



Automation in real estate processes

Implementing a fully automatic digital real estate process when purchasing a home in Finland using the DIAS platform

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Master's Degree Thesis

International Business Management

2023

Master's Degree Thesis

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Automation in real estate processes. Implementing a fully automatic digital real estate purchase process when purchasing a home in Finland using the DIAS platform.

Arcada University of Applied Sciences: International Business Management, 2023.

Identification number:

27722

Commissioned by:

(No commissioner)

Abstract:

The digital real estate purchase process in Finland is not automatic throughout the pipeline. Further, the process using the digital trading platform DIAS (for the residential real estate market in Finland) only functions in one real estate purchase scenario, which is the focus of this thesis. There are steps that require manual work, mainly because of old laws and regulations. There is a need for automating the current real estate purchase process in Finland. The aim is to make the process smoother, thus increasing the usage of it. This thesis was conducted to find ideas and solutions for automating the process. This thesis includes three research questions. Identifying (1) the bottlenecks and (2) hinders in the process when it comes to automating the process, and then moving on to (3) solutions for the issues. This thesis is based on semi-structured interviews (main and follow-up interviews) with experts in the field. The experts represent the actors in the process. The biggest issues to tackle in the future are data and regulations. Costs need to be reduced when it comes to data searching. Data also needs to be standardizing and preferably single pooled. Outdated laws need to be updated and machine readable as far as possible to enable current and future needs. These same findings can be seen all over the world based on research on how to speed up real estate processes. This will inspire to further research and help with the development of solutions for automating the process. Being able to develop an automatic digital process for a basic real estate purchase scenario will create value-adding services and grow the ecosystem.

Keywords:

Automation, digitalization, real estate, qualitative, abductive.

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Glossary of terms and abbreviations used

Bearer instrument	The holder of a bearer instrument (for example a physical form) is assumed to be the owner. There is no specific information about the owner on the bearer instrument.
Brokerage	The commission paid to a broker for handling the selling of a real estate.
Cadastral	Data concerning land and properties rights and interests, including details. A showing of these records.
Code of Real Estate	Legislation (regulations, laws, rules, and amendments) concerning acquisition of real estates in Finland.
Digital and Population Data Services Agency (DPDS Agency)	Government agency in Finland. The Finnish digital agency.
Easement	The right to use or enter a property without possessing it.
Electronic Identification, Authentication and Trust Service (eIDAS)	A regulation valid for EU countries. The regulation ensures that electronic interactions between businesses are safer, faster, and more efficient.
Housing loan	A loan from a bank with the purpose of buying a real estate (a home).
Land Information System in Finland	An online service platform, run by the National Land Survey of Finland. It can be used for identifying owners and rights of use concerning properties.
Legal confirmation of possession	Registering of ownership (after the confirmed proof of ownership change needed is verified).
Mortgage	Legal agreement concerning the housing loan borrowed and details about housing loan information (interest, loan time, payment schedule, etc)
Mortgage deed	A mortgage deed is a confirmed certificate of a hypothec. The hypothec refers to a registered real security over a real estate. The certificate also states the receiver of the mortgage deed.
National Land Survey of Finland (NSL of Finland)	An official department in Finland, issuing cartography and keeping register on real estates. The local authority in Finland when it comes to updating information about ownership of real estates.
Notary	A witness for a real estate purchase when the purchase is not done digitally.

Proptech	Property technology. Information technology that helps with selling, buying, and managing real estates.
Property Transaction Service (PTS)	An online service by National Land Survey of Finland. Used for completing the registration of ownership and signing purchase agreement for a real estate purchase.
Real estate	The physical plot, including the house.
Tax office	The Finnish Tax Administration.
Transfer tax	A tax that the buyer needs to pay when acquiring a real estate.
Usufruct	A person has the right to use and benefit from a property, while the ownership of the property belongs to someone else.

1 Introduction

Digitalisation means implementing digital technology (Gartner, 2023). Digitalizing processes mean transforming manual work and processes into digital form, so that it can lead to for example, automation and financial benefits for a business (Kembro & Norrman, 2022). Automation is when the human intervention is minimized. Automation does not require digitalisation, but digitalisation enables automation, a paperless world, and replacing human presence with systems and machines. Previous research indicates that digitalisation can speed up real estate processes when being able to digitally distribute real estate data (Saul et al., 2020). Further automation saves resources when manual processes are replaced by automation (Schumacher et al., 2005). While Schumacher et al. research is for manufacturing, automating any manual processes can be assumed to lead to savings in expenses and time.

1.1 Background

From my own work experience, serving in the banking industry with real estate purchase processes for over 10 years (handling housing loan applications and helping buyers, sellers and real estate agents with real estate purchase processes), I can say that the digital real estate purchase process is not fully automated. Because of all the manual work, customers often find the real estate purchase process to be a complex process, frequently requiring time and patience. The actors in the process, for example, banks, are doing their own part in the process at their own pace, and some of the parts in the process can become bottlenecks that prolong the original time schedule. This can lead the buyer to think that something is wrong when not getting an explanation for the delays. The interviews conducted for this thesis highlighted the same problems. The process of buying a real estate in Finland is still, for the most part, old fashioned; the laws are outdated, even if you would do the purchase digitally (Interview: Koli, 2022). There are a lot of actors involved in a digital real estate purchase process: local authority, banks, real estate agents, and businesses offering platforms for a digital way of signing purchase documents (Interview: Heikkilä, 2022). One of these businesses that offer a platform is Digitaalinen Asuntokauppa DIAS Oy (DIAS). DIAS was established in 2018 (DIAS, 2022) and the platform is developed by Tomorrow Tech in collaboration with Nordic and Finnish banks,

real estate agents, Finnish authorities, and government officials (Tomorrow Tech, 2022). The platform was first used in 2019 for digital purchase processes when buying an apartment in Finland (DIAS, 2022). Since February 2022, DIAS has been able to offer the platform also for digital real estate purchase processes. DIAS is owned by local banks Aktia, Danske Bank, OP, and S-Pankki, and the biggest owner is Alma Talent, a Finnish media company focusing on digital solutions and services (Alma Media Oyj, 2022). The platform connects the buyer, the seller, the banks, and the real estate agents in the purchase process with a user friendly new solution (Interview: Koli, 2022). All of the actors in the purchase process need to act and react to each other in accordance with the law (Interview: Koli, 2022), for example the bank can't tell the real estate agent about details concerning any delays from the banks part because of bank secrecy towards their clients (Interview: Bank, 2022). The intent of the DIAS platform is to make the digital purchase process more transparent (Interview: Koli, 2022) by using distributed ledger technology (DLT) (Tomorrow Tech, 2022). Using DLT has been proven to increase transparency in processes that provides online and digital solutions when it comes to real estate processes (Konashevych, 2020). But before implementing DLT, when it comes to combining governance, authority processes, technology, and data, it requires further research to get the full picture of implications, risks, and benefits. Similar challenges with transparency exist elsewhere in Europe. For example, in the Netherlands, the possibility of implementing blockchain technology has been investigated as means to speed up processes for real estates and land registration processes (Veuger, 2020).

1.2 Aim of the study and research questions

According to the interviews conducted for this thesis, the real estate purchase process in Finland starts with a need to buy or sell a real estate and ends with the legal confirmation of possession. This thesis will focus only on a part of the whole process, starting with the real estate agent preparing and needing to upload data and documents into digital platforms (meaning that the buyer and seller are recognized and the price of the real estate has been confirmed), and ending with the legal possession of the real estate being confirmed to the buyer. The aim of this thesis is to find manual steps and bottlenecks in the researched process, and what it requires for the manual steps in the process to be automated. The research questions are: (1) what causes bottlenecks in the current digital real estate purchase process, (2) what are the hindlers for automating the process now, and

(3) what would it take to implement a fully automated digital real estate purchase process in Finland? According to the interviewees there is no previous similar qualitative research done on this phenomena in Finland.

1.3 Method and approach

This thesis follows an abductive research approach, where a plausible conclusion is presented based on previous knowledge and new empirical data (Davidsen & Højlund, 2021; Kovács & Spens, 1998). Even if some of the results and phenomenon in this thesis will be supported and explained by existing theories and the goal is an explanatory result, doing an abductive research will give new insights and produce results that can be of great use (Nenonen et al., 2017). The abductive argument is that a fully automated digital real estate purchase process could be achieved in the future. Empirical observations support this argument. It has already been partly proven by automation being achieved in other fields, where automating steps has been proven to bring benefits to the actors in the process (Schumacher et al., 2005). According to the interviews conducted for this thesis, we have already seen the benefits when some parts of the process have been automated with the help of using DLT, making the process more transparent than what it was before and more time saving.

The empirical part of this research was executed as a qualitative study using semi-structured interviews. This was necessary to do when looking for explanatory result and to make it somehow tangible when it comes to experience (Conrad & Tucker, 2019). The interviews included a main interview and a follow-up interview. The follow-up interview was included to bring qualitative rigor to this research and verify the validity of the primary data (Morse et al., 2002). The interviewees were selected based on their involvement and knowledge concerning the process researched. Later in the thesis, these are referred to as 'experts'. The interviews were conducted with a representative from a bank (anonymity promised for the bank), a representative from the National Land Survey of Finland (Pauliina Heikkilä), a real estate agent (Hanna Lehtikangas), and a representative from DIAS Oy (Annika Koli). These experts represent the actors that are involved in the process, taking care of their own part in the process when it comes to digitally purchasing a real estate in Finland. Interviewing these experts verifies the reliability of the data which is important in qualitative research (Morse et al., 2002).

Interviews were also conducted with two representatives from a workgroup, set up by Finland's prime minister Sanna Marin in 2022 to look at the current Code of Real Estate from 1997 that has been unchanged since then (Tervonen, 2021). The work group is tasked with finding solutions and suggestions for updating the law, enabling a more smooth process to concerning real estate trade in Finland (Interview: Kaivosoja & Tervonen, 2022). The literature review will include peer reviewed articles and journals, previous research on automation and digitalization, and the unified theory of acceptance and use of technology (UTAUT2) (Venkatesh et al., 2012).

I will start with defining the current process (depict the steps and phases) to present the steps that requires manual work and the bottlenecks in the process. The result will detail the different manual steps in the real estate purchase process in Finland and what it would require for the steps to possibly be automated in the future. The process includes a lot of manually required labour, one reason for this is the outdated Code of Real Estate which prevents a fully automated process for now (Interview: Heikkilä, 2022). I will discover the benefits for the actors in the process when automating manual the steps in the purchase process. I will then continue to present the actors point of views on the bottlenecks, hinders and what it would require to automate the steps that are not yet automated. The interviews showed that there is a pattern when it comes to adopting new digital technology, and it has been a slow start in Finland when it comes to adopting the digital real estate purchase process. I will use the UTAUT2 theory to explain and understand this behavior (Venkatesh et al., 2012).

