015). Thus, every public or private equities, stock, bond, or derivatives transaction can be transcribed in a block and detect fraud or money laundry. Aside from the traditional form of financing, blockchain technology opens opportunities to improve the contemporary forms of financing. Furthermore, instead of using platforms that collect donations and distributes them to campaign runners through crowdfunding, it could use a decentralized platform that handles the donations.
If the campaign is successful, the money will go to the runners, or if not, the money will be returned to the donators. This solves a big problem of trust that new crowdfunding establishments face (Foroglou & Tsilidou, 2015).

Both Sweden and the United Kingdom have introduced technology to the real estate conveyancing process and land registration (Garcia-Teruel, 2019; Lindström, 2018). Furthermore, several private firms have investigated the possibility of implementing a digital transaction process using distributed ledgers in buying and selling real estate. Blockchain technology is argued to be the best option to achieve greater transparency and provide liquidity in the transaction process when trading assets (Garcia-Teruel, 2019).

2.4.3.1 Smart contract

One of the driving factors of blockchain in real estate transactions is smart contracts. The core idea behind smart contracts is to transfer ownership, leases, or other property rights at a minimized cost (Cong & He, 2018). A smart contract can also mitigate information asymmetry and increase trust and transparency between actors. Simplifying, automating property, and cash flow management, reduce time and costs from long transaction processes are some of the parts that smart contracts can help improve in the real estate market. Looking at the commercial real estate market, smart contracts can be used as transactions, and leasing terms could be stored on the blockchain, enabling higher transparency. It can also have a positive effect while the tenant rents the premises since smart contracts would enable the possibility for deposits or automatic payments from the tenants to the landlord. Smart contracts could also handle initial deposits and pay them back after the leasing period (Morena, et al., 2020).

By tokenizing properties, a token can represent a value in the property and thereby be leased or sold through smart contracts by applying suitable consensus (Konashevych, 2020B). With smart contracts and tokens that digitalize property rights and ownership, the real estate market can create the opportunity for online contracts (Konashevych, 2020A).

Smart contracts can be used with blockchain technology, allowing counterparts in a transaction or leasing process to interact more before engaging in the contract. The involved counterparties can analyze the script and the deal's outcomes using smart contracts. Furthermore, because the script has already been sent out on a network that the counterparties do not control, the smart contract increases the assurance of its execution. Finally, the counterparties will have verifiability over the contractual process because all their interactions are digitally signed, and the contract cannot be changed later (Christidis & Devetsikiotis, 2016).
3 Theoretical framework

This chapter will present the theoretical framework on which the master thesis has been based. Firstly, a framework for blockchain adoption will be presented to show how and with what difficulty a new technology can be established within a specific field. Subsequently, the two theories, the Hype Cycle, and the Transaction costs theory, will be presented.

3.1 A framework for blockchain adoption

To predict the adoption of a particular product, an accessible tool is to categorize different foundational technologies in four phases. These phases depend on the amount of competitiveness and coordination, and novelty (Iansiti & Lakbani, 2017). An application with low novelty and low competitiveness gains acceptance first. An application with high novelty and high competitiveness might take decades to evolve. These are typically the ones that can transform a whole economy.

The degree of novelty depends on how new the application is to the world. A newly founded application has a low novelty, and as it matures, the more novel it is, the more effort is required to ensure that users understand it and what problems it solves. The second dimension, complexity, represents the number of parties in the ecosystem coordination that need to work together to produce value with the technology.

Table 2: Illustration of the four quadrants regarding the degree of novelty and amount of complexity and coordination (Iansiti & Lakbani, 2017).

<table>
<thead>
<tr>
<th>Degree of novelty</th>
<th>Amount of complexity and coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Single use</td>
</tr>
<tr>
<td></td>
<td>Localization</td>
</tr>
<tr>
<td>High</td>
<td>Substitution</td>
</tr>
<tr>
<td></td>
<td>Transformation</td>
</tr>
</tbody>
</table>
3.1.1 The quadrants

In the first quadrant, single-use, with a low novelty and low coordination, the products have the potential for improvement. The applications create better, less costly, and highly focused solutions (Iansiti & Lakhani, 2017). An example is an email, which is a cheap alternative to phone calls and faxes. Also, bitcoin falls into this quadrant since it offered immediate value to the few people that used the alternative payment method.

The second quadrant, localization, with a high novelty and low coordination are applications that need only a limited number of users to create immediate value. Examples of technologies in this quadrant are within the financial service sector, such as the bank of America, JPMorgan, and the New York stock exchange, testing blockchain technology as a replacement to the manual transaction process in trade finance and foreign exchange or cross-border settlement.

The third quadrant, substitution, contains applications that are relatively low in novelty and high in coordination, thus building on already existing single-use and localized applications. However, on the other hand in a need for high coordination between different actors to establish an increasingly public usage. The adoption of this application is complex since they aim to replace entire ways of doing a certain business that might be deeply embedded within organizations and institutions (Iansiti & Lakhani, 2017). Examples of applications in the third quadrant are cryptocurrencies. Many cryptocurrencies have outgrown the primary bitcoin payment method with a critical difference. New cryptocurrencies require every party included to adopt it, which challenges the government and institutes that always have overseen and handled such operations. Furthermore, consumers who use the application must change their behavior and understand the innovation and how to implement the functional capability to manage the cryptocurrency.

The fourth quadrant, transformation, with high novelty and coordination, fall into applications that could change entire social, political, and economic systems. These applications are highly complex and need many actors and institutional agreements on standards and processes. Furthermore, significant social, legal, and political changes are required for the adoption to work (Iansiti & Lakhani, 2017). Examples of applications in the fourth quadrant are Skype and smart contracts. Smart contracts may be the most transformative blockchain technology at the time since there have been early experiments with smart contracts in venture funding, banking, and digital rights management.
Each of the quadrants represents a stage in technology. Identifying which of the quadrants different blockchain technologies fall into will give a guideline for the timeframe of implementing blockchain technology in the real estate transaction. Furthermore, it will indicate the level of collaboration and consensus needed and assess the state of blockchain development in the real estate sector and what kind of process and infrastructure must be established to facilitate the innovation’s adoption.

3.2 Hype cycle

The hype cycle is a graphical depiction from Gartner Glossary of the most common pattern that a new application or innovation goes through. Gartner devolves around 90 new hype cycles in various domains for clients to follow different innovations and their future potential (Baum, et al., 2020). The model combines a ‘hype level’ and the ‘engineering or business maturity’, depending on expectation and time. The model contains five stages: innovation trigger, the peak of inflated expectations, a trough of disillusionment, the slope of enlightenment, and the plateau of productivity.

![Figure 3: Components of the Hype Cycle (Fenn, 2007).]

