

**Understanding why blockchain technology adoption rate lags in Real Estate markets  
when compared to several major sectors:**

A mixed-methods approach with qualitative and quantitative data

Daan Bartels

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Version	Final version: October 16, 2019
Author	D.F. (Daan) Bartels
Student number	S3548694
E-mail	info@daanbartels.com
Primary Supervisor	dr. M.N. (Michiel) Daams
Secondary Supervisor	dr. F.J. (Frans) Sijtsma

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## **Abstract**

Public blockchain is an open, transparent, peer-to-peer digital ledger in a decentralized network that cross verifies itself where transactions and data are recorded publicly and chronologically. This research investigates why real estate companies appear to be lagging with adopting blockchain technology when compared to other major sectors. Because blockchain is mentioned in the literature to be a potentially disruptive technology for the real estate sector, it is useful to know why and if this sector lags with adopting. Mixed-methods used to identify the apparent lagging of blockchain in real estate are: analysing a self-gathered database of the 100 largest banks and 100 largest real estate companies based on market capitalization on the relative adoption of blockchain technology through logistic regression, identifying the movements of patent applications towards blockchain technology across sectors and identifying the perceived characteristics by text-analysing interviews with potential users of blockchain: two notaries, a real estate manager, a blockchain expert and a bank official. Only 16 of the 100 largest real estate companies are found to have adopted blockchain compared to 86 of the 100 largest banks, suggesting a higher adoption rate in the banking sector. The 100 largest banks are found to be significantly larger in size when compared to the 100 largest real estate companies. The significant larger size of banks and the higher adoption rate is in line with the Diffusion of Innovation theory. Market capitalization in U.S. dollars and number of branches per company are found to be significant indicators that are positively correlated for implementation of blockchain in real estate companies, confirming the assumption of size influence on innovation within the sector. Results from the interviews are in line with the quantitative results and add the suspicion that the banking sector feels more pressure to adopt innovative technologies. Furthermore, the blockchain expert has clarified that blockchain technology is adaptable, starting in private blockchains and transforming into public blockchains.

**Keywords:** adoption rate, measuring innovation, blockchain technology, real estate management processes, diffusion of innovation theory, financial institutions.

## 1. Introduction

While blockchain technology for real estate is called to be disruptive by the literature (Swan, 2015; Veuger, 2018) adoption appears to be lagging when compared to other major sectors. Identifying if a potential disruptive technology is lagging and why it is lagging gives insight towards perceived characteristics of the technology. Perceived characteristics influence adoption ratios and are compared to the literature if they are perceived correctly, which in turn can help companies reformulate their adoption decision, accelerating or decelerating adoption. Furthermore, it is important to measure adoption ratios of technologies because technologies are becoming increasingly important worldwide for practically every sector (Hyysalo & Usenvuk, 2015). Unnecessarily postponing of adopting new technologies or adopting too early can hurt sectors.

One of the reasons why postponing adoption can be hurtful is based on investment decisions (Rogers, 1971). Investment decisions are based on, among other things, yields and risk perception (Menezes et al., 1980). Yields and risk perception are influenced by drawbacks in sectors. Some drawbacks in the real estate sector are: relative lack of liquidity, low transparency and relatively high transaction and managing costs (Georgjev et al., 2003). When sectors adopt new technologies sooner, therefore improving investment opportunities, other sectors might become less attractive for investment. To help companies structure their adoption decisions, this research compares adoption ratios of blockchain technology.