The research will also open up what we can learn from the interviewees and from other research or related topics that need to be taken in consideration when it comes to understanding the future and finding solutions for the process of a fully automated digital real estate purchase process in Finland. The interviewees stated that there isn't enough data from using the DIAS platform, when it comes to digital real estate purchases, because of it's short existence. But we will, nevertheless, discover what has been learned since then. Hopefully this can inspire for further research for example to find solutions for automating some of the remaining manual steps in the process.

2 Literature review

In this chapter, I will review previous research that are relevant to this thesis and digitalizing and automating processes. I will also go through theories and frameworks that can explain adoption of digital solutions. Previous research related to my thesis are (1) digitalization, (2) automation, (3) blockchains and smart contracts, (4) machine learning, NLP, and AI, (5) technical aspects, and finally (6) factors concerning adaptation on technology relating to real estate purchase process. Continuing with (7) explanations on technology adaptations like UTAUT, UTAUT2, and Garner's hype curve. Ending with (8) a summary.

2.1 Briefly about digitalization in the real estate sector

Digitalization has been proven in complex processes with many actors (in foreign trade processes) to reduce handled paper documents, human errors, and lost time (Karabulut, 2020). Introducing digitalization into the real estate ecosystem changes business models, processes, IT systems, and services (Vigren et al., 2022). Digitalization also creates digital platforms and allows other industries to enter the real estate market. Businesses within real estate are used to new digital solutions, and thus better at absorbing new innovations concerning digitalization. There are some obstacles when looking at digitalization in the real estate sector. The companies can only strengthen the ecosystem if they have organizational capabilities to create and capacity to absorb innovations and digital solutions. It is difficult if an imbedded routine or process within a company does not lead to developing innovations. Actors in a process needs to work towards common goals and not rely too much on other inventing innovations. Achieving a fully digitalized real estate process will enable a lot of positive aspects: less need to rely on human recourses, increases transparency, connecting actors in the process, and enable smooth transactions, automation, and validation of data (Saull et al., 2020).

Other conventional industries, like the banking industry, has already seen and experiences the benefits of digitalization; decreased expenses, increasing revenues, and saving time (Paulet & Mavoori, 2020). Digitalizing processes leads to efficiency and introducing different fintech solutions that also generates benefits to the customers.

2.2 Automation for speeding up processes

Automation is for example, when programs, machines, and robots take over a process or work, and humans are no longer needed for executing that part (Benanav, 2020; Veuger, 2020). Automation truly speeds up processes. It enables complex design for processes, and for machines to learn, identify, and create. But in some situations, a human need to interfere even if the work is automated. For example, if the work or process needs a human to check the quality or correct potential errors. The reality of a fully automated process isn't possible currently if the process is too complex from before.

Previous research conducted in the UK shows that potential delays in typical property transactions are mostly related to data issues (Saul et al., 2020). It could be that the data isn't up to date, accurate, or easy to find (because it's not digitalized). And it's expensive to acquire. Which can cause lack of work motivation. Or there is lack of standardized format within data. Data format in general is an issue. There could be delays because software and data integration has not been considered. Re-negotiations between seller and buyer can delay the process, and if any changes need to be as a result. Financial issues can also delay, for example if the buyer isn't able to raise the money needed for the purchase. Barriers were identified when trying to solve how to speed up the process and tackle the bottlenecks. The barriers are operational, regulatory, and social barriers, which need to be overcome before new technology can be adopted. Data needs to be validated, when using this kind of technology, which increases costs. A Property Passport needs to be created to prevent delays in real estate transaction. But this would require new integrated digital technology and data sharing innovations to make it possible. The positive effects are that the transaction becomes transparent and increases data availability and quality. Regulations need to change to prevent any legal issues when implementing and using new technology. Due diligence is the most complicated to resolve when working on preventing delays. Here the study refers to information not being up to date, standardized, single pool, or trusted.

2.3 Blockchain and smart contracts for real estate processes

Existing smart contracts are based on a distributed network: either blockchain or distributed ledger technology (DLT) (Feng et al., 2019). This chapter will introduce these topics with relevant information when it comes to real estate processes.

Blockchain has been proven to have multiple benefits and be of use in the real estate field (Veuger, 2020). It's a system that can record data. Specifically recording transactions in a chain of blocks. Thus, the name blockchain. Every new block includes the new transaction data combined with the previous block's data. Blockchain can be used to coordinate the interaction between the actors in a process, and to record data for transactions (Garcia-Teruel, 2020). For example, bank transactions and ownership transactions. But blockchain hasn't been implemented or accepted fully in the real estate field due to lack of data and experience, even if an impressive cadastral would exist. If blockchain would be implemented in real estate processes, it should at least have a built-in option to alter data afterwards in case of previous data errors.

Moving on to smart contracts. Smart contract is a program, based on a distributed network, that can receive and use external data to then update it automatically within the program (Feng et al., 2019). The defined stages of a contract's life cycle work as inspiration when developing smart contracts. It includes 1) preparation, (2) examining and approving the contract, (3) signing the contract, (4) reviewing the contract and situation, (5) performing the actions according to the agreement, and (6) outsourcing certain steps if necessary. Any changes done to the content of the agreement caused by disputes are supervised by relevant actors. Changes to a contract can cause problems in the timeline of an electronic process, even if updated synchronization of steps can be achieved. A good smart contract would be able to eliminate these kinds of issues and be user friendly to truly replace a traditional contract.

Smart contracts speed up and increase reliability of transactions, enable automating processes, and can also enable utilization and integration of artificial intelligence (Feng et al., 2019; Frantz & Nowostawski, 2016). Negative issues to a smart contract based on blockchain are fraud and assets being stolen. Any bugs and issues in a network need to be fixed for a smart contract system to work. The idea of a smart contract system is to replace humans with computers, automating steps and processes. But there is no need for a smart contract if the human is more accurate than the computer. One example for this is when contracts are only readable by humans. But there has been previous research done by Frantz and Nowostawski in 2016 where a semi-automatic method was introduced as a potential solution for these kinds of situations. More about this in the next chapter (2.1.4).

Another example is the importance to follow laws for the contract to be realistic. But most laws are not truly readable by computers. This could be solved by turning text into machine language, introducing computational laws. Effective supervision needs be ensured when enabling auto-execution to prevent possible loopholes.

Previous research before 2020 points out that a man-made smart contract is not truly intelligent (Feng et al., 2019; Sentamilselvan et al., 2021). It has bad abilities to detect risks and can only execute simple tasks and transactions. For a smart contracts to be considered intelligent when creating contracts, it would require for example speech recognition and ability to understand and process speech and text like human does (natural language processing, NLP). It would also require ability to analyse data to recognize the model of the transaction and do security checks based on text or logic. Existing smart contracts can't adapt to other new data and rules to create automatically new contracts for new scenarios. This affects compatibility and the scalability of using smart contracts. Validation of terms is an important part, and some argue that machines lack the ability to guarantee fairness. Others argue that machines can absolutely guarantee fairness, because machine's objectivity is on a totally different level then what a human's is; humans have the risk to fall for a sentimental view with analysis and results.

There are different models when it comes to building smart contracts (Feng et al., 2019). Research suggests that the best method for future smart contracts is to break down the data into components to enable life changing options. Meaning that contracts are split into smaller root contracts, molecular contracts, and atomic contracts. In this model there is a logical order to the contract's function and when executing operation and updates. When there is a logical order for the smart contract to execute actions, it can function autonomously and automatically (Chen et al., 2018).

There has been an extensive international exploration done between 2017 and 2019 concerning the impact in the Netherlands of integrating blockchain technology in real estate processes (Veuger, 2020). The aim was to understand whether blockchain is the "right" option now to implement in real estate processes or if it's better to wait for more disruptive technology. The research included data concerning real estate projects and processes (current and initiatives) that are influenced by blockchain technology. That data showed that implementing of blockchain into real estate has increased rapidly worldwide,

since 2016. And adaptation of blockchain happens globally, evenly spreading in many local markets when it comes to integrating it to land registry protocols. Most initiatives have been in USA and England, USA being the leader. Conclusions were made that there is still more research needed concerning the benefits and potentials of integrating blockchain. Findings show that there are properties with many different existing rights and agreements which lead to complex real estate processes. Other previous research shows smart contracts to be expensive, inefficient, and mostly single applications when it comes to using smart contracts for complex real estate processes (Feng et al., 2019). A new smart contracts model is needed to tackle these current issues.

Further development of smart contracts would enable the use in a larger scale (Feng et al., 2019). For example, smart contracts would be able to adjust to individual needs when automatically generating contracts. In addition, applying smart contracts can change current transaction structures and models. But regulatory requirements complicate the development of processes (Veuger, 2020). For example, EU countries need to consider eIDAS and other relevant regulations. In this case integrating blockchain technology will be too complex and expensive, and the cost exceeds the benefits.

With blockchain the data is stored in the block at all the actors, which means that any data is immediately and simultaneously updated and verified: you can trust that everyone has the same information (Veuger, 2018, 2020). This would increase transparency but decrease the importance of an actor's role in the real estate process. Using blockchain would be a simple solution for a country without a proven track record or property ownership (excluding corrupted countries), to make the processes transparent, more effective, and safer. Which in order leads to more trust towards the system.

2.4 AI to manage contracts

Using and creating artificial intelligence (AI) has many benefits (Qadir et al., 2022). One benefit is that the AI is bias throughout processes and pipelines. Another clear benefit is that it increases profits in a business. For example, Linear is using AI with the mission to decrease manual work for real estate agents and speeding up processes (Linear, 2022). They have created an AI called AIDA; a machine that uses given keywords to produce text that mimics text produced by humans. According to Linear it's the world's first AI

that produces presentation text used for selling homes. AIDA is still learning and developing better results; the more the users use AIDA the better the result. When there are already machines producing texts, one can assume that it would also be possible to have machine that interprets contracts.

Conflicts arise in processes when wanting to combine automation with AI (Frantz & Nowostawski, 2016). When wanting a machine to read contracts that only humans can read. Natural language processing (NLP) is one solution for this (Mukherjee & Bala, 2017; Sentamilselvan et al., 2021). NLP works as an interface between the machine and the human made text, trying to understand by examining human text or speech. Machines using NLP can even detect irony, sarcasm, and even emotions in human language. It requires the right input with coding, data, categorization, and classification rules for NLP to produce a successful output. Easier specifications and encodings are enabled by introducing high-level language into smart contract's capabilities (Frantz & Nowostawski, 2016). Also, systematic modelling of the contracts helps. Meaning that the contracts is made into a collection of codes and data that shows the functions and states.

Previous rapid development of AI has thought that the important factor is to test the AI (Qadir et al., 2022). To find potentials for AI and identify risks before integrating it to any process. It is critical to understanding how the AI comes to a result and important to have transparency in a process where AI is integrated in decision-making.