3.2.1 Innovation trigger

The first phase is the innovation trigger, where the product gets an early media announcement, proof-of-concept story, or another technology breakthrough. This is the phase where venture capitalists and adopting companies aim to capitalize on the product. Often the product is not usable, and commercial profitability is unproven.
3.2.2 Peak of inflated expectations

The second phase concludes earlier publicity with success stories categorized by high expectations boost or hyped future. On this ground, companies act by either investing or not without having a clear strategy or proper business care.

3.2.3 Trough of disillusionment

The third phase is categorized by misalignments when the promised productivity fails to deliver through experiments and implementations. As a result, the interest wanes. In this phase, the investors only continue to invest if there is a significant improvement in the production to satisfy early adopters.

3.2.4 Slope of engagement

The fourth phase includes instances where the product has benefitted the adopters and becomes more widely known, as the second or third generation of product arises from the providers. More investors and companies choose to invest in the enterprise, while conservative companies remain cautious.

3.2.5 Plateau of productivity

In the final phase, the technology is realistic valued, and mainstream adoption starts to take off. The technology's broad market application and relevance are paying off.

![Diagram of the hype cycle and its stage indicators](Fenn & Raskino, 2008).

*Figure 4: The hype cycle and its stage indicators* (Fenn & Raskino, 2008).
Different innovations may need different time frames to be successful, that is, the time between the ‘peak of inflated’ expectations and the ‘plateau of productivity’. This gap is called the ‘time-to-value gap’ and varies depending on each technology’s penetration potential, performance constraints, and integration complexity (Fenn & Raskino, 2008). As a result, the associating hype cycle for each product may vary between a year to several decades. Although, a ‘normal technology’ is anticipated to be around five to eight years. In contrast, ‘fast track technologies’ may take only two to four years, and on the other side of the spectrum, ‘long fuse technologies’ may take up to several decades (Dedehayir & Steinert, 2016).

3.3 Transaction costs theory

Transaction costs theory has been applied in social and political science, organization theory, and strategic management (Kim & Mahoney, 2005). Transaction costs theory and agency theory are contractual theories that evolved from the same background as property rights theory. Definition of a transaction is described as a move of control or rights. The transaction costs theory describes the appropriate structural form for a transaction with certain characteristics.

One definition of transaction cost theory is that the optimal organizational structure achieves economic efficiency by minimizing the exchange costs (Williamson, 1979). The theory proposes that each kind of exchange produces coordination expenses of observing, controlling, and overseeing transactions. Williamson has defined transaction costs as the cost of the economic system of the firm. He has contended that such expenses are to be recognized from production costs. A leader can decide to utilize a firm structure or source from the market by comparing transaction costs with internal production costs. In this way, the cost is the essential determinant of such a choice.

Exchange costs comprise a blend of elements that obstruct, forestall, or make a transaction between actors more costly (Skogh & Lane, 2000). The term cost in this way includes not only related monetary costs but also costs that happen because of time delays or different troubles in a transaction. These expenses can be separated into three classifications: previous costs, during or after an exchange. To carry out an agreement, the exchange costs connected with the agreement can be classified as ex-ante and ex-post (Williamson, 1981). Ex-ante transaction costs happen in association with the making of the agreement, and information asymmetry characterizes the cost. In contrast, ex-post transaction costs occur after the foundation of the
agreement when the two parties are verified to have finished their concurred piece of the agreement. In a perfect market, with complete information access and trust, the ex-post expenses would not occur (Skogh & Lane, 2000). That is not true in the present market. In contrast to agency theory, transaction costs theory assumes that the contractual regulation is incomplete, prompting a theory centered around ex-post transaction costs (Kim & Mahoney, 2005). Further on, in transaction costs theory, it is not a curtain for an ideal unitization contract. At the same time, at first, forming the financial impetuses accurately and administration is a decision between accessible collections of monitoring and decision-making systems rather than an ideal blend of these components. The transaction costs theory has a more comprehensive view of the administration decision than, for example, agency theory.

3.4 Theory application

The framework for blockchain adoption has been presented to help the authors answer research question three and create a discussion. The theory provides knowledge of blockchain's current position as a new technology and what will be needed from the sector to adopt blockchain. Using examples from other technologies and the current use of blockchain in different sectors provides a perspective on how blockchain can be adopted. This information will give the authors knowledge of the risks and challenges for the market in integrating blockchain.

The hype cycle theory presents knowledge of new technologies' different stages. The theory will help the authors by providing knowledge of all the different stages and help identify where blockchain currently is as new technology. Furthermore, by comparing other new technologies' current positions and earlier positions in the hype cycle, the future demand and development for blockchain in the real estate market can be discussed and concluded.

The transaction cost theory will help to provide relevant discussion points to help answer research questions one and two by defining and providing information about transactions and costs in different stages in a transaction. It also provides information on the cause of costs in a transaction.
4 Method

This chapter will describe the methodology used in this thesis. The section will also explain why these methods have been chosen and how the data has been collected.

4.1 Method choice

Qualitative studies that constitute the research method for this study are often characterized by their interpretive character, as the researcher in these studies intends to understand the subjective meanings (Saunders, et al., 2016). In contrast to quantitative studies that intend to achieve mathematical measurability, qualitative studies aim to understand the imminent context so as definitions, characteristics, and concepts. The studied subject in this thesis will need to be interpreted and made sense of from both a subjective and social meaning. The data collection and analysis will be used to develop a theoretical explanation. This is a standard methodology with inductive approaches.

Settling on a qualitative study for this theory appeared to be most appropriate. The inductive methodology is advantageous for research where the subject is new, and there are not much accessible reports in the subject. With an inductive method, pre-laid out speculations and hypothetical structures are not expected initially, making this approach the most appropriate (Robson & McCartan, 2002). This thesis aims to investigate if real estate owners in the Swedish real estate market can use blockchain as a helpful tool to digitalize. Investigate what can be tokenized and the risk of blockchain and tokenization. Several research shows that real estate transactions take much time and are costly. Many studies investigate if blockchain can help in this process; however, there is a gap in information regarding what can be moved to blockchain. Therefore, the author will collect data to generate, interpret and analyze information about blockchain, the transaction process, and the risks.