Public blockchain is an open, transparent peer-to-peer digital ledger in a decentralized network that cross verifies itself where transactions and data are recorded publicly and chronologically (Swan, 2015; Veuger, 2018; IBM 2019; Corda 2019). Blockchain is an upcoming technology, crossing into multiple industries such as banking, real estate, healthcare and more (Veuger, 2018). Blockchain has been around since 1991 but only gained traction in 2008 with the Bitcoin concept (Mansfield, 2017). Blockchain is seen as a technology that is highly suitable for the real estate sector with potentially: digitalizing building data; reorganizing title and land registration systems; creating smart (rental) contracts; improving valuation and quickening financing (Swan, 2015; Mansfield, 2017; Barkham et al., 2018; Mansab Uzair et al., 2018). The academic literature describes the benefits of blockchain in the real estate sector as faster transaction times; higher transparency; decentralization of data; increasing liquidity; automatization; decreasing counterfeiting; decreasing managing costs and improving verifiability (Mansab Uzair, et al., 2018; Spielman, 2008; Swan, 2015; Veuger, 2018; Ray, 2018). Literature states that blockchain technology can eliminate third parties in management processes; tenant agreements can be stored without server hosting; financial transactions can be done without banks (Firica, 2017). Blockchain can decrease real estate transaction times and reduce transaction fees, making the real estate market more accessible (Nasarré-Aznar, 2018). There is currently a gap in the academic literature of blockchain adoption ratios in the real estate sector.

Blockchain is being tested in multiple real estate sectors. Title and land registration parties from Dubai or the Cadastre from the Netherlands are testing blockchain (Veuger, 2018). Property ownership

software using blockchain is being tested, for example from parties such as Ubiquity, ChromaWay, Bitland, Bitfury and IBM (Spielman, 2016). Large real estate companies also predict implementation of blockchain in the real estate sector. Cushman & Wakefield (2018), one of the largest real estate service companies in the world (appendix F), states that blockchain will be expected to be in the conceptualization phase until 2020 to 2022. This implies that blockchain has not gained traction yet in the real estate sector. Cushman & Wakefield (2018) forecast that widespread adoption will take place between 2024 and 2028. Because the methodology of the forecast of Cushman & Wakefield is unclear, high-quality research could give more insight in adoption of blockchain technology in real estate markets. Furthermore, other sectors such as financial institutions and healthcare organizations, appear to have higher adoption rates. Attaran et al. (2019) have found that already over 50 banks have created a consortium to develop blockchain technology named R3. Additionally, healthcare organizations already created pilots to transfer patient documentation through blockchain. There is little to be found of blockchain pilots in large real estate companies (based on literature research and a collected database which can be found in appendix F), most are about the previously mentioned title and land registration companies, new start-ups or software companies. This suggests that real estate companies are lagging in adopting blockchain technology when compared to financial institutions or healthcare organizations.

Comparing adoption ratios of blockchain in real estate management is socially relevant by helping companies structure their adoption decision. Finding ways of measuring adoption rates in technology gives the possibility of creating indicators that significantly influence adoption. Because it is still very complex to forecast the adoption of new technologies and many papers exist regarding this topic, this research adds to the academic literature by creating significant indicators of adoption. Additionally, these indicators of adoption can be measured while the market has not adopted the technology market wide. Most existing frameworks of measuring adoption ratios can only be used when technologies are grounded in the market (Davis et al., 1989; Ajzen, 1991; Koul & Eydgahi, 2017).

Blockchain technology appears to be lagging in the real estate sector when compared to other major sectors, potentially hurting the real estate sector due to investment decisions as mentioned at the beginning of this chapter. This master thesis aims to identify and compare the adoption rate of blockchain technologies within real estate markets against other sectors. This thesis contributes by expanding technology adoption frameworks and shows if the benefits of blockchain technology from the literature are conceived equally by the real estate market. As previously mentioned, real estate appears to be lagging in adopting blockchain when compared to financial institutions and the healthcare sector. Therefore, the following central question has been composed: *Why does blockchain technology adoption rate appear to be lagging in Real Estate markets when compared to other sectors?*

To answer the central question, a conceptual figure is shown which can be found in figure 1, this conceptual model is grounded in the Diffusion of Innovations theory from Rogers (1971). Even while the theory of Rogers is over 50 years old, the theory is still used widely and appreciated by many (Dibra, 2015). The Diffusion of Innovation Theory identifies adoption rates based on several indicators.