2.5 Current state of technology in the real estate business

The proptech (property technology, also known as real estate technology) sector with its start-up companies and new technologies play a global role when looking at digitalizing and automating real estate processes (German PropTech Initiatives, 2016; Tagliaro et al., 2021). Proptech started emerging in the US and in the UK in the early 2000s and most investments and initiatives are today made in the US, the UK, and China.

According to Veuger (2020), we are not currently living in a typical era. The real estate market, blockchain, and disruption will continue to evolve, which will continue to effect behaviours and have a social impact. Previous studies implies that we should wait for better and cheaper solutions if blockchain isn't considered to have strong hold in the

market. The issue with waiting is that we don't know how long it will take for blockchain to develop. Blockchain has been a welcomed "wake up call", because the current systems are old fashioned which leads to more human mistakes and errors, asset theft, and risks. There has been a test using blockchain as a technical solution in real estate (transaction and mortgage deeds processes) in Sweden during 2016. A process was developed with the help of Lantmäteriet (the Swedish local authority issuing cartography and keeping register on real estates), banks, and technology and solution developers for land administration. The aim of the test was to find risks and understanding the issues before blockchain could be implemented into real life real estate processes. They also wanted this test to inspire others to follow and develop the ecosystem. The result showed that a secure real estate and mortgage deed process can be achieved in Sweden when (1) the data is digitally filed. (2) The blockchain will ensure and secure the authenticity of the data and confirmations (signatures, confirmation of ownership, and processes done concerning the real estate). (3) The Lantmäteriet needs to store the blockchain information including any proof and (4) information needs to be confirmed by third parties (banks, real estate agents, seller, buyer, etc). (5) The files and records will be public unless the local law forbids disclosing it. (6) Everything should be stored in the blockchain because there is no further investigation on what risks there are if implementing a bearer instrument. (7) To further prevent forgery or someone stealing a property the process can have strengthen identification procedures (for example, more required identification or multi signatures, etc.). The risk for forgery and theft is small, because it would require someone to enter a new similar process with stolen previous information and data.

Smart contracts have a lot of potential when it comes to real estate market; renting, selling, buying, and managing real estates (Hedera, 2022; Peranzo, 2022). The real estate market is expected to grow annually over 5% between 2022 and 2030. It is expected that more solutions are being developed and at a faster pace. The real estate market is also expecting to change, with real estate agents still having a role in the future within connecting buyers and sellers. Today smart contracts are used in real estate mainly within the context of managing the use of data, transferring property ownership, rental and lease agreements, and investments concerning real estates.

There is a clear market trend when it comes to software development, and that's applying functions supporting application programming interfaces (APIs) (Nawaz et al., 2022). API is basically a web service where data can be transferred, and tasks programmed. Implementing APIs allows different businesses from different industries to access a specific process, creating new platforms, growing ecosystems, and it creates new collaboration opportunities with value-adding services. Companies and businesses using APIs are for example Google and Amazon. APIs help increase efficiency in programming tasks when businesses can with their own digital systems connect with each other remotely, via the web, in a standardized way. It is so popular and there are so many options for web APIs that new ones are created constantly and in many industries. The consequences are challenges like choosing the right option for a business or market. The internationally known Finnish elevator company Kone is also investing big in APIs. They have their Kone Digital Platform, where integrating APIs creates new services and they are looking for new collaboration opportunities with other businesses (Kone, 2022). They want to create a new world and something new with APIs. For example, when you enter an elevator, it starts to play your favourite song. Or when you order food, a robot is delivering and communicating with the elevator to access you on your floor in a building.

2.6 A short introduction to research on adaptation of technology

A study was conducted in Malaysia about understanding the importance, the attitudes, and the viewpoints on adopting AI (Rahman et al., 2021). But also, the challenges of adopting it to the banking industry, which has been considered a conventional industry. The assumption was that the user's attitudes effect the implementation of AI in the industry. The research showed that AI is important to implement when it comes to preventing risks, detect fraud, and detect money laundering. The challenges of implementing AI are lack of regulation requirements for AI, security issues, and data privacy. And the lack of skills and compatibility issues when it comes the IT infrastructure. There are factors that has a big impact and affects the potential user's attitudes and intentions on adopting AI. The result shows that the factors have to do with how the user's perceive AI: if they can trust it, if it's useful, any risks that follows, and how other people around the user's perceive AI.

Social influence and how humans perceive the usefulness of a financial technology affects if and how it is adopted (S. Singh et al., 2020). There are different approaches when looking at how humans perceive the use of technology (Qadir et al., 2022). It can be the human's behavior that drives to the development of technology. Or a technology (or a feature of a technology) that suddenly changes the behavior of humans. However, external sudden changes in the environment that forces quick solutions and adaptation of new technology can change the view on adapting it. For example, the Covid-19 pandemic has forced businesses to speed up digital solutions and transformation, and customers to take the first leap towards adapting to new technology sooner. This has led to recognizing the benefits and having a positive view on further developing solutions and using technology. (Starr et al., 2021)

2.7 Explanations on technology adaptation

The theories will help explaining what effects the users' acceptance and usage of new technology. Because this thesis has to do with a digital service, I will explain the research on extending the unified theory of acceptance and use of technology (UTAUT2) which is an update on the unified theory of acceptance and use of technology (UTAUT). UTAUT is the first theory that explain the acceptance of technology. But the technology UTAUT explains is considered old, and therefore UTAUT2 is more fitting to this thesis when it focuses on new technology.

But before jumping into UTAUT2 it is important to first understand three other models and theories concerning how individual acceptance work, and what affects the result of a person using or not using a technology (Venkatesh et al., 2012). There is (1) the technology acceptance model (TAM). TAM helps us understand a user for a new tech: the process how a user starts to adapt a new technology by having previously formed attitudes that forms opinions (Chuttur, 2009). These opinions and attitudes can form even before trying the new tech, and they affect how the user perceive the usefulness of the new tech. External variables can affect the user when figuring out if the tech is perceived useful. Then there is (2) the theory of reasoned action (TRA). TRA gives possible explanations to how people behave in specific situations (Nickerson, 2022). For example, a negative feeling about and towards the new tech can make someone not wanting to use it. But also vice versa, positive intentions will increase the probability of someone using

it. The final theory is (3) the social cognitive theory (SCT) which explains the users' expectations for how the new tech will perform and how the user expects himself/herself to perform while using the new tech (Yang & Zhang, 2022). It all depends on the users' previous knowledge; it determines if that person has chosen the right skills to achieve a certain goal.

2.7.1 The unified theory of acceptance and use of technology (UTAUT and UTAUT2)

The UTAUT explains how people's behavior works when deciding to accept and use a new tech without experience from previous similar techs (Venkatesh et al., 2012). And the UTAUT2 includes having the experience from before.

According to Venkatesh et al. (2012) the original model (UTAUT) behavior affects by four different elements. The elements are (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. People tend to have expectations on how a new tech works and how much effort they will put into using the new tech. The social factors affect their behaviors and the people's compatibility affect the result of using a new tech. The new model (UTAUT2) includes three more elements in addition to the four old ones. The elements are (5) hedonic motivation, (6) price value, and (7) habit. The people having had relations and experience with tech from before tending to have behavior that affects intentions of using the new tech.

2.7.2 Gartner's hype curve

The process of people adapting to new technology and new innovations can be described with the help of the Gartner's hype curve, or cycle. The Gartner's hype curve explains that when there is a new tech it usually triggers interest after which there is a natural hype where the adaptation and usage increases (Gartner, 2022). The current users trigger more user, and finally the usage peaks. During the peak the companies should be active with developing the new tech and better at communicating the value, it is a mistake to let leave it alone or ride the peak phase for too long. Many companies make this mistake, and it usually leads to the danger zone: something happens that results in a rapid descend in users. The rapid drop in the curve explains that the users' or customer's expectations wasn't met, or something failed about the new tech ending in users drop off.

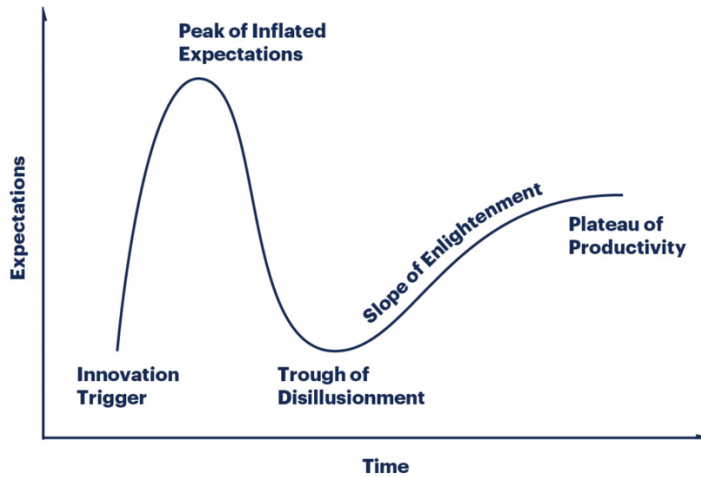


Figure 1. Garner's hype curve

After this there is basically only two options: (1) try to build up the hype again by improving the users' expectations and become productive (to become understood a establish a strong hold in the market), or (2) start all over again (thus called the cycle) (Gartner, 2022). It is up to the company to decide what is more beneficial for them and which techs they should gamble on.

2.8 Summary

Digitalizing and automating steps and phases in the real estate purchase process will speed up time, minimize errors, decrease costs, increase effectiveness, and make the process smoother (Benanav, 2020; Paulet & Mavoori, 2020; Veuger, 2020). When it comes to bottlenecks in real estate processes, most issues are connected to data (Saul et al., 2020). Data can be hard to utilize, find, and to trust, and expensive. Data validation can also be time consuming. Any changes that need to be done and re-negotiations concerning data also causes delays. Hinders have to do with regulations, operations, and even social barriers. Data needs to be standardized. For the process to be fully accepted and adopted, it needs to generate benefits, be transparent, and be trustworthy (Paulet & Mavoori, 2020).

The underlying technology for smart contracts is based on blockchain or distributed ledger (Garcia-Teruel, 2020; Veuger, 2020). The distributed network ensures that data is up to date, standardized, correct, and simultaneously updated for all the actors. Smart

contracts are used for executing actions within a process, to then fulfill an agreement term (Hedera, 2022; Peranzo, 2022). In real estate they are used for example, when managing the use of data, transferring property ownership, management of rental and lease agreements, and managing real estate investments. Blockchain hasn't been fully implemented in real estate processes yet (Garcia-Teruel, 2020; Veuger, 2020). It is constantly being researched worldwide, to learn if it's the right option and how it can be used within real estate processes. To implement smart contracts and blockchain technology, it would require all actors in the process to adopt to the new technology (Saull et al., 2020).

There seems to be a negative attitude towards smart contracts when discussing the intelligence of these contracts (Feng et al., 2019; Sentamilselvan et al., 2021). NLP, analysing skills, and model recognition needs to be introduced into the smart contracts. But when it comes to objectivity, machines seem to have the upper hand. When implementing smart contracts challenges are identified when texts are not readable by machines (Feng et al., 2019; Frantz & Nowostawski, 2016). Laws and contents need to be standardized for this to be possible. They also need to be, as much as possible, translated into machine language. This would enable smart contracts, automation, and digitalization to be further developed.