4.2 Data collection

4.2.1 Document analysis

In this thesis, a significant effort has been put into the literature review to assess and establish a gap in earlier research, reinforcing the importance of the aim of the thesis. All the data and information collected have helped identify what needs to be studied to answer the research questions. Conducting a thorough literature review based on academic literature and appropriate market information has helped the authors choose the most suitable method.
Document analysis is a systematic process of reviewing or evaluating documents. The documents can be both printed and electronic materials. Document analysis is an analytical method that requires the data to be examined and interpreted to understand and develop empirical knowledge (Corbin & Strauss, 2008). The analyzed documents are produced without the researcher’s intervention (Bowen, 2009). The documents that can be used in a Systematic evaluation can take different forms, such as journals, Books, organizational or institutional reports, survey data, and public records. The data analysis includes finding, selecting, and making sense of the data contained in the documents. Data analysis can be used together with other qualitative research methods to corroborate findings from different methods, thus reducing the potential biases in a single study. This can also increase the credibility of a study. According to Patton (1990), using triangulation helps defend the study of the accusation that the findings are simply an artifact of a single method.

4.2.1.1 Usage of document analysis

The researcher use data drawn from documents, to contextualize data collected during interviews. Initially the documents were found to conduct an in-depth analysis on the research questions. The aim is to find claims in the texts that either agree or contradict with the initial results from the literature review. Thus, the analytic procedure entails finding, selecting, appraising, and synthesizing data contained in various documents. The documents have been used to triangulate together with the interviews to validate and corroborate data obtained during the study.

In this study, document analysis and interviews will be conducted to provide credibility to the study. The documents that will be analyzed are reports, books, seminars, surveys, and reports. After thorough research documents is found, selected, interpreted, and evaluated, documents relevant to the study will be included. Secondly, the data analysis will provide the authors with relevant information about the subject. The documents can also provide the authors with information and insight that can be valuable to a knowledge base.

The research questions in this thesis aim to answer the challenges and risks of implementing blockchain technology in Sweden's rental real estate sector. The challenges could be described through a document analysis made by academic papers and publications, lectures, experts’ observations, and real applications of blockchain technology in other sectors. The following table states the different documents that have been analyzed to discuss and find answers to this thesis research questions.
Table 3: A sampling of documents and data analyzed

<table>
<thead>
<tr>
<th>Documents selected</th>
<th>Data analyzed</th>
<th>Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Future of Real Estate Transactions Report Summary (Saull &amp; Baum, 2019)</td>
<td>Issues to implement blockchain</td>
<td>RQ1, RQ2 and RQ3</td>
</tr>
<tr>
<td>Blockchain and Commercial Real Estate (Spielman, 2020)</td>
<td>Usage of blockchain</td>
<td>RQ2</td>
</tr>
<tr>
<td>The State of Blockchain in Real Estate 2021 (Bronckers, 2021)</td>
<td>Investigating the timeframe for blockchain technology adaptation in real estate transaction</td>
<td>RQ2</td>
</tr>
<tr>
<td>PWC’s Global Blockchain survey 2018 (PWC, 2018)</td>
<td>Blockchain is here. What’s your next move?</td>
<td>RQ2 and RQ3</td>
</tr>
<tr>
<td>Tokenization – The Future of Real Estate Investment? (Baum, 2020)</td>
<td>The challenges and the different forms to tokenize a property</td>
<td>RQ2 and RQ3</td>
</tr>
<tr>
<td>Blockchain in commercial real estate. The future is here! (Kejriwal &amp; Mahajan, 2017)</td>
<td>Opportunities to improve real estate transactions</td>
<td>RQ3</td>
</tr>
</tbody>
</table>
4.2.2 Interviews

In a qualitative study, data is collected primarily from semi-structured and in-depth interviews and secondarily from observations and written documents. In the semi-structured interview, predetermined questions will be used. However, the questions can evolve, and the interview can switch directions. This is one reason why semi-structured interviews are a suitable method in this scenario (DiCicco-Bloom & Crabtree, 2006).

Semi-structured interviews can be conducted in various ways and are versatile and flexible ways of doing interviews (Kallio, et al., 2016). The interviews can be conducted in person, online, or by phone. The interviews can also be conducted in a group or individually (Saunders, et al., 2019). Doing the interview one-on-one can give a more in-depth interview where a deeper dive into the matter can be done. In contrast, group interviews provide the interviewees with the possibility for more discussion and the ability to share more experiences (DiCicco-Bloom & Crabtree, 2006).

In this thesis, the primary data will be collected from semi-structured interviews. This method will allow the author to have a nuanced and flexible way of studying the topic. The respondents that will be interviewed will be carefully selected. The respondents will be selected by looking at certain qualities. The respondents will have a certain level of knowledge about either blockchain or the transaction process in the real estate market or both to provide different aspects and knowledge in the areas. Therefore, the authors will carefully select interviewees to find the most suitable people to interview.

4.2.2.1 Interviewees

A total of three interviews have been conducted with a time consumption of one hour per interview. The interviews were conducted in the respondent’s workplace or through a digital meeting. If desired, the interview questions have also been sent in advance to the respondents via e-mail to give them a greater overview of the study's intention and give them the opportunity for preparation. The interviews have helped the authors understand the subject and deeper analysis.

The selection process of interviewees has been based on traders and researchers in the relevant research areas, which is supposed to enrich most for the study to be able to answer the research questions within the areas:
All the interviewees have accepted to have their names and organization published in this thesis. The respondents we have interviewed in this study are reported according to the following table below by organization, name, feature, and date of each interview.

Table 4: Summary of completed interviews.

<table>
<thead>
<tr>
<th>Organization/company</th>
<th>Participating</th>
<th>Role</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newsec</td>
<td>Jakob Westin</td>
<td>Deputy Head of Capital Markets at Newsec</td>
<td>2022-04-25</td>
</tr>
<tr>
<td>Luxembourg Institute of Socio-Economic Research</td>
<td>Anetta Proskurovska</td>
<td>Ph.D. Researcher</td>
<td>2022-04-26</td>
</tr>
<tr>
<td>Olov Lindgren AB</td>
<td>Sven Renström</td>
<td>CEO</td>
<td>2022-05-06</td>
</tr>
</tbody>
</table>

**Jacob Westin**

Newsec is a company with a broad full-service property housing company in northern Europe. They offer property owners, investors, and tenants different services within property asset management and advisory. They provide analyzes of market trends, support in connection with the sale or acquisition of a property or a portfolio, updated values of the property portfolio, or advice on political decision-making processes in land development issues. Jakob Westin started his career in 2010 when he graduated from The Royal Institute of technology and is now partly responsible for the transaction team at Newsec.

**Anetta Proskurovska**

With a diverse background in architecture, urban planning, and economic geography, Proskurovska is well-positioned to grasp the logic of specific technical, economic, and social processes in transitioning urban land and housing markets (Research, 2022). Proskurovska has
a master’s degree in Geography and Spatial Planning and Architecture of Building and Structures. Now Proskurovska is writing her Ph.D. Research on the ABTLAS project, which aims to be finished in 2022. She is investigating blockchain-based reorganization of urban land systems and housing markets. In this research, she explores the application of blockchain for land administration and housing transactions in Luxembourg, Sweden, and the UK.