The conceptual model shows these indicators in five steps. These five steps are based on the level of knowledge of the technology, the ability of persuasion to adapt, the actual decision to implement or not, the implementation phase in which the technology is either built or tested and finally the confirmation step to keep rejecting, keep adopting or stop the rejection or adoption of the technology. Prior conditions, characteristics of decision-making unit and the perceived characteristics of blockchain influence the decision to adopt or not.

There are multiple ways of identifying adoption ratios of technologies, this research uses a mixed-methods approach. The mixed-methods approach is used to identify the actual made decision through quantitative data and the perceived characteristics of blockchain and prior conditions through interviews. Other potential ways to identify adoption ratios are through large scale surveys or interviews, suggesting quantitative or qualitative research. Mixed-methods is deemed most suitable because the data from both types of research can complement each other, strengthening conclusions and gathered data.

To be able to answer the main research question, the level of knowledge and perceived characteristics have been gathered following by showing the decision made by companies. This has been done in three sub-questions. The first sub-question is to describe the knowledge regarding blockchain technology and is: *“What are main advantages, disadvantages and hurdles to overcome for using blockchain technology within real estate management processes?”* This sub-question is answered by comparing the literature review with results gathered from interviewing a blockchain expert and results gathered from semi-structured interviews with potential users of blockchain technology.

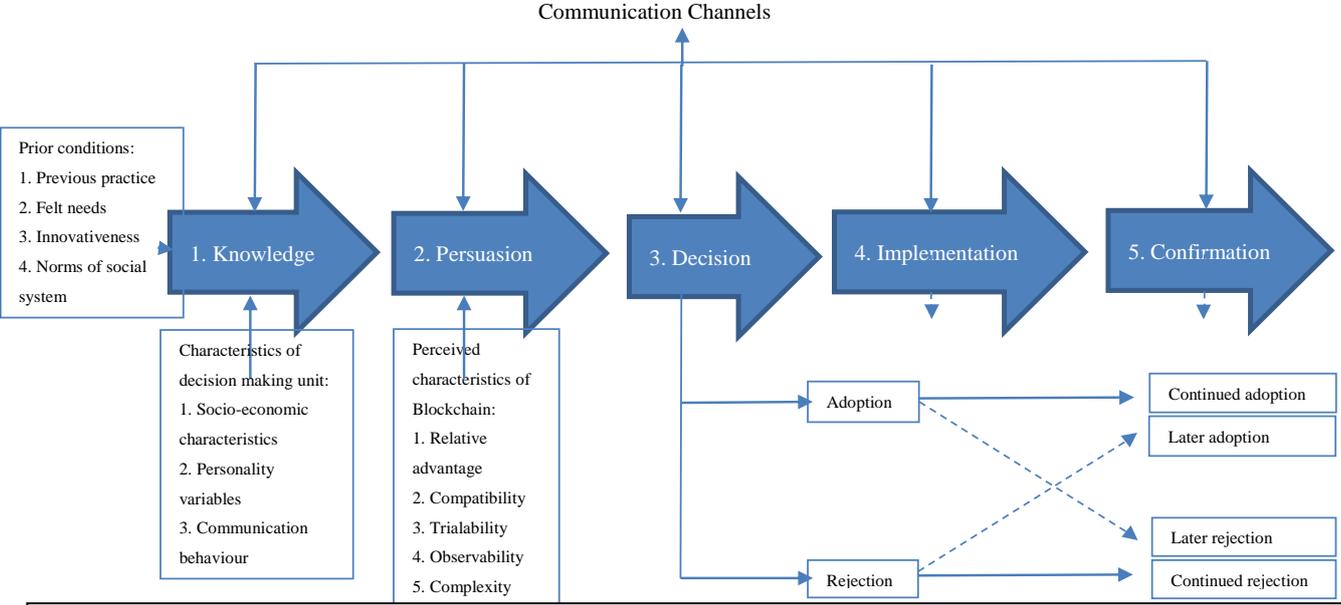


Figure 1. Conceptual model of implementation of blockchain following the Diffusion of Innovation Theory (Rogers, 1971, adjusted).