To automate a process while using smart contracts, the best options seem to have to do with breaking the process into smaller pieces: automating one step at a time (Chen et al., 2018; Feng et al., 2019). And then tying the parts together in a logical way. When a true automatic, digital process is achieved it will increase transparency (Veuger, 2018, 2020). But it will decrease the actor's roles in the process. The ecosystems will grow, and new opportunities will arise when introducing interfaces into platforms (Vigren et al., 2022). It will for example, create value-added services. APIs seems to be of big interest, and can lead to creating value-adding services (Nawaz et al., 2022)

New technology within real estate is a hot topic (German PropTech Initiatives, 2016; Tagliaro et al., 2021; Veuger, 2020). Different technologies (especially blockchain) and new solutions are constantly being tested. New technology companies are being established all over the world and in different industries. The intent is to keep innovating technology for further potential developments concerning effectiveness and efficiency.

Technology has its own evolution, and it seems to speed up the more time goes by (Tagliaro et al., 2021). But there aren't only technical and regulatory aspects when implementing new technology. The technology itself or developing technology is worth nothing if the users (the people) doesn't use this technology (Qadir et al., 2022; Rahman et al., 2021; S. Singh et al., 2020; Starr et al., 2021). It all comes down to behaviors, attitudes, and perceptions. Usually, one can expect a small sample of users to start using the new technology (Venkatesh et al., 2012). And if everything works and the users experience receiving of value, the rest will follow in time. Any negative associations can destroy or have a negative impact on intentions and expectations (Nickerson, 2022; Yang & Zhang, 2022). Sometimes users get hyped by new technology (Gartner, 2022). This can lead to the users increasing in the beginning when interests are triggered. Companies have to figure out ways on not losing the hype aby not meeting the users' expectations.

3 Method

Work on this thesis started with me reviewing the current real estate purchase process based on data at the DIAS webpage. I systematically identified phases and steps in the process, and I identified steps that is considered manual work. With this information at hand, I outlined the researched process. To get answers to my research question I needed to verify the content of the process and get a better insight to it. I also needed to identify all manual steps and the bottlenecks in the process.

An abductive research approach was chosen when looking at my starting point with this research (having only previous uncompleted set of data) and what I wanted to achieve. An abductive research approach introduces new ideas and insights (general or particular), and abductive reasoning helps with creative thinking for a plausible conclusion (Kovács & Spens, 1998). For example, based on previous research, plausible conclusions can be done concerning automating the process. The real estate purchasing process can be automated, but there is an incomplete set of data to conclude on what it will take to do this. In this thesis the result will produce a case: introducing new ideas and insight that can help when further automating the process in the future.

Due to elusive primary data and the lack of data availability, I needed to go directly to the experts. Actors in the process can open up what it takes to automate it. This would help find solutions and answers to my research question and verify the outlining of the process. I chose qualitative research as a method for collecting the primary data. The technique I used was having semi-structured interviews with the experts. Using this technique would give more depth to the answers, leaving room for more explanations, and to find new information (Myers, 2013; Saunders et al., 2019). Interviewing the experts would bring validity to my primary data (Myers, 2013).

3.1 Limitations in the research

In this thesis the real estate purchase scenario investigated includes limitations that are listed in the table below.

Table 1. Limitations in the research

Actors and Real estate	Limitations
DIAS	<ul style="list-style-type: none"> • The DIAS platform is used in the process.
Seller	<ul style="list-style-type: none"> • 1-2 sellers. • Alive. • Of legal age. • Can legally sell and buy real estate without any additional legal permits. • Has a mortgage from before that needs to be paid off. • Has been living in the real estate for at least 2 years continuously. **
Buyer	<ul style="list-style-type: none"> • 1-2 buyers. • Alive. • Of legal age. • Can legally sell and buy real estate without any additional legal permits. • Taking a new mortgage for buying the real estate. • Pays transfer tax for buying the real estate.
Real estate agent	<ul style="list-style-type: none"> • Hired by the seller.
Bank	<ul style="list-style-type: none"> • The seller's bank • The buyer's bank. • The banks can be the same or different banks.
NLS of Finland	<ul style="list-style-type: none"> • NLS of Finland is involved in the process.
Real estate	<ul style="list-style-type: none"> • A plot with a ready built house. • The price has been determined and accepted by the seller and the buyer. • The house has no need for renovations • No need for changes to previous documents concerning the real estate (excluding the change of ownership and transferring mortgage deeds) • There is enough of mortgage deeds from before (no need to order more) • Mortgage deeds are electronic.

** According to the current tax law the seller doesn't have to pay taxes on any profit that is made from selling the real estate if the seller has owned and been living in it for at least two years continuously (Verohallinto, 2022).

Real estate purchases that do not fit these criteria have not been investigated.

3.2 The interviews

The interviewees were selected based on their current position and working experience, they needed to preferably be in a higher position and working closely with development stages. This was important for the primary data and the result to be considered reliable and of good quality (Riege, 2003). I achieved this by informing my requirements in my request for an interview. I contacted in total seven different banks, of which three answered, and in the end only one agreed to an interview. Concerning real estate agents, I contacted four different companies of which two agents answered, but only one was suitable for an interview. DIAS and NLS answered promptly and gave their consent to participate. It was suggested that I should also interview a person from the Finland's Ministry of Justice, specifically someone from a task group that is working on the possibility to update the Code of Real Estate with the intent for potential automation and digitalization in the future. I succeeded in establishing contact with this task group. Only the bank requested anonymity, which was promised.

The interview questions were sent via e-mail beforehand to all the experts. Based on the experts feedback I needed to do some small changes to the questions before sending the new updated version. I used the same questions for all the experts. The design of the final questions had six themes that consisted of 1-8 questions per theme. The structure included themes about (1) the interviewers knowledge of the researched topic, (2) statistics on digital real estate purchase usage, (3) identifying phases and steps in the current purchase process as it works today, (3) finding the bottlenecks in the current process, (4) finding the steps in the purchase process that are not automated, (5) finding hinders and bottlenecks for automation of the process, and recognizing benefits from automating steps, and finally (6) the experts view on the future of digital real estate purchase process, and what would be required for the process to be fully automated.

The interviews were first booked as main interviews for 60 minutes with each of the experts. After this I booked 30-minute follow-up interviews. The idea with the follow-up interviews was to verify the result to bring rigor to the qualitative research (N. Singh et al., 2021). Microsoft Teams was used as the platform for the remote meetings because it enabled using automatic transcript and recording the video meeting. Transcription was necessary to do because of the method used in this research: in qualitative research the

data needs to be in text format (Myers, 2013). The recordings would help in a different way: going back to observe interviewees behaviors that could suggest explanations to some results (Myers, 2013). Some interviewees did not answer some questions because the interviewee did not want to explicit their view. In these cases, the interviewee was afraid of getting judged for expressing views and opinions in a certain way. But all the interviewees could explain their part in the process, and they did answer the questions concerning what they think it will take to fully automate their part in the process. Everyone could also identify at least some bottlenecks, either told by other actors in the process or bottlenecks they encounter themselves.

3.3 Analysing the data

After the interviews were conducted, I first checked the transcript: listening to the recorded meetings while reading the transcript and correcting any textual errors. When analysing the primary data from the main interview, I categorized and labeled the interviewees answers with the help of the themes used in the interviews, and then looked for patterns and similarities (Saunders et al., 2019). I wanted to find out if people were telling the same things, describing the same phases and steps in the process. This enabled me to outline the whole process and point out the steps that are done manually. This allowed me to depict the whole process (see Figure 3), which led to creating Table 1 that explains the specific researched area withing the whole process. After this I searched for themes and answers to my research questions; (1) the bottlenecks in the process, (2) the hinders in the process that could be the cause for not automating steps in the process, and (3) what it will take to automate the manually handled steps. The bottlenecks and hinders were vital to find because they can explain why a step in the process is not automated. But the bottlenecks could also present potential benefits to why a step should be automated, giving new insight and reasons for automation. This resulted in Table 2, which describes the ten themes with its key content to my research questions.

4 Results

This chapter includes depicting the process, indentifying the manually handled steps, and answering the research questions.

4.1 Outlining the process

According to the experts the digital real estate purchase process starts with the buyer wanting to buy a real estate and the seller wanting to sell a real estate, and ends with the confirmation of legal possession (see Figure 3). This research area includes and focuses only on the parts that are described in the red boxes (Figure 3). Starting from when the buyer and seller have agreed on the real estate, price and terms for the purchase, and ending with the confirmation of the legal possession and the mortgage deeds being transferred. The researched scenario does not include the part where the buyer signs the housing loan agreements. It is only mentioned briefly (even though manually required steps can be identified: it's a separate platform provided by the bank where mortgage documents are signed). The experts also brought forward that there can be some small differences in more specific process details when it comes to banks. This is why the explanations are made with a general view on steps. Property Transaction Service (PTS) is also a separate platform, but it is required and necessary for the digital real estate purchase to be legally confirmed.

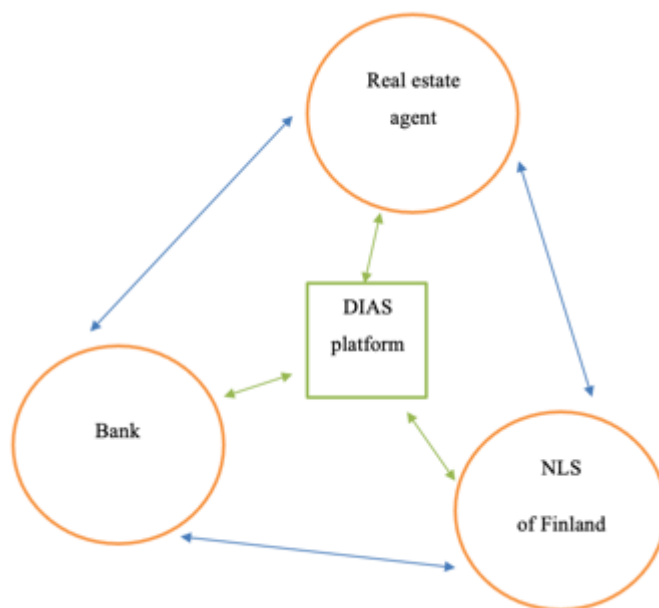


Figure 2. Interfacing vs. traditional way

Before the digital real estate purchase was an option, the actors needed to connect with each other directly via phone, e-mail or sending paper work to share data and information (blue lines in Figure 2). The idea with the DIAS platform is that the bank, the real estate

agent, and NLS of Finland don't need to connect with each other outside the platform. Information flow and the process proceeds via the DIAS and using interfaces (green lines in Figure 2), and automatic e-mails are sent to the buyer and seller when they need to execute an action. It should be "straight forward" and transparent. But the experts identified contact issues that creates bottlenecks in the progress. These issues has to do with the transparency of the process. More about this later in the chapter, when discovering the bottlenecks. Now moving on to depicting the process (see Figure 3).