Sven Renström

Olov Lindgren AB is a company located in the center of Stockholm and owns 115 residential real estates in and around Stockholm. Their business idea is only to buy and build properties to increase their real estate portfolio. The company was founded in 1911 and has since then only sold three properties, one of which they bought back, one that they want to buy back and one they had to sell because of the construction start of Södra Station. As the CEO of Olov Lindgren AB, Sven Renström has been in many real estate acquisitions. Every year, Renström and a few others from the management team receive and request prospects of properties to investigate. They can investigate up to 100 properties per year, onto which they decide on a few properties they would like to investigate more.

4.2.2.2 Interview guide

In this thesis, the semi-structured interviews are based on predetermined open-ended questions prepared separately for the interviewees. The interviewees are residential real estate owners, advisory companies, and blockchain experts. Open-ended questions enable follow-up questions for further dialog between the interviewers and interviewees. An interview guide with the questions for each interview is presented in appendix 1.
5 Results

This chapter presents the answers obtained in interviews with real estate owners and experts within the field and the document analysis.

5.1 What are the residential real estate transaction process phases in the Swedish real estate market?

To understand the current transaction process phases in the Swedish real estate market, interviews and document analysis have been conducted.

Westin describes the current transaction process as follows; Newsec conducts a scope including market analysis, the value of the property, potential buyers and the worth of selling, et cetera, which is the foundation in the tender for the transaction (Westin, 2022). From an accepted bid Newsec help the seller with a thorough screening of the property, and the company, conducting a market analysis and a valuation of the real estate. Further, in consultation with the seller, send a teaser to potential buyers. This could be everything between three to a hundred buyers depending on the seller's preferences and the real estate position. While the potential buyers decide whether they want to lay a bid on the property, Newsec creates an information memorandum that has showings of the property and answers questions about the real estate. On a specific date, all the interested buyers can put in an indicative bid and other conditions, of which the seller decides on one buyer they continue with. This results in a due diligence process where the buyer thoroughly analyzes the real estate and the holding company, which varies in time depending on the property, the seller's provided information, and how much the buyer wants to investigate. He mentioned that it could take up to two months. In parallel with the due diligence process, they negotiate the contract terms.

This transaction process that Newsec conducts can be divided into four parts (Westin, 2022). The first part is where Newsec conducts a screening of the prospect. In the second part, they contact potential buyers with a teaser before the real estate goes out to the market. The third part is where the marketing process is done. In the final part, the buyer conducts a due diligence and negotiates the contract terms.

Before making an indicative bid Sven Renström, at Olov Lindgren AB conducts an ocular inspection to have more information before deciding whether they would like to purchase the property (Renström, 2022). If they decide to make an indicative bid and they win, they move
forward with a due diligence process. Usually, this process takes about two weeks, where they can ask questions and revive more information regarding the property. During this process they also make a more thorough ocular inspection. Parallel with this process, they negotiate the terms and conditions of the purchase. The negotiation can be influenced if new risks are found during this process.

A commercial land transaction comprises five distinct processes involving various parties (Saull & Baum, 2019). The preparation and marketing periods required to create an asking price and negotiate a sale are the responsibility of the sellers and their representatives. The conveyance, which is the formal procedure by which rights over land are created and transferred, is handled by one pair of lawyers acting for the buyer and another acting for the seller. This includes all essential legal work done during and after the due diligence. Finally, a property registry must collect land taxes and legal document ownership during the post-completion phase. After that, the transaction is finished.

5.2 What is the potential of blockchain technology to improve the efficiency in the residential real estate transactions process?

Westin says that a digitalization such as a blockchain could improve all four parts of the process differently. When Newsec conducts a prospect screening, they receive information from the seller. Jakob suggests that if blockchain were implemented in the real estate market, information would be more reliable and trustworthy to the buyer when presented through the second and third parts with a teaser and marketing. Furthermore, through blockchain technology, the information asymmetry in the due diligence and the information memorandum would decrease, and the transparency would increase.

According to Jakob, companies such as Newsec wish and try to develop software for a more digitalized real estate market in Sweden. However, the sector is still extremely conservative (Westin, 2022). Especially in the due diligence process, they use new software where documents can be uploaded and confirmed by inspectors, such as radon measurements or rental documents. He believes that the best way to make the market more digitalized is to take small steps to decrease the risk of expenses and could be more easily economically motivated. Another challenge that Westin mentioned is related to the different companies using different real estate acquisition procedures. These systems would have to be standardized if blockchain technology were implemented.
Anetta Proskurovska (Proskurovska, 2022) mentions in the interview that there are benefits to implementing blockchain technology in the real estate sector in Sweden. The primary phenomenon that will reduce the transaction time is to reduce the usage of paperwork and instead have all the paper digitally. With different software solutions, the Swedish real estate market is certainly going in that direction. Nevertheless, for blockchain technology to be implemented properly, the government must standardize the transaction process, making the market smoother and faster. She believes that the government must participate in the standardization because the government and state institutes play a part in such transactions. Although, a change in how transactions work would be a considerable cost, which is one of the main issues Proskurovska studies in her Ph.D.

Renström describes one challenge Olov Lindgren faces is how accurate prospects are (Renström, 2022). While looking into different prospects, they expect some of the information to be inaccurate, or there might be information left out. This might lead to a wrong decision to proceed or not to proceed the purchase. If the information were to be more trustworthy, it would make the process easier and faster to make the right decision for the company.

According to PwC's 2018 poll of 600 CEOs from 15 territories, 84 percent said their companies are using blockchain technology somehow (PWC, 2018). The reason mentioned in the report is that a well-designed blockchain, as a distributed, tamperproof ledger, can eliminate intermediaries, lower costs, and increase speed and reach.

The paper “Tokenization – The Future of Real Estate Investment?” by Andrew Baum examines the available mechanisms to tokenize real asset ownership and create active secondary markets in tokenized or fractionalized units. This research resulted in three gains introduced through tokenization. Speed in the transaction and privacy avoids making public information available and exploiting the efficiencies of Blockchain (Baum, 2020). The paper presents the benefits of Blockchain, the economic benefit of tokenization is greatly dependent on the developed application. The fundamental mismatch between common perceptions of real estate tokenization and a realistic vision of the near future is the frequently drawn picture of a single property asset being tokenized for the retail investor, which is unlikely to gain substantial traction. Two radical developments must be simultaneously accepted for blockchain technology to work correctly. Firstly, there must be a demand for the fractionalization of single real estate assets. Secondly, the participants must be comfortable with Blockchain and the digital underpinning of tokenization.
The report “The Future of Real Estate Transactions Report Summary” presents the potential and opportunities for Blockchain. Every stage of a property's lifecycle requires data. Investors require information on the building, cash flows, maintenance, potential risks, market assumptions, tenancy schedules, and more when purchasing an asset (Saull & Baum, 2019). This information must be efficiently communicated from and to prior and current owners, legal advisors, property managers, and others, but the process is often inefficient and slow.