The second sub-question of this thesis is: *“What are the perceived characteristics of blockchain technology for potential users within real estate management processes?”* The perceived characteristics of blockchain technology and prior conditions are gathered through semi-structured in-depth interviews

with potential users. The transcripts of these interviews have been text analysed. This sub-question focuses on step 1 and 2 of figure 1, ‘knowledge’ and ‘persuasion’.

The third sub-question is of quantitative nature and gathers data of the decision of companies: *“In what phase of decision making to implement blockchain is the real estate management sector in comparison to other sectors?”* The progression of blockchain in real estate is compared to the financial sector through logistic regression based on a gathered dataset, which contains public information about real estate companies and banks and their implementation status of blockchain technology. An additional comparison has been done by comparing the movements across time of patent application in blockchain technology in four sectors. These sectors are identified from the literature to be potentially disruptive (Swan, 2015) and are: real estate companies, financial institutions, healthcare organizations and the automobile industry. This sub-question focuses on step 3 from figure 1, ‘decision’.

The remainder of this paper is organized as follows. Section 2 explains and defines blockchain. Section 3 describes the theory and section 4 the empirical approach. Section 4 presents the results and section 5 concludes.

## **2. Blockchain Definition**

As mentioned in the motivation: public blockchain is an open, transparent, peer-to-peer digital ledger in a decentralized network that cross verifies itself where transactions and data are recorded publicly and chronologically (Swan, 2015; Veuger, 2018; IBM 2019; Corda 2019). Blockchain technology has a high level of possible applications and can be structured differently. The structure of blockchain can be identified through several known “types” and differ from each other with obtaining and distributing permissions for reading and/or writing.

There are three types of blockchain identifiable: permissionless, permissioned and consortium blockchain. A public blockchain is a fully decentralized blockchain in which any party can write and read without any prior permission needed. Consensus of writing (transactions) is usually done in public blockchains by mining coins to solidify blocks of data. These miners receive compensation in the form of coins and verify all transactions of data through mining. In other words: a public blockchain is a blockchain that supports itself and all parties are equal. The public blockchain is usually called permissionless. A permissioned blockchain is a blockchain in which a party or organisation gives certain permissions to users. There are two types of permissioned blockchains, the first being a blockchain in which anyone can read the blockchain but only permissioned parties can write. The second type of permissioned blockchain is when reading and joining can only be done with permission, all parties are therefore known in the blockchain. Consensus is often reached when those with permission give approval. Mining is not necessary in both types but can be optional. The last identified type of blockchain is more of a hybrid blockchain called the consortium. The consortium blockchain is equal to the private blockchain except it is partly decentralized by creating a group of users that have permissions instead of only one party. The consortium blockchain can be made fully decentralized by creating a playing book

with pre-set rules to add more permissioned users. In this playing book the rules to obtain permission are specified clearly and differ widely, for example: permission can only be granted by those that already have permission and a minimum number of permissions from other users are needed before verifying and/or writing is possible (Meng et al., 2017; Spielman, 2016; Dijkstra, 2017; Moerel 2019; Zhang et al., 2018; Li et al., 2018).

Academic literature shows somewhat of a mix up in names of the permissionless and permissioned blockchain. Spielman (2016), Dijkstra (2017), Moerel (2019) state that public blockchain is equal to permissionless and private blockchain is equal to permissioned. Private blockchain can be two types as mentioned in the previous paragraph. Meng et al. (2017) and the interviewed blockchain expert (chapter 4.1) agree that a permissionless blockchain is always a public blockchain, but state that a permissioned blockchain can be a private blockchain or a public blockchain. A permissioned private blockchain is in the findings of Meng et al. (2017) a blockchain that cannot be read or joined without permission whereas a permissioned public blockchain is a blockchain that can be read publicly but writers need permission.