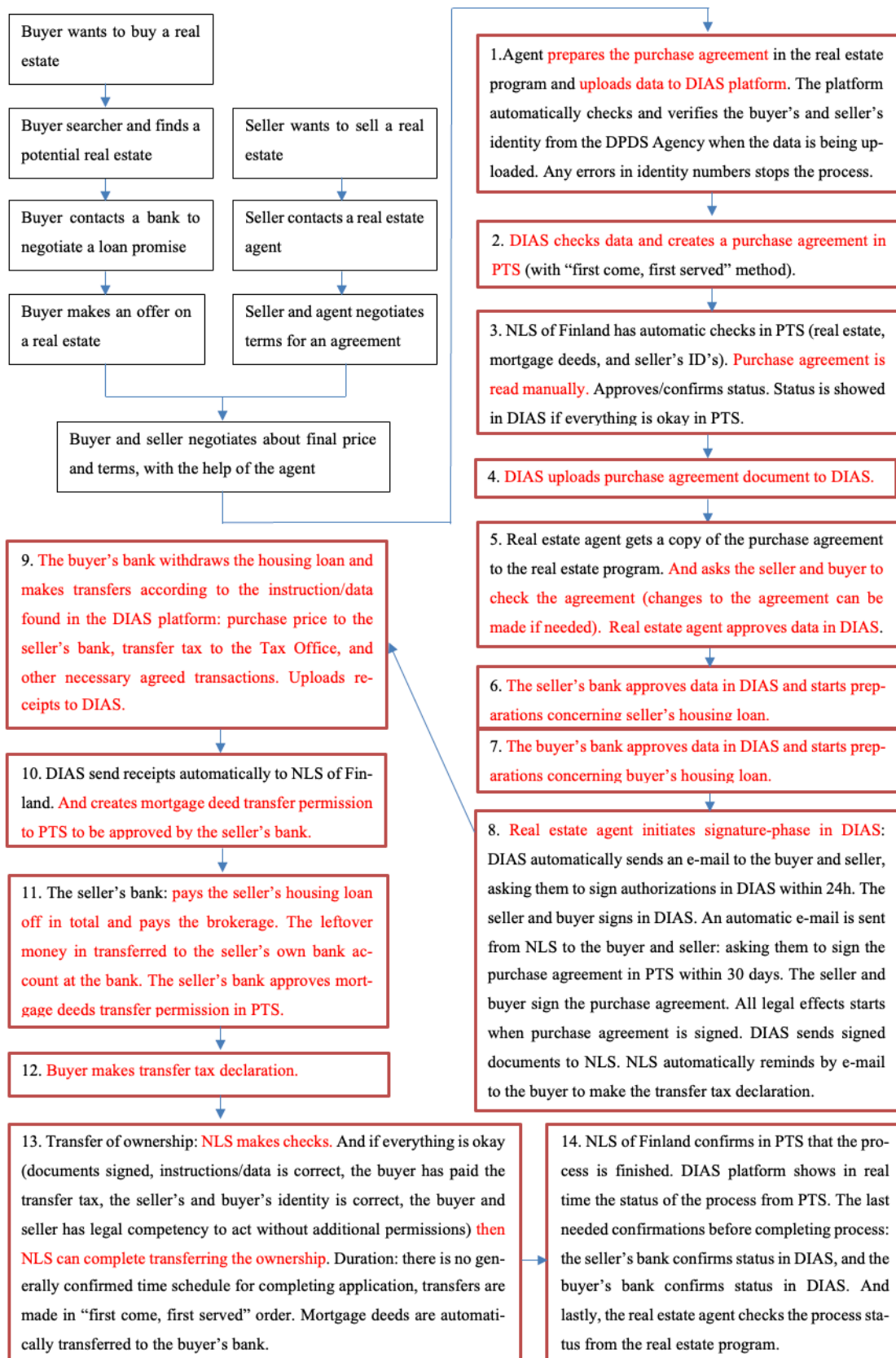


Figure 3. Complete model on the real estate purchase process including the digital purchase part

Figure 3 shows that the whole process is massive and extensive. The limited researched digital real estate process is described in table 1 (the manually handled steps that were identified is highlighted with the color red). The real estate agent prepares the purchase documents which needs to be approved by National Land Survey of Finland (NLS of Finland), the buyer, and the seller. After this the banks can start preparing for the actions concerning the housing loans, other payments, and other needed actions. The seller has no need for a notary to verify the sale, because the sale is done digitally. The real estate agent initiates the signatures phase. After this no more changes can be done to the data used in the process. After authorizations are given in DIAS and the purchase agreement signed in PTS, all legal effects starts. The buyer's bank withdraws the buyer's housing loan, pays the purchase price to the seller's bank and pays transfer tax. The buyer needs to do the transfer tax declaration directly to the Tax Office. After this the seller's bank pays off the seller's mortgage in full, and pays the brokerage to the real estate agency. After this NLS of Finland completes the registration of ownership and transferes the mortgagage deeds to the buyer's bank. Final checks and approvals to finalize the process are made in DIAS and in the real estate agents own program.

4.2 Answering the research questions

The whole process has been outlined in the previous chapter. Now the manual steps in the researched process are identified before moving on to answering the research question.

The manual steps identified are connected with preparing the purchase agreement, checking signatures and status updates, updating status during the process, making payments and uploading receipts, transfer tax declaration, and approving the updating of the real estate ownership (see Table 2, text highlighted with red color). The DIAS platform uses interfaces so that the actors can communicate with each other during the process updating of the following step and status: everyone waits until the status update in DIAS indicates for the next step to start.

As it works now, the data is manually inserted into the process and the people in the process needs to coordinate and follow the order of the actions, as they have done before the digital process. (Interview: Heikkilä, 2022).

The main phases in the process

	Preparing purchase agreement	Checks	Initiating purchase	Signing documents	Payments + actions	Change of ownership	Final checks	
The main stages inside the phases								
<i>Actors in the process</i>								
<i>DIAS</i>	<ol style="list-style-type: none"> 1. Check information. Creates the purchase agreement to PTS with data from DIAS. 2. An automatic signature request is sent from DIAS to the seller and the buyer. 24h time limit for signatures starts. 3. Uploads purchase agreement document to DIAS after NLS of Finland checks are done. 4. An automatic reminder is sent if any signatures are missing 1 day before the PTS 30-day signing time limit. 		<ol style="list-style-type: none"> 1a. Signs authorizations in DIAS. Time limit 24h. 1b. Signs authorizations in DIAS. Time limit 24h. 3a. Signing purchase agreement in PTS. Time limit 30 days. 3b. Signing purchase agreement in PTS. Time limit 30 days. 		<ol style="list-style-type: none"> 3. Receipts are sent automatically via DIAS to NLS of Finland. Mortgage deed transfer permission is initiated by DIAS in PTS for seller's bank to approve. 			
<i>Seller</i>	<ol style="list-style-type: none"> 5. Approves the purchase agreement. 				<ol style="list-style-type: none"> Transfer tax declaration is done to the Tax Office. (The Tax Office informs NLS of Finland when declaration is done). 			
<i>Buyer</i>	<ol style="list-style-type: none"> 6. Approves the purchase agreement. 						<ol style="list-style-type: none"> 3. Checks the process status from the real estate program. 	
<i>Real estate agent</i>	<ol style="list-style-type: none"> Prepares draft of the purchase agreement in the real estate program. Uploads data/information/instructions to DIAS. 		<ol style="list-style-type: none"> Initiating signature-phase in DIAS. (No changes can be made to the purchase agreement after this) 				<ol style="list-style-type: none"> 3. Checks the process status from the real estate program. 	
<i>Seller's bank</i>	<ol style="list-style-type: none"> 7. Checks information in DIAS. Approves the draft in DIAS. Starts with preparations for the seller's housing loan (checks instructions and that there will be enough money to pay off the old housing loan). 				<ol style="list-style-type: none"> 4. Receives money from buyer's bank, pays seller's housing loan off and pays brokerage according to the instructions. Approves in PTS the permission to transfer mortgage deeds. 			<ol style="list-style-type: none"> 2a. Gets notified in DIAS of process status. Completes process by acknowledging status by accepting it.
<i>Buyer's bank</i>	<ol style="list-style-type: none"> 8. Checks information in DIAS. Approves the draft in DIAS. Starts with preparations for the buyer's housing loan (buyer signs the bank's documents and is asked by the bank to do so before the process continues). 				<ol style="list-style-type: none"> 2. Withdraws buyer's housing loan. Pays purchase price to seller's bank and pays transfer tax to Tax Office. Uploads receipts to DIAS. 			<ol style="list-style-type: none"> 2b. Gets notified in DIAS of process status. Completes process by acknowledging status by accepting it.
<i>NLS of Finland</i>	<ol style="list-style-type: none"> 2. Automatic checks are made when uploading data to PTS (real estate, mortgage deeds, and seller's ID). The purchase agreement is checked manually + confirmation to DIAS. 			<ol style="list-style-type: none"> 2. An automatic e-mail is sent to the seller and the buyer, asking them to sign purchase agreement in PTS. 30-day time limit for signatures. 	<ol style="list-style-type: none"> 1. Automatically initiates the process of change in ownership. Automatic reminder is sent by e-mail to the buyer to do the transfer tax declaration. 			<ol style="list-style-type: none"> 1. Sends information to DIAS, confirms that the process is finished.

Table 2. The digital real estate purchase process execution model

The reasearch questions and the key points are gathered in Table 3 below. The first research question is (1) what causes bottlenecks in the current digital real estate purchase process. The bottlenecks are issues that slows down the process and causes mostly irritationsm interuptions or confusion. These bottlenecks can partly or wholly be resolved by automation. The second research question is (2) what are the hinders for automating the process now. Identified hinders for automation are significant issues that are seen as actual hinders that can't be tackled with automation. The third research question is the result: (3) what will it take to automate steps and phases. The experts recognize and identifiy what changes are needed for automating the process.