The report concludes that most delays occur during the due diligence phase of a commercial real estate transaction (Saull & Baum, 2019). The current state of technology in the commercial conveyancing profession is limited to digitizing the existing workflow, which provides more efficient transmission of information than a paper-based procedure but is not yet capable of automating more complex jobs. Many of the delays are related to data storage or transfer issues.

The study done in the report had all participants agree on worries about the consequences for data security. A freely accessible, single pool of up-to-date, standardized property information may decrease most of the causes of delay mentioned (Saull & Baum, 2019). One of the technologies identified as having the best chance of successfully resolving one or more of the identified delays is Blockchain. The report mentions that Blockchain has the potential to provide several advantages over even the most complex current land registration methods. The real estate market could become more transparent as the availability and quality of real estate data improve if blockchain land recording is further developed. Increased liquidity resulting from open access to verified, accurate data has the potential to revolutionize the way real estate is transacted. Because proof of ownership may be established irrevocably on the Blockchain, title insurance requirements will be decreased. Analysts, regulators, and land management officials will benefit from constructing more extensive and reliable property data.

One of the potential uses for Blockchain in the real estate market mentioned by Avi Spielman is a database management and upkeep. Because blockchain is essentially a database, displaying available properties could help the market (Spielman, 2020). The fact that databases are not designed to communicate with one another is a significant flaw. For example, one multiple-listing services site (MLS) may use one database protocol while another uses a different database protocol. As a result, these two databases speak two separate languages. Their lack of communication causes inefficiencies in the listing process, such as the requirement to post listings on several MLS sites. This is where the possibility of human mistakes enters the equation. Every time a person is required to post, repost, update, alter, or remove a post across various platforms, the likelihood of erroneous, misleading, outdated, or contradicting
information increases geometrically. Blockchain is presented as a possible solution to this problem in the report. A blockchain-based universal MLS service could eliminate the need for different MLS systems, allowing for greater real-time listing information, reduced human error, and protecting sensitive private data from being shared or commoditized. Furthermore, pricey third-party running fees would be reduced if not eliminated.

Deloitte finance services have developed a report that dives deeper into the blockchain technology’s applicability to property purchase and sale transactions. The current transaction process is complex and involves multiple steps. Thus, finding a property and closing a transaction can be time-consuming and costly for all parties.

Deloitte has found three opportunities related to blockchain on which it could improve real estate transactions (Kejriwal & Mahajan, 2017). Firstly, searching for information about a property is often connected with a subscription-based platform. However, with the help of blockchain, the information could be distributed across a peer-to-peer network. Secondly, due diligence is often paper-based, time-consuming, and usually stored in siloed places and has limited flexibility to be customized to suit various needs. Blockchain allows this information to be stored in a digital forum related to the property. Thirdly, there is complexity regarding the leasing agreements due to dependencies among landlords, tenants, property managers, and various vendors. Blockchain could facilitate leasing agreements through smart contracts on a blockchain platform. This would enable transparency in lease terms and transactions.

FIBREE report shows that blockchain adoption is growing in the real estate sector. The LinkedIn profile and websites indicate that the already known products are still up to date. Secondly, other platforms such as ICO Bench and Crunchbase, and LinkedIn are used to find new products. By the end of the research period, FIBREE announced 394 products listed in the 2021-edition of the worldwide FIBREE Product database.

The number of products available since 2019 has reduced by 40% to 2020, followed by an increase of 30% in 2021 to 394 products. This result could indicate that blockchain within real estate has, on a global level, left the bottom of the ‘Trough of Disillusionment’ in Gartner Hype Cycle. Only time will tell if this is the case or if the covid-19 pandemic has impacted the situation. The leading continent is Europe, but the fastest-growing country is USA, with an increase of 36 products from 2020 to 2021, giving 108 products.

The products are categorized within eight categories: ‘Plan & Build’ (2.79%), ‘Markets & Platforms’ (32.99%), ‘Transaction & Escrow Services’ (5.08%), ‘Smart City Solutions’
In this thesis, the most interesting is ‘Transaction & Escrow Services,’ ‘Invest & Finance,’ and ‘Research and Valuation.’ These products take up a big portion of the total products worldwide. In combination with that, Europe has the most products, and the digitalization in the real estate sector is fast-growing and finding new application areas for the technology to thrive.

5.3 What are risks and challenges with implementing blockchain technology in real estate transaction processes?

Proskurovska believes that one of the most significant risks with implementing blockchain could be a drastic change in market prices, affecting the entire real estate market. Whether the prices go up or down, we would have a new financial situation in the real estate market. Since this technology might be a disrupting technology for the real estate market, there is a risk that there will be a long acceptance and adoption time. A fast change of systems for an entire market would be perilous, and it would be more reasonable to make small changes over time towards this new technology. Another challenge is that we cannot know for sure how big market share is needed to use this technology for it to be standardized.

Renström believes that the implementation of blockchain technology would be complex. The reason is that many big real estate companies, together with Lantmäteriet, must join for the technology to work. There would also have to be changes in regulations that force companies to choose a more digitalized platform to make transactions.

Furthermore, like many others, Olov Lindgren is a company that capitalizes on information asymmetry in an acquisition process. An example could be the possibility of expanding the property that other potential buyers do not know of. In this case, Olov Lindgren may want to place a higher bid than other potential buyers. This would mean that the risk with information asymmetry also might remove opportunities. This, in the long run, could result in a perfect market that big companies such as Olov Lindgren do not want. On the other hand, from the seller's perspective, information about the property might jeopardize the purchase price that one actor has found and told the broker about. The broker is required to notify the other potential buyers but might not since the seller wants the highest possible price. Renström also believes that most companies do not want to give out more information than they already do regarding their tenants, renovations, building rights, building permits et cetera.
Many corporate operations benefit from increased openness and traceability (PWC, 2018). The biggest impediments to blockchain adoption, according to the PWC poll, are regulatory uncertainty (48 percent), a lack of trust among users (45 percent), and the capacity to bring the network together (44 percent). As found by the survey, there are some challenges to be addressed before adopting blockchain. Many have a lack of trust and are worried about regulatory uncertainty. The report argues that the best way to adopt blockchain is to make blockchain adoption an evolution, not a revolution. Another challenge for blockchain is that if different parties put data and transactions into the blockchain, the data must be standardized, and the blockchain's governance must be reliable.