Non-academic websites (Medium, 2019; Investopedia, 2018) go even further and state that there is also a private permissionless blockchain. The private permissionless blockchain, while different in name, is equal to the consortium blockchain that is fully decentralized with a pre-set playing book, in which new permissioned users can be chosen by existing permissioned users. The terminology permissionless seems out of place because there are still permissions distributed and obtainable even though the rules to obtain permission are pre-set during the launch of the blockchain.

As can be seen, there are many types of definitions for blockchain. All these types have different functionalities. This research will use the definitions as in the first paragraph of this section: (1) a public blockchain is always permissionless. A private blockchain where permissions are set by a single entity contains two types. The first type is (2) readable without permission but writable only with permission; the second type (3) readable and writable only with permission. A consortium (4) is where multiple parties are given permission for specific actions at the start and new permissions for these actions can optionally be given out through a pre-set book of rules. Permissions could for example be: verifying transactions.

The different types of blockchain all have separate perceived benefits and downsides. Public permissionless blockchains are seen as the most decentralized form but their versions are met with critical views. Some critical views are: its protection of privacy because everyone can read all transactions, scalability because miners need to verify transactions which impact bandwidth; latency and maximum size. Additionally, miners cost energy which is deemed not sustainable (Swan, 2015; Moerel, 2019). Private blockchains with one entity handling permissions bring benefits to privacy and scalability, but immutability of transactions is frowned upon. A consortium with a pre-set playing book that is fully decentralized gives benefits to privacy, scalability and its immutability due to a higher decentralization of permissions. However, the pre-set playing book for distributing permissions is

created by one or more parties and could pose problems depending on the created rules (Kshetri, 2017; Swan, 2015; Moerel, 2019).

A noteworthy remark: the type of blockchain defines the working of the technology. However, as with most technologies, if everyone who has editorial rights agrees to switch to a new version of blockchain and users without editorial rights (readers) keep using the blockchain, changing the type of blockchain becomes possible. Private blockchains can be changed quite easily due to the low number of editorial rights, but with public blockchains this becomes quite hard. One example of this is the Bitcoin hard fork in 2017. Part of the users of the Bitcoin network wanted to change but some wanted to make different changes. This resulted in the well-known Bitcoin (BTC) network and the less known Bitcoin Cash (BCH), that each have equal history and data from before the fork and now exists side by side with their own monetary values and coins (BTC Direct, 2019).

### **3. Theory**

#### **3.1 Applications of blockchain**

This chapter shows the identified applications for blockchain technology in real estate services. Research shows that blockchain can resolve privacy disputes (Cha et al., 2018); Nasarre-Aznar (2018) finds that blockchain can reduce transaction costs, Firica (2017) finds that blockchain has deep implications to real estate management due the previously mentioned reasons. Dijkstra (2017) states five hypothetical opportunities for blockchain in real estate: (1) digitalizing real estate with all their characteristics; (2) finding alternative finance tools; (3) easier exchange of ownership of real estate; (4) making lease contracts cheaper and more manageable and (5) registering performance of buildings and tracing lifecycle of building materials.

Blockchain is called a disruptive technology and has many applications within Real Estate (Veuger, 2018). Spielman (2016) states that most of the industrialized world uses land registration systems for land title transfers and that blockchain can be used as a decentralized, more transparent alternative. Nasarre-Aznar (2018) goes even further stating that current land title systems have high costs which can be reduced through blockchain by disintermediation. By using blockchain for land title systems, transaction costs can be reduced; transaction times can be increased and thus also increasing liquidity and markets will become more transparent. Nasarre-Aznar (2018) and Mansab Uzair, et al. (2018) add that cross-border real estate transactions can be boosted through blockchain and smart contracts can be used for automation of many processes such as rent collection.