Table 3. Matrix: research questions and result

Themes	Question 1. BOTTLENECKS	Question 2. HINDERS	Question 3. SOLUTIONS
Human errors	<ul style="list-style-type: none"> • Manual data entry. • Change requests. • Forgetting to do something. • Lack of knowledge of the process. • Digital competence. 	<ul style="list-style-type: none"> • Human behavior and acts. For example, deliberately not following the steps in a process. 	<ul style="list-style-type: none"> • Standardizing data -> manual data entry can be resolved with automation. • (No solutions)
Transparency	<ul style="list-style-type: none"> • Contacts outside the DIAS platform when delays are noticed. 	<ul style="list-style-type: none"> • Some information can't be shared with everyone. 	<ul style="list-style-type: none"> • (No solution)
Cost	<ul style="list-style-type: none"> • Negotiating terms (when you can negotiate who pays for what). 	<ul style="list-style-type: none"> • Developing solutions and searching for data is expensive -> not sustainable or reasonable to develop if costs are too high. 	<ul style="list-style-type: none"> • Decrease costs. • Someone else develops and pays, and other benefits. • Figuring out who pays.
Data	<ul style="list-style-type: none"> • Validation of data. • Data searches. • Data errors. 	<ul style="list-style-type: none"> • Data errors. • Automatic data searching isn't available for all data. 	<ul style="list-style-type: none"> • Data needs to be correct, comprehensive, easy to access, standardized. • Distribution of data: automatic/using interphases.
Written text	<ul style="list-style-type: none"> • Reading texts. • Interpreting and decision making. 	<ul style="list-style-type: none"> • AI and machines can't interpret text in PDF files now. 	<ul style="list-style-type: none"> • Replace documents with permissions.
Manual work	<ul style="list-style-type: none"> • All manual work. 	<ul style="list-style-type: none"> • Situations that require interpretations, consideration, and ability to form probability-thinking. 	<ul style="list-style-type: none"> • Standardization in simple cases.
Regulations	<ul style="list-style-type: none"> • Manual work: reading documents. 	<ul style="list-style-type: none"> • Regulations prevents certain automation. For example, when requiring a purchase agreement. • Code of Real Estate. 	<ul style="list-style-type: none"> • Updating laws and acts: Code of Real Estate, act concerning automation in decision making.
Technical view	<ul style="list-style-type: none"> • If the platform/-s doesn't function well or correctly. 	<ul style="list-style-type: none"> • Some actor's platforms can't handle certain automation now. 	<ul style="list-style-type: none"> • Development is needed -> money is needed. • Growing the eco-system. • Automating one part at a time. • More users -> more experience to develop solutions.
Agreement structure	<ul style="list-style-type: none"> • Making contracts separately with every actor. 	<ul style="list-style-type: none"> • (No hinders) 	<ul style="list-style-type: none"> • Better agreement structures: open for everyone to use.
Security structure	<ul style="list-style-type: none"> • When manual work is required. 	<ul style="list-style-type: none"> • Manual work is required for some checks. 	<ul style="list-style-type: none"> • Better and stronger security structure: risk analysis and examinations.

The (1) bottlenecks identified has to do mostly with human errors and manual work. The buyer can suddenly start renegotiating the loan offer with different banks in the middle of the process (in this case the real estate agent starts to wonder what causes delays, and the bank can't communicate about what is happening because of bank secrecy). Also people forgetting to do something causes delays. For example, the buyer forget to declare the transfer tax or the seller forgets to sign the purchase agreement. Not following the process steps also slows down the process. For example, the real estate agent can initiate

the signature phase too fast. Actors starts to wonder what is going on, which also causes delays when extra contacts outside the DIAS platform is needed to clarify uncertainties. Other issues slowing down the process are type errors that needs to be corrected (at the moment correction request concerns approximately 30% of all digital purchases when using the DIAS platform). Gathering data also causes delays in the process, when it isn't standardized or digital data. Data searches is expensive and can cause delays when debating who is responsible for paying the fee. The data needs to be up to date and correct. Meaning that if there are significant delays, new data searches are needed.

It would be a big thing if data searches would be free of charge. [...] It is really in no ones interest if the data is incorrect (Interview: Koli, 2022)

Peoples actions and behavior can be a hinder. If people don't want to use the new technology or process, there will be less data to use for developing the process.

Old habits affect my intention on using new technology (Interview: Lehtikangas, 2022).

The purchase agreement, which is required by regulation, is a big cause for delays: if there are any errors or other terms that prevent the process from proceeding. Also, interpretations and decision making is manual work. This means that someone needs to check and read the purchase agreement, even if some automatic checks are done in the process of drafting it. The experts agrees that basically all manual work slows down the process. And all data that is written text, that isn't digital or standardized, slows down the process. Unfortunately, current security strucutres often requires a human to make decisions and do manual work. For example, at the bank when withdrawing the housing loan and making payments. Lack of digital competence or lack of knowledge about the process slows down the process. Abvious reasons for delays are technical issues: if a platform doesn't work or performance is slow for whatever reason. Agreement structures are also an issue, when having to to contracts sepatately with every actor. For example, DIAS has to do agreement with every real estate agency separately.

Some bottlenecks can also lead to identifying (2) hinders. For example, if the buyer deliberately stops following the steps in the process and starts to renegotiate housing loan terms. If this leads to changing the bank for the buyer, the whole process stops. New

correct data needs to be uploaded, and this takes time when an actor changes in the process. Some platforms can't handle automation which create technical hinders. Other hinders identified are transparency: everything in the process can't be transparent. For example, when it comes to bank secrecy. Data searching and developing solutions are expensive today. When it comes to data, the data has to be correct. And unfortunately all data required in the process isn't possible to automatically validate today. Written texts can't even today be interpret by machines or changed automatically to digital, standardized data when it comes to this specific process.

There isn't an AI or a machine today that can read for example, the required purchase agreement which is in pdf format. (Interview: Heikkilä, 2022)

As it work today, the experts also pointed out that AI and machines can't replace a human today when it comes to interpretations, probability thinking, and when consideration is required. This applies also when it comes to security checks. The current Code of Real Estate creates hinders for automation. Also other regulations prevents development of automation.

Regulations can prevent automating steps. [...] The possibility to influence is basically zero in this case. (Interview: Koli, 2022)

The (3) results. Solutions include standardizing data, which would eliminate type errors when data can be digitally sent and uploaded. But the experts didn't find any solutions for if the buyer is refusing to follow the steps. Transparency is an issue, and true transparency is very hard to achieve. As already stated, when identifying the bottlenecks and hinders, the bank can't inform the real estate agent the purpose for a delay, if it's caused by the buyer or seller. The current Code of Real Estate is old fashioned. All experts agreed that this needs to be updated in way that enables automation, at least within certain steps.

Legal acts and requirements needs to be further checked, to see if there is a place for them in the present day. One possibility on what is checked, is if the purchase agreement can be replaced by a consent. [...] Easements are made step by step. Checking which requirements can be abdicated. This way we are moving towards more appropriated and justified requirements that fits into the current society. (Interview: Kaivosoja & Tervonen, 2022)

Easements in the process could mean replacing documents with permissions. These kind of easements has already been done in processes concerning apartments of housing companies. Following easements were suggested by the experts concerning real estates: replacing the purchase agreement with the seller's permission (similar to the apartment processes), and replacing the agreement on mortgage deed transfer with a permission. This permission would automatically cancel any existing mortgage deeds held by the seller. And automatically apply for new, more fitting mortgage deeds for the buyer. All of this could be standardized data. Because of expensive data searches and the cost of developing solutions, the experts agrees that a cost-effective, sustainable solution isn't possible to develop now. But what the experts recognize as a possibility is to develop in the future a fully automatic process for a basic real estate purchase scenario.

DIAS has already proven that the users will increase if the process is simple enough to coordinate and execute procedures. (Interview: Kaivosoja & Tervonen, 2022)

And this can be achieved by automating one small part at a time, gathering experience, and further developing solutions. Costs need to go down. Because high costs causes delays when discussion arise on who will be responsible for paying the fees.

The bigger the cost, the bigger the discussion is about from whose wallet it will be taken from. Especially when we're talking about a process with many active actors. (Interview: Koli, 2022)

Data needs to be easier to access and utilized, so it can be used for more purposes. Data also needs to be correct. Because of scattered data, a comprehensive digital data pool was suggested. The data pool needs to include all needed data in the process, so it can benefit all actors during different steps in the process. Some suggested that the data pool needs to be accessible also by other actors, to further develop and create value added services. This way the ecosystem will grow. The expert had different views on who would be responsible for keeping this so called up-to-date register. Some suggested the local authority (NLS of Finland) and some suggested a third party.

It is hard to say if automation significantly decreases current risks in the current process. And how much automation will increase risks and create new risks. [...] Solutions for automation are faster accepted if it's simpler and needs less fitting. (Interview: Kaivosoja & Tervonen, 2022)

The actors have their own interests and need to protect themselves. This is why better and stronger security structures are needed for automation to be better accepted. It requires better analysis and examinations when it comes to decision-making and protection of data.

Information security is essential, when automating and thinking of the risks. (Interview: Heikkilä, 2022)

Lack of data competence in people is a risk and forms bottlenecks for developing the process. Time will resolve this: the older generation with less digital experience is decreasing. It can now be tackled with offering help and education. But if the process isn't easy enough it will be an issue. And human attitudes also play a role. The experts recognize that it will take time for the majority to choose the digital process instead of the traditional, and for the digital process to become a part of daily working habits.

[...] Someone can think that "I do one case a month, it's all the same if I do it face-to-face or not". (Interview: Bank, 2022)

They also recognize that development requires users and feedback. At first there is usually a small sample of users when introducing a new digital process. Encouragement is needed to increase the users. If those users have a positive experience and personally gain something from it, they will recommend it to others and keep using it. This will increase users and generate more feedback that will benefit development. Unfortunately, the majority of potential users are waiting on further development (sticking to old habits until much later). They either choose other digital platforms that they are used to or choose the traditional process. One reason for choosing the traditional process is because there is no trust in the process.

Some people feel that it's safer to have a banker to "do everything in front of you", from signing documents in person to getting a paper receipt on transactions made. [...] The digital process is a secured and a safe alternative. So, if anyone has any concerns about it being unsafe, I would say it's the opposite. (Interview: Heikkilä, 2022)

When discussing future development solutions, blockchain technology was something that the experts don't see as having a strong hold in this specific process. Reasons were that there isn't enough knowledge of the usage, benefits, and how it could be implemented in

the current process in Finland. The current process uses the DIAS platform that is based on distributed ledger technology (DLT). The experts agree that the future hold solutions more towards using interfacing and creating value adding services.

5 Discussion

In this chapter I will combine findings from literature and previous research with findings from the interviews.

5.1 Development and adaptation of technology

For digitalization and innovations to emerge in the real estate ecosystem, the organizations need to have capabilities to create (Vigren et al., 2022). But also, the capacity to absorb innovations and digital solutions. The real estate ecosystem will grow better and faster when actors work together towards a common goal, rather than waiting for others to invent solutions. The experts bring up that a “waiting game” is causing currently delays in inventing solutions. Money is a big cause for this, but also the lack of experience and knowledge. It seems that actors in the process are waiting on other actors to spend their money first, instead of participating as an active actor from the beginning.

Both Veuger (2020) and Feng et al. (2019) found that it will take time for a new technology to be adopted and integrated if there isn't enough knowledge or research done from before. The experts have noticed the same pattern and agrees with this point of view. They think it will take time before there is enough personal knowledge of the new technology to be adapted and integrated into daily working habits.