Tokenization is at an early stage of its development, and it will take time for tokenization to be accepted within the real estate (Baum, 2020). One significant risk is that the advantages would be noticed and delivered to the market participants but solely focus on the digital fractionalization of single assets. For its unconvincing economics, the demand is limited, and the obstacles are significant.

A challenge that came to light through the trial was presented by The Swedish company ChromaWay. ChromaWay has created a private blockchain-based transaction system that eliminates individual data verification requirements (Saull & Baum, 2019). In June 2018, a live demonstration of a fully integrated blockchain transaction in Stockholm was presented using their system. This process revealed two significant roadblocks. The first roadblock involved issues with identity verification, with the presentation demonstrating the use of current centralized technology to validate signatures along the transaction chain. The second concern was the legal recognition of blockchain-based contracts, with the relevant contracts still needing to be put into an EU standard format before being examined independently. Some of the challenges to implementing blockchain are identified in the report. These are a digital identification solution, a private or hybrid blockchain, accurate data, connection infrastructure, a population used to technology, and a trained professional community.

Iuon-Chang Lin and Tzu-Chun Liao have written the article about blockchain security issues and challenges. They analyzed the problem through a survey where they concluded mainly six security issues and challenges with blockchain (Lin & Liao, 2017).

The first problem is the majority attack. This is where miners join and form a “mining pool” to mine more blocks. Thus, they can hold 51% of the computing power the mining pool can control a blockchain since they have the authority to decide which block is permissible (Lin &
This can modify the transaction data, stop the block verifying transaction, or stop miners mining any available block. The second problem is the “fork problem.” This is where a new blockchain software is published, then a new agreement in consensus also changes the nodes. The new nodes might not follow the current technology for the old nodes, which could lead to a “fork” in the chain, this would mean that the chain would divide into two separate chains, with the old nodes and the new nodes. The third issue is the “Scale of blockchain,” which involves the problems of storing the data as the chain grows bigger and bigger. As well as the time it takes to synchronize the data as it continuously increases. The fourth issue is the “time confirmation of blockchain data.” The usual time to confirm a transaction is around two or three days, but with blockchain, the time reduces to about one hour. Although, with a lightning network, bi-directional payment channels allow payments to be securely routed across multiple peer-to-peer payment channels. This enables any peer on a network to pay any other peer even if they do not have a direct channel open between each other. The final issue regards the “integrated cost problem.” A change in a fundamental transaction model will not only be expensive and time-consuming, but it brings many challenges regarding the economic benefits, meeting the requirement of supervision, and bridging with traditional organizations.
6 Analysis and Discussion

In this chapter, the literature study, the results from the interviews, and the document analysis are being analyzed and discussed.

6.1 What are the residential real estate transaction process phases in the Swedish real estate market?

As mentioned, the current real estate acquisition process in Sweden contains four phases depending on the segment in which the acquisition is made and who the buyer and seller are. In general, the phases are research and marketing, indicative bid, due diligence, and contract negotiation. These four phases are seen differently by the different actors. According to the transaction cost theory, exchange costs comprise a blend of elements that obstruct, forestall, or make a transaction between actors more costly (Skogh & Lane, 2000). The term cost in this way includes related monetary costs and costs that happen because of time delays or different troubles in a transaction.

From the perspective of a consultant for the seller, the first phases are the most time-consuming. Since they, together with the broker and the seller, conduct a thorough investigation of the property to answer all the questions that the buyer might have in the latter due diligence phase. The reason is twofold, they want to be professional, maintain a good reputation, and do a reasonable property valuation so that nothing comes up in the contract negotiation phase.

From the buyer's perspective, there is a prolonged process of finding properties that reflect the specific business scope and idea. But, given that a property has been found, the most consuming part is the due diligence and the contract negotiation phase. An acquisition is not a protracted process for a big, well-established firm like Olov Lindgren. The management team decides whether to buy a property depending on who the seller is and the ocular inspection they make before the indicative bid.

We believe that Olov Lindgren is a very experienced real estate company. However, their answers cannot be generalized to the whole sector. Thus, when they say that their due diligence process takes about two weeks. Another company might conduct its due diligence much more carefully because of the inaccuracies and uncertainties. We believe that Jakob Westin describes a more extensive representation of the transaction process as he works for the seller and is, therefore, more engaged in the process from start to finish. The time for due diligence varies
depending on the property, the provided information, and how much the buyer wants to investigate. As aforementioned, the time set aside for due diligence varies depending on different variables. We believe it is hard to make a precise assumption on a timetable. Therefore, we conclude that this research has identified the transaction process phases and described these phases based on interview and document analysis. We also conclude that the timeframe on each phase varies based on buyers, sellers, and properties.

Beneath is a summary of the steps in the acquisition process in the real estate sector in Sweden.

**Table 5: Real Estate Transaction Process Phases.**

<table>
<thead>
<tr>
<th>Findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four phases of the acquisition process; research and marketing, indicative bid, due diligence, and contract negotiation.</td>
<td>(Devaney &amp; Scofield, 2015; Gustafsson &amp; Palm, 2018)</td>
</tr>
<tr>
<td>The timeframe of the different phases is highly dependent on the type of business and experience.</td>
<td>(Westin, 2022; Renström, 2022)</td>
</tr>
</tbody>
</table>

**6.2 What is the potential of blockchain technology to improve the efficiency in the residential real estate transactions process?**

The adoption of blockchain technology has been successful in some sectors while not at all in others. Blockchain adoption is undoubtedly a hot topic, and many startups try to capitalize on the potential (Bronckers, 2021). Furthermore, the products related to the real estate sector give up a significant portion of the total products worldwide. This indicates that blockchain is on the rise in real estate transactions.

The real estate sector in Sweden is quite conservative, making it hard to implement different digital solutions, which is why Westin believes that a fast implementation of blockchain in the real estate sector is not possible. For a tremendous change in how we acquire real estate in Sweden to be made possible, small innovations in the different parts of the process would, in the long run, enable blockchain technology to be possible. PWC report also argues that the best way to adopt blockchain is to make blockchain adoption an evolution, not a revolution (PWC, 2018). Both Westin and Proskurovska mention that different software companies have this aim. Implementation of blockchain would reduce the transaction time and usage of paperwork.
Furthermore, they are convinced that for an implementation to work correctly, the government must take part in standardizing the transaction process. On the other hand, this would result in huge costs and changes in the law.

Every stage in a property life cycle requires information on the building, cash flows, maintenance, potential risks, market assumptions, tenancy schedules, and more when purchasing an asset (Saull & Baum, 2019). This information gathering is often inefficient and slow. The current state of technology is limited to digitalizing the existing workflow, which provides a more efficient transmission of information than a paper-based procedure but cannot yet automate more complex jobs. One of the identified technologies for reducing the delay is blockchain. The real estate market could become more transparent as the availability and quality of real estate data improve if blockchain land recording is further developed. Increased liquidity resulting from open access to verified, accurate data can revolutionize how real estate is transacted (Saull & Baum, 2019). This information is delivered to the potential buyers through a prospect. The prospect contains information about the property which Renström means could be wrong and thus needs to be verified by the acquirer. Using blockchain to verify the prospect's information would enable the possibility of time-saving, which reduces cost (Renström, 2022).

Furthermore, there are many other perspectives where a blockchain could improve the real estate sector regarding distributed, tamperproof ledger, eliminating intermediaries, lower costs, and speed in the transaction. Privacy avoids making public information available and exploits blockchain's efficiencies, database management, and upkeep. Since blockchain is essentially a database, displaying available properties could help the market (Spielman, 2020). This would enable multi-listing services to use one database protocol. The common problem is that when an agent is required to post, repost, update, alter or remove a post across various platforms, the likelihood of erroneous, misleading, or outdated increases. Blockchain gives the possible solution to this problem since it eliminates the need for different MLS systems. This opportunity with blockchain is not the most critical regarding the residential real estate market since the demand for condominiums is larger than for properties.

Beneath is a summary of the potential of blockchain technology to improve the efficiency of the residential real estate transactions process.
Table 6: Potential of Blockchain technology in transaction processes.

<table>
<thead>
<tr>
<th>Findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blockchain cannot be implemented in Sweden without some help from the authorities.</td>
<td>(Westin, 2022)</td>
</tr>
<tr>
<td>For a blockchain adoption to be completed, the real estate sector must take small steps in that direction. It cannot be evolved over a short period.</td>
<td>(PWC, 2018; Westin, 2022; Proskurovska, 2022)</td>
</tr>
<tr>
<td>The advantages of blockchain are diverse; reduction of the use of paperwork, reduction in the information asymmetry in the prospect, and reduce the acquisition timeframe.</td>
<td>(Saull &amp; Baum, 2019; Renström, 2022)</td>
</tr>
</tbody>
</table>

6.3 What are risks and challenges with implementing blockchain technology in real estate transaction processes?

As one could imagine, there are many difficulties with blockchain adoption in the real estate sector. Jakob mentioned the possibility that companies with a low turnover of properties would not profit from adopting blockchain technology. The reason is that a transfer to blockchain would not be possible if not both parties were included in the new technology. Thus, as Proskurovska mentioned, the transaction would have to be made twice, once with blockchain and once without. This results in big companies not wanting to be the technology adoption flagship since it is mainly connected to an initial cost with few beneficial arguments. We have identified that blockchain is in the “Trough of disillusionment” phase according to the hype cycle, the third phase. Misalignments categorize this phase; the interest wanes when the promised productivity fails to deliver through experiments and implementations. In this phase, the investors only continue to invest if there is a significant improvement in the production to satisfy early adopters. This connects to what Westin and Proskurovska mentioned, relating to the adoption timeframe. They believe that the technology must take small steps with different software that enables an easier and smoother transaction process, which would, in the long run, enable a thorough adoption of blockchain.

Another challenge found in the interview with Renström is that information asymmetry in a transaction can be beneficial for an experienced buyer or seller. The reason is that those
opportunities and risks can come from information asymmetry, which would mean that some actors in the market would be reluctant to adopt the technology. Since they otherwise could capitalize on the information asymmetry. In the literature, this issue mostly gets presented as a problem that needs or should be fixed rather than an opportunity. Since the real estate market is often seen as inefficient due to information asymmetry, transparency problems, personal bias, high transaction costs, and slow transaction process (Shiller, 2014).

A good illustration showing some of the challenges with blockchain was shown by ChromaWay, where they did a complete transaction using blockchain. The two problems, identity verification and legal recognition show some of the issues of implementing blockchain (Saull & Baum, 2019). Some of the challenges that need to be addressed before implementing blockchain are identified in the report; these are a digital identification solution, a private or hybrid blockchain, and accurate data and connection. We believe that this trial reflects our findings in the document analysis. Furthermore, as the study from PWC showed, a large percentage has a great concern regarding regulatory uncertainty and a lack of trust among users. Renström also mentions that a move over to blockchain would require regulation that forces companies to choose a more digitalized platform to make transactions.

Even though blockchain has been introduced in several fields (Xia, et al., 2017; Novo, 2018; Sun, et al., 2016), Iuon-Chang Lin and Tzu-Chun Liao mentioned six security issues and challenges with blockchain. These are “mining pool,” “fork problem,” “Scale of blockchain,” “time confirmation of blockchain data,” and “integrated cost problem.” For blockchain to be adopted appropriately, these issues must be improved. This goes hand in hand with the previous research on banking (Reiff & Munchiello, 2021) and digital voting (Arthur, 2014). Furthermore, Renström and Westin expressed their concern about the security issue in that not all real estate owners want to enable other actors to have access to their documents. Thus, the municipalities have to be careful in adopting this dilemma. A question that arises is, “who is going to get access to the information, and who should check that the information is correct?” This also relates to the information asymmetry that some companies might capitalize on.

An interesting aspect is a theory of “a framework for blockchain technology,” which indicates the challenges for an application to get accepted. According to the theory, smart contracts fall into the fourth category, “transformation,” which means that the application is highly complex and could change entire social, political, and economic systems. In the manner of blockchain in transactions, this application would undoubtedly change the transaction process (Proskurovska, 2022; Westin, 2022). Thus, it would fall in the fourth category as well.
Beneath summarizes the risks and challenges of implementing blockchain technology in real estate transaction processes.

*Table 7: Risks and Challenges with implementing blockchain technology in transaction processes.*

<table>
<thead>
<tr>
<th>Findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies with a low turnover of properties would probably not profit from an adoption of blockchain technology.</td>
<td>(Westin, 2022)</td>
</tr>
<tr>
<td>The transaction would have to be made twice, once with blockchain and once without.</td>
<td>(Proskurovska, 2022)</td>
</tr>
<tr>
<td>Because of the issue of initial high cost with blockchain adoption, there are no big companies that want to be the flagship in the technology. Thus, the adoption must take small steps with small implementations that make the transaction process more efficient.</td>
<td>(Renström, 2022; Saull &amp; Baum, 2019; Westin, 2022)</td>
</tr>
<tr>
<td>Another challenge is that information asymmetry in a transaction can be beneficial for an experienced buyer or seller. Also, identity verification, security, and legal recognition show some of the issues in implementing blockchain.</td>
<td>(Westin, 2022; Saull &amp; Baum, 2019; Arthur, 2014; PWC, 2018)</td>
</tr>
</tbody>
</table>
6.4 Managerial implications

Blockchain in the real estate market is something we believe will be implemented. However, adopting blockchain can be difficult and quite long for the conservative market, that is, the real estate market. We think that the optimal for companies and governmental organizations is to take small steps toward a more digitalized market. We believe that a drastic implementation of blockchain is a risky and challenging transformation without the proper benefits for the risk. There will be implications for all the actors in the market. Both the buyers and sellers will be directly affected by increased transparency, and consultants and brokers will probably have a shift in their role during a transaction. Owners of properties will have an easier way of storing information and will be able to find information from the previous owner. We view most implications for actors as positive; however, an increase in transparency might be negative for professionals in the field since it might reduce risk and possibilities.