The real estate agent stated that there are more positive feelings towards other options and platforms, instead of the DIAS process, when executing a digital real estate purchase process. And therefore, thinks this is one reason why the real estate agents don't choose to use the DIAS process very often. The negative feeling towards DIAS is that it's a new process option that is still under development. This is because there is only one purchase scenario option available now. Other negative feelings that arise is losing an extra income (the brokerage) or losing one's job as a consequence from choosing the digital way (compared to the traditional process). This leads to less people using DIAS then what the potentials are. This behavior was stated earlier when introducing the theory of reasoned

action (TRA). According to TRA positive and negative feeling and intensions affects the behavior and actions (Nickerson, 2022). Understanding how and why people act the way they do is important for a business to succeed. According to the experts, the real estate agents have used the old processes and routines even when new options are available. Old routines are so imbedded into their daily work that it makes it difficult to move towards using new innovations. This was also pointed out by Vigren et al. (2022) when researching the capability of creating and the capacity to absorb innovations and digital solutions within real estate companies.

The usage of DIAS within digital real estate purchase processes has had a slow start. No specific data is revealed or found though due to its short existence. When looking at already known negative feelings about DIAS and adapting the Gartner's curve, we can establish that there is a risk of rapid descend in usage rate if expectations are not met. Based on the interviews the expectations are that all options and scenarios should be enabled in DIAS. This way the DIAS platform could be an options for everyday processes. The possible outcome can be affected by manipulating the user, and thus affecting the action of the user (Ajzen & Fishbein, 1975). Manipulation can be for example, to reward people for using the platform. And this way cause positive feelings, even if expectations are not met. Old habits die hard, according to the UTAUT2 (Venkatesh et al., 2012). This was also assured by the real estate agent, when revealing that old habits affects her intentions of using DIAS.

What we learn from this is that a company can't just push their message out or expect the users to adopt to new technology instantly. For the new technology to be truly accepted and adapted, it must generate real value and benefits for the user.

When viewing on the customer attitudes towards adapting to new technology and businesses speed on developing new digital solutions, Covid-19 pandemic has showed that external environmental situations can change and speed this up (Starr et al., 2021). All of the experts have heard similar comments from businesses and customers that advocate this.

5.2 Complex processes

Veuger (2020) and Feng et al. (2019) also found that if the technology is too expensive, it is unlikely to succeed. The benefits need to exceed the expenses. The experts summarized that a digital real estate purchase process is expensive to create today, at least when it comes to complex real estate processes. And there is a lot of different complex real estate scenarios in Finland. Also, acquiring needed verified data for the process is expensive, difficult and time consuming. The interviewees see that it would be a game changer if data would be cheap, easy, and quick to access.

Veuger (2020) explains that a truly automated real estate process can't be achieved today because of all the existing complicated scenarios. The experts pointed out that this is the case in Finland, and there are several reasons for this. One is the outdated Code of Real Estate. For example, the local authority NLS of Finland can only automate the legal confirmation of possession if the seller's permission for the purchase would be enough (instead of requiring the purchase agreement). There can be all sorts of demands and terms in the agreement that could prevent the legal confirmation of possession from happening. This is because the Code of Real Estate states that a purchase agreement is needed, with only minimum requirements about the content of the agreement. So, manual work is required to check and validate the purchase agreement.

5.3 Smart contracts, blockchain, and APIs

Smart contracts can speed up and enable at least some automation in processes (Feng et al., 2019). The experts expressed that they have already seen this benefit after having automated some of the steps in the process from before. Less time is needed for a purchase process because there is no need to specify and agree the date and time for signing the documents. Everyone can check and sign documents whenever and wherever, as long as they have personal netbank codes used for digital identification and have internet access. The process has a clear order for the steps and phases, which increases the reliability of the transactions. The experts say that there are some negative sides and contradictions to this though. Even though smart contracts should increase the reliability of transactions, some people don't trust the process and still demand a face-to-face meeting which requires more time to set up. One reason for this is the fact that the customers, the real estate agents, and the representatives at the banks don't have enough

knowledge and experience with a digital real estate purchase process, and therefore could require using or prefer choosing the old manual process.

Issues like contracts that can only be read by humans is a hinder for automating the process (Feng et al., 2019). The experts point out this issue in particular. But there are existing machines that produces text, mimicking humanly produced text (Frantz & Nowostawski, 2016; Linear, 2022). Assumptions can be made that the possibilities lies also in having machines and AI produce and generate contracts. This could be achieved by having the machine interpret contracts and content produced by humans with the help of NLP. This should be further researched in the future to explore the possibilities. The expert's view is that a machine can't interpret or use text produced by humans. For example, when the purchase agreement is a PDF document. The seller and buyer can write additional unstandardized terms in the purchase agreement which requires a human to read through it for decision-making. This is viewed as a hinder for automating the process. And their thought on a solution in a basic real estate purchase scenario, tackling this hinder, is to change the Code of Real Estate. This way the purchase agreements would not be needed to examine manually, but instead it would be enough that the seller agrees to the purchase. Basically, replacing the purchase agreement with the seller's consent would enable automation in the process.

Other problems with smart contracts are when changes are needed (Feng et al., 2019). Changes to the contracts causes a change in the timeline of the process. The experts recognized the same cycle. They have to start all over if any changes have been done to the purchase agreement after it has been uploaded to the DIAS platform, and the purchase has been instigated and started. Some changes can even prevent the digital purchase from happening because of current limitations. When new data and rules are introduced, it requires a new contract. But smart contracts can't create new contracts autonomously, which affects the scalability and compatibility of using a smart contract (Feng et al., 2019). This passage can be recognized from the expert. They presented that DIAS first introduces only one option for a smart contract to digital real estate purchase process, and they will later develop it and introduce more options. This way experience will be gathered that can help when implementing new options and scenarios.

Veuger (2020) described that blockchain can help with coordinating steps in a process concerning real estates. But the risks must be thoroughly investigated before implementing this system. According to the experts I interviewed, there is no direct need for implementing blockchain. There is also according to the experts not enough knowledge about blockchain for it to have a strong hold when considering what new technology to implement in the process. They feel that APIs are the way to go and that is what they are all investing in. APIs is also what the DIAS platform is performing with and focusing on. But Veuger (2020) did present a successful test done in Sweden in 2016 that resulted in a successful and efficient way of implementing blockchain into real estate and mortgage deed processes. This is a good example on a test that could be used when looking at option for automation in Finland's real estate processes. When after all, having similar track record of property ownership and similar land registry processes as Sweden.

Sweden has been testing implementing blockchain technology and found real benefits like minimizing risks and human errors from using it (Veuger, 2020). Also, in the Netherlands many tests and research has been done concerning blockchain and real estate processes. And they found that blockchain will possibly be integrated in the real estate processes. According to the experts interviewed for this thesis there is no immediate need for blockchain technology in Finland, and they focus more on developing API solutions. One reason for this is because of the existing complex transactions. Previous research proves the cost for integrating blockchain would be higher than the benefits generated from it, when looking at complex transactions (Veuger, 2020). And according to the experts this has been noticed: it's a money issue. For example, there are debates about and restrictions on how the local authority in Finland (Maanmittauslaitos) uses the tax money to develop technical solutions. Because of this there is more pressure on private actors to develop their solutions. So those solutions can then be integrated in the smart contract platform DIAS using API's.

Blockchain would increase transparency (Veuger, 2020). And increasing transparency in the real estate purchase process was the goal when introducing and developing the DIAS platform (Tomorrow Tech, 2022). But the experts don't see blockchain being integrated in the near future based on their own current existing knowledge.

An impressive cadastral on properties and disruptive technology is not enough for developing a fully automated real estate process (Veuger, 2020). It's also considered

impossible to automate all processes. Reasons for this are complex processes that lead to cost exceeding the benefits. Furthermore, it would require everyone to have their own digital identity and computer, to enable connecting with everyone in the process, the country needs to have a political will to integrate new technology, and steps in the process need to be standardized. These facts were also verified by the experts to be the case in Finland. But the real estate industry is considered conventional. And it was pointed out in the interviews that this could be a reason for slow usage and adoption of fintech, proptech, and information technology solutions. But other conventional industries have already seen the benefits from digitalizing and automating processes (Paulet & Mavoori, 2020). Similarities can be seen when looking at what has happened in the banking industry and what is happening in the real estate industry. Follow-up studies and experts sharing knowledge globally are the keys to finding solutions when it comes to automating real estate processes, and understanding the full impact (Veuger, 2020).

6 Conclusion

Complex processes with many actors takes time to digitally automate. But a basic scenario and a simple process that can utilize standardized data can most certainly be truly automated today.

The digital real estate process today is based on specific documents, data and actions. Some of the requirements are real hinders for automation today. For example, legal requirements in the process. The parts that could be automated seems to have a clear connection with the fear of loosing one's important position for business making. Another connection can be made with costs: it is expensive to find solutions for a digital automation. Some actors feel that others should pay for developing solutions. While other feel that the solution have to be sustainable, meaning cheap. Automating and digitalizing steps in a process should decrease costs and errors. But for now, there doesn't seem to be a sustainable solution that suits and benefits everyone.

Previous research in automating real estate processes shows that automation can speed up processes, save time, and decrease costs. People who work with digital real estate processes could be freed from basic and simple cases and instead focus on more demanding cases where the human expertise is needed. The majority of the real estate

purchase cases are basic and straight forward. But they seem difficult when human errors arise, which causes frustration.

The lack of needed technology and human attitudes are slowing down the development. It is a walk on glass, when it comes to peoples attitudes. The actors need to convince the users that the benefit is greater when choosing the digital process instead of the traditional process.

It is clear that complex cases are impossible to digitally automate right now in Finland. But what is possible is digitally automating all simple and basic cases. Where decisions can be based on and when all requirements can be identified with standardized data. But it wont happen over night. The best course of action is to automate step by step. Breaking the process down into smaller pieces, and using the collected feedback from the previous automated steps, new and better solutions can be developed.

Because the process includes many actors, and for the ecosystem to grow, the solutions need to benefit many users and be sustainable in the long run. It also need to inspire new actors and value-added services. It is also important to examine current laws and regulations to see if they are still relevant. New legal options are required to develop new solutions.

Based on the interviews we can conclude that the real estate agents and banks don't want to minimize their role in the process. Also, the buyer needs a housing loan from the bank to buy a house. These factors can slow down the development of automating the process, or prevent the whole process from being fully automated. Banks want to sell value-adding services (insurances and interest rate caps) and housing loans, while the real estate agent want to get income (brokerage and the extra income from performing as a notary). They don't want to loose their important role in the process. Conclusions can be made that the bank and real estate agents could loose some of the extra income if the process would be truly automatic. It seems that everyone I interviewed for this thesis is expecting an automated digital real estate purchase process, but not necessarily requiring one. And everyone has their different reasoning when it comes to requiring it.