6.5 Suggestions for future research

**Law and regulation**

During the research of the challenges of blockchain adoption, the authors have stumbled upon many information gaps regarding the laws and regulations that many authors and interviewees have mentioned. Further research on what must change and how it should change could be an interesting continuation within this field of study.

**Third party in the transaction process**

The third parties in a transaction process, such as banks or brokers, have a significant impact on the transaction process. Adopting blockchain technology would either indicate that these parties might not be as useful as before or must evolve their current way of working. Deeper research into these questions is interesting since blockchain enables the sector to evolve drastically.
7 Conclusion

This thesis has investigated the impact of implementing a blockchain-based system in the real estate industry. The research contributes to a better understanding of blockchain technology and its possibilities and challenges in the real estate industry. The importance of adjusting to rapid changes regarding increased digitization was discussed in this thesis.

The shift to blockchain-based systems is most likely one of the modifications that must be made in both the financial and real estate markets for actors to maintain long-term market positions. The real estate industry is conservative and inflexible, so it needs to undergo a fundamental shift and adapt to a blockchain-based system. Based on the interviews and document analysis, it can be concluded that all the various actors were positive toward a blockchain-based system, resulting in a more secure and transparent market. Despite everyone's positive attitude regarding blockchain, the actors are unwilling to invest until its entire potential is shown. Because the technology is still in its early stages of development and has the potential to make the market substantially more transparent, the actors are naturally cautious about its application. Furthermore, the expenditures for implementing new technology are high, which is slowing down the process. The cost of building and implementing a new digital system, whether blockchain or anything else, is high, so the development costs are insufficient to prevent implementation.

Because blockchain has the potential to increase market transparency, one can debate whether investments will be more successful because of the increased transparency or whether there will be fewer real estate speculations. A market that is overly emotional and biased is inefficient. Due to fewer speculations, property cycles would be affected, and bubble impacts in the property market would be reduced. As said in the interviews by Renström and Westin, if the market has full transparency, both risk and opportunities get reduced.

In conclusion, a fundamental shift toward greater digitalization in the real estate sector is almost certainly required, with blockchain-based solutions being one possibility. One of the most significant obstacles to the smooth adoption of a blockchain-based system is people's perceptions of digital systems' trustworthiness. Another significant hurdle for blockchain technology is persuading businesses and organizations that it is trustworthy and worthwhile to invest in. Because of the quicker transaction processes, intermediates, such as brokers or banks, will probably have different work tasks. This can help save money while also improving the
efficiency of your transaction. One of the system's main benefits is its high level of security
and the fact that it is very hard to hack, making it difficult to tamper with or defraud the system.

We conclude that the time used for each phase in the acquisition process varies based on buyers,
sellers, and properties. Furthermore, despite that many view blockchain as a technology that
quickly disrupts real estate transaction processes, we conclude, based on interviews and
document analysis, that blockchain innovation instead progresses incrementally, which is due
to many challenges and risks associated with the technology, as well as the conservative nature
of the industry.
References


Corluka, D. & Lindh, U. (2017). Blockchain a new technology that will transform the real estate market, Royal Institute of Technology.


Konashevych, O. (2020B). General Concept of Real Estate Tokenization on Blockchain, European property law journal, 9(1-2), 1–45


Moura, T. & Gomes, A. (2017). Blockchain Voting and its effects on Election Transparency and Voter Confidence, Copyright held by the authors.


PWC. (2018). Blockchain is here. What’s your next move?, PWC.


Appendix

Appendix 1: Interview questions

Jaakob Westin – at Newsec

1. Could you please describe who you are and what your role is at Newsec?
2. What is the process of acquiring (buying) properties in your organization?
3. What is the process of selling properties in your organization?
4. Which parts of the property acquisition process are most time consuming?
5. Which parts of the property acquisition process are most resource intensive?
6. What are the benefits of increased transparency in the real estate market? Which actors would benefit the most from increased transparency?
7. What kind of benefits would there be if the property transaction process would be more transparent?
8. How would the property transaction process change if there would be more information available in the acquisition process?
9. How does the real estate industry view blockchain technology? Which applications do you think the technology is best suited for?
10. Do you think blockchain could create more transparency in a property transaction process?
11. Do you think it is possible to standardize systems and processes in the real estate industry? What challenges are related to such standardization?
12. How cooperative are the real estate market players in developing the industry?

Anette

1. Could you please describe who you are and what your role is at ….?
2. Digitization of the residential and commercial real estate market has been a hot topic in Sweden and globally. What are the primary benefits of this digital development?
3. The current residential real estate transaction process is costly and time consuming. How do you think implementing of blockchain technology would benefit the process?
4. Do you think blockchain could create more transparency in real estate acquisition process?
5. What do you think are the primary obstacles to implement blockchain in the real estate market?
6. What are the benefits for a real estate owner buy or sell properties on a blockchain based market? What risks are involved?

7. Do you see it as a risk that only few actors start using blockchain in transaction processes? How could the blockchain based transactions become more popular in the industry?

8. Do you think that the market is mature to adopt blockchain in the near future? Could you estimate a timeframe for the adoption?

Sven Renström – At Olov Lindgren

1. Could you please describe who you are and what your role is at Olov Lindgren?
2. What is the process of acquiring (buying) properties in your organization?
3. Which parts of the property acquisition process are most time consuming?
4. Which parts of the property acquisition process are most resource intensive?
5. What are the benefits of increased transparency in the real estate market? Which actors would benefit the most from increased transparency?
6. What kind of benefits would there be if the property transaction process would be more transparent?
7. How would the property transaction process change if there would be more information available in the acquisition process?
8. How does the real estate industry view blockchain technology? Which applications do you think the technology is best suited for?
9. Do you think blockchain could create more transparency in a property transaction process?
10. Do you think it is possible to standardize systems and processes in the real estate industry? What challenges are related to such standardization?
11. How cooperative are the real estate market players in developing the industry?