Further investigations, examinations and research is needed for the process to develop and become truly automatic. It is critical to find lasting solutions that bring true value to the users. The digital and automatic process will never completely replace the traditional process. There will still be a need for the traditional process in extreme and complicated scenarios. But the idea and the goal are to make the process smoother for most of the people.

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8 Appendices

Appendix 1. Instructions for the interviewee (in Finnish)

Tutkimuskysymys: mitä se vaatii, että digitaalinen kiinteistökauppa prosessi olisi täysin automatisoitu Suomessa? Elikkä **ei sitä, että onko se mahdollista tänä päivänä**, vaan **mitä se vaatii** (lakimuutoksia, yhteistyötä, tiedon validointi aikaisemmassa vaiheessa jne.).

- Kyseessä on vain siitä mitä kaupantekoon kuuluu (allekirjoitetaan kauppakirja, asuntolaina nostetaan, maksetaan maksut, omistusoikeus siirtyy, lainhuuto vireille jne.). Katso taulukko sivulla 2.
- Käytetään kauppakirjaa varten vain DIAS-alustaa (kiinteistövaihdannan palvelua ei käytetä kauppakirjan allekirjoittamiselle). Elikkä tarkoitus on selvittää syyt ja ratkaisut, jotka johtaisivat DIAS-alustan käyttöön ja KVP jäisi kokonaan pois.

Tarkoitus on selvittää kokonaisuuden näkökulmasta:

- Mitkä ovat esteet (miksi prosessi ei ole automatisoitu/ei voi automatisoida)?
- Mitä muutoksia tulisi tapahtua (jotta prosessi olisi automatisoitu)?

Skenaario/rajattu tilanne:

- **Käytetään vain Dias-alustaa** kauppakirjan allekirjoittamiselle (DIAS on se yhteinen alusta kaikille toimijoille/osallistujille + rajapintayhteys)
- **Ostaja/myyjä:** 1-2 henkilöä, elossa, täysi-ikäisiä, ei poikkeustilanteita
- **Ostajalle asuntolainaa:** Ostajalla asuntolainatarve, asuntolainalupa olemassa ja pankki tietoinen kohteesta. Vain ostettava kohde vakuudeksi (vakuus hyväksytty jo pankissa: myyntiesite, kuntokartoitus-raportti ja muut tarvittavat asiakirjat kuten lainhuutotodistus ja rasisitustodistus on tarkistettu pankissa). Jos ostajia 2kpl: molemmilla on samassa pankissa asiointi ja ottavat yhden yhteisen asuntolainan pankista missä heillä on jo asiakkuus (jos yksi ostaja: ottaa yhden asuntolainan pankista missä hänellä on jo asiakkuus). Ostaja maksaa koko kauppahinnan kerralla (ei alku- ja loppukaupat). Ostajaa maksaa myös varainsiirtoverot.
- **Myyjän asuntolaina maksetaan pois:** Myyjällä/myyjillä on yksi asuntolaina, joka maksetaan kokonaan pois. Myyjä/myyjät maksaa kiinteistövälittäjälle myyntipalkkion. Jos rahaa jää yli, niin loput on sovittu, että tulee siirtää sen poismaksettavan asuntolainan lainanhoitotilille.
- **Kiinteistövälittäjä:** Myyjä käyttää kiinteistövälittäjää
- **Kohde:** valmis omakotitalo joka hyväkuntoinen (ei remontti tai pintaremontti tarvetta), ei uudelleen järjestelytarvetta tai muita muutoksia, nykyiset panttikirjat ovat sähköisiä ja niitä löytyy riittävästi ennestään. Tontti on omistustontti.

Odotuksia haastattelevalta:

- Vastaa ensin omasta näkökulmasta, yleisellä tasolla (tässä ei haeta yksityiskohtaisia teknillisiä tietoja. Vaan yleisellä tasolla riittää hyvin, jos et osaa/pysty tarkemmin kertomaan)
- Voit myös kommentoida, jos tiedät muitten osapuolten haasteita/tietoja (esimerkiksi yhteistyön perusteella)

- Jos et pysty vastaamaan/et osaa vastata kysymykseen, niin ohitetaan se.
- Kyseessä on semi-strukturoitu haastattelu, joten keskustelulle ja muille kysymyksille on tilaa.
- Arvioitu 60 minuuttia vastausaikaa/keskustelua. Lisäksi myöhemmin alkusyksyllä jälkihaastattelu (noin 30min)

X = yritys/organisaatio/viranomainen, missä olet töissä

Appendix 2. Interview questions (in Finnish)

1. TYÖKOKEMUS

- **1aS:** Nimi, työkokemus ja mitä teet tällä hetkellä?

2. TILASTOT

- **2aS:** Montako kiinteistökauppoja vs. digitaalisia kiinteistökauppoja tehdään Suomessa (% tai kpl)? Onko sinulla tätä tietoa, v.2020, v.2021 ja v.2022?
 - Vuonna 2021 oli 75 500 kiinteistökauppaa (Toppinen 2022).
- **2bS:** Monessako kaupassa X on ollut mukana?
- **2cS:** Sanoisitko, että digitaalisten kiinteistökauppojen määrä nousee/on nousussa?
- **2dS:** Oletko huomannut, että digitaalisia kiinteistökauppoja vastustetaan?

3. VAIHEET JA OSAT, TÄLLÄ HETKELLÄ

- **3aS:** Voitko kuvailla mitä tapahtuu kauppapäivänä? Kuvailisitko sitä mitä tapahtuu kiinteistökauppapäivänä tällä tavalla (katso taulukko)? Edustaako taulukko tyypillistä mallia (miten prosessi menee Suomessa tällä hetkellä)?
- **3bS:** Voitko tunnistaa vaiheet?
- **3cS:** Voitko tunnistaa osat/toimenpiteet, jotka liittyvät X:ään?
- **3dS:** kauanko digitaalinen kauppa tyypillisesti kestää vs. perinteiset kaupat? Miten kauan X:n osuus prosessissa kestää?

Taulukko: Esimerkki, mitkä kaikki vaiheet ja osat liittyy kauppapäivään.

Kiinteistökaupat	Asiakki: DIAS Oy	Asiakki: Maanmittauslaitos (MML)	Kaupat: Pankki	Vainajienverot	Myyjän laina	Välittäjän myyntipalkkio	Omitusokteen muutos: MML	Panttikriat
Kauppakirjan teko ja lähety DIAS ja KVP-alustoihin	Allekirjoitus + valtuutus pankille	Kiinteistövähdannan palvelu (KVP)	Kauppahinnan maksu: pankista pankiin	Ostaja maksaa				
	Ostaja allekirjoittaa viimeiseksi	Ostaja allekirjoittaa viimeiseksi						
	Myyjä allekirjoittaa ensin	Myyjä allekirjoittaa ensin						
Kiinteistöväittäjä tekee ja lähettää alustoihin			Pankki nostaa lainan ja maksaa 0:in		Pankki maksaa pois	Pankki maksaa myyjän tililtä		Ostajan pankki tilaa
							MML	MML
	"Siisä päivässä hoidettu"							
Lähetetään välittäjän alustasta DIAS alustaan ja KVP-alustaan	Kauppaneuvottelu ei tarvita							

4. YHTEYDET JA ALUSTAT (digitaaliset kiinteistökaupat)

- **4aS:** Onko alustanne integroitu/alustallanne rajapintayhteys minkä alustan kanssa/mihin alustaan? Mitkä sovellusrajapinnat tunnistat?
- **4bS:** Kenen kanssa X:llä on eniten vuorovaikutusta, kenen kanssa teillä on eniten tekemistä/yhteistyötä?
- **4cS:** Kuka on X:n tärkein ”yhteistyökumppani”?
- **4dS:** Kenen kanssa X:llä on eniten ongelmia/esteitä/hidasteita? (välittäjät, pankit, MML, DIAS)
- **4eS:** Montako muita tarjoaa yhteistyötä / alustoja digitaalisille kiinteistökaupoille? (esim. Alma Talent, Kiinteistövähdannan palvelu jne.).
- **4fS:** Onko DIAS alusta paras kaikista vaihtoehdoista (kauppakirjan allekirjoittamiselle)? Miksi?

5. AUTOMATISOINTI: ESTEET JA RATKAISUT

- **5aS:** Mitkä osat ei ole automatisoitu? Montako käsiparia on tällä hetkellä mukana hoitamassa osia, montako ihmistä siis tarvitaan hoitamaan X:n osuudet (manuaalista työtä)?
- **5bS:** mitä se vaatii, että ne osat automatisoidaan?
- **5cS:** mikä osa/mitkä osat koet, että pitäisi ehdottomasti olla automatisoitu ja josta saisi sitten eniten hyötyä?
- **5dS:** voitko tunnistaa pullonkaulat, jotka manuaalinen työ aiheuttaa? (X:ssä ja muut yritykset)
- **5eS:** tunnistatko riskit, jos osat/vaiheet automatisoidaan?
- **5fS:** Automatisointi on kätevää, mutta onko se välttämätöntä?
 - Tuleeko osat/vaiheet väkisin automatisoida, vai voiko antaa aikaa (antaa kaikkien omaksua aikanaan)?
- **5gS:** Voiko automatisointi nopeuttaa prosessia? Miten/missä?

6. TULEVAISUUS

- **6aS:** Auttaisiko se jo löytyisi/olisi yksi tietoaallas, joka sisältää standardoitua kiinteistöihin liittyvää informaatiota, joka on myös ajan tasalla?
 - Olisiko tällaista mahdollista toteuttaa/ylläpitää?
 - Mitä se vaatisi X:ltä tai ylipäättänsä?
- **6bS:** Miten Digitaalinen Identiteetti (Digital ID) kiinteistöille, olisiko tälle vaihtoehdolle tarvetta? (Digital ID: kerätään dataa, joka kertoo omaisuuden luonteesta/sisällöstä ja eri vaiheista, jotta sitä voi sitten käyttää digitaalisiin ratkaisuihin, kun tehdään yhteistyötä)
- **6cS:** Onko tarvetta tekoälylle tai koneoppimiselle, kun automatisoidaan vaiheita/osia prosessissa?
- **6dS:** Miten lohkoketjuteknologia:
 - Jos sitä hyödynnetään jo tällä hetkellä, niin millä tavalla/missä?
 - Jos sitä ei hyödynnetä tällä hetkellä, niin miten sitä voisi integroida protokolleihin? Olisiko siitä lisäapua?
 - Onko Suomessa tahtoa ja halua integroida lohkoketjuteknologiaa?
- **6eS:** Tehdäänkö yhteistyötä muitten maiden kanssa? Onko olemassa yhteinen tahtotila (Suomessa, EU jne.)?

LÄHDE

Toppinen T., 2022. Maanmittauslaitos, *Kiinteistökaupassa kova kasvuvuosi edellisen koronavuoden tapaan.*

<https://www.maanmittauslaitos.fi/ajankohtaista/kiinteistokaupassa-kova-kasvuvuosi-edellisen-koronavuoden-tapaan>