Veuger states that: ‘The real estate world finds itself at a tipping point of a transition: a dramatic and irreversible shift in real estate systems in society’ (2018, p.1). This quote is targeted at blockchain and mentions that blockchain is hardened against counterfeiting. Veuger (2018) finds that blockchain is expected to increase worldwide, for example, with plans of the government of Dubai to have all government documents in blockchain by 2020. Veuger is critical in his conclusions stating that: (1) the relationship between blockchain and real estate has not been proven yet in practice and therefore needs

more research; (2) blockchain can only work within real estate when completeness and transparency are used.

Janowicz et al. (2018) creates an overview of value propositions of blockchain technologies for science in general and aims to show how blockchain can help, as an example, academic writing. The research finds that blockchain can help make journal management workflows transparent; managing data to support reproducibility; connecting researchers through funding and managing intellectual property. Although this example does not correspond directly to real estate management processes, the possibilities are comparable. Blockchain can be used for all transactions, from buying coffee to real estate. By using blockchain for these transactions many mediators can be eliminated or minimized. For example, banks can be removed from intermediating payments due to the high level of security and transparency within blockchain (Swan, 2015).

### 3.2 Technology adoption theories

Measuring and predicting adoption rates of innovation is complex. There are many innovation of technology theories and frameworks. This research has investigated three of these theories which are the foundation of technology adoption studies in various contexts. These three models are: Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB) and Diffusion of Innovations theory (Davis et al., 1989; Ajzen, 1991; Rogers, 1971). The structure of these theories has been compared to create the most suitable framework for this research. The diffusion of innovation theory is explained and shown in part 1.3 with the conceptual figure. The Diffusion of Innovation theory maps prior conditions, characteristics of decision-making unit and perceived characteristics and also maps the decision phase into the model (Rogers, 1971).

TAM models focus on perceived ease of use towards perceived usefulness and attitude to map a behavioural intention. Perceived usefulness is made visible through questionnaires and tests of the program. Adoption rate according to the TAM model is influenced by how users experience the software and furthermore the attitude towards the software. The so-called easy-to-use is important as it creates a certain attitude with users. Attitude is influenced by the opinions of co-workers and mass media. Negative (positive) attitudes decelerate (accelerate) adoption rates (Venkatesh et al., 2003).

The TPB model focuses on mapping behavioural beliefs, normative beliefs and control beliefs that affect respectively attitude, subjective norms and perceived behavioural control to identify behaviour. The model shows that besides attitude and the experience of the software as seen through model TAM, TPB also states that norms influence adoption rates. Grounded norms have the possibility of (temporarily) disregarding superior innovations, slowing progress and adoption rates. Norms can be grounded in the history of the company or certain personal values (Koul & Eydgahi, 2017). This research uses a slightly altered conceptual framework from the Diffusion of Innovation Theory (Rogers, 1961). The used conceptual framework is based on: identifying prior conditions such as felt needs to implement blockchain technology and characteristics of decision-making unit; identifying perceived characteristics

of blockchain and identifying the actual made decision (behaviour). This overlaps with the TAM model, except for the easy-to-use measure. The easy-to-use measure is hard to measure because there are no market-wide ready to use blockchain software programs available. The TPB model has added norms, which are also very hard to measure when comparing multiple companies. The size of this research does not allow for measuring norms on a per-company basis and is therefore not used.

### **3. Methodology**

To explain why adoption rates of blockchain technology appear to be lagging in real estate, qualitative methods are used to identify perceived characteristics of blockchain by potential users and adoption rates have been identified through quantitative methods. Qualitative research has been done to identify the level of knowledge regarding blockchain and opinions and expectations. Furthermore, qualitative research is used to identify possible gaps in the literature. Quantitative research has been done to measure current adoption rates of blockchain technology and identify significant indicators for adoption rate. In both parts of research, the focus has been on large companies. Large companies are used because the Diffusion of Innovation model of Rogers (1971) state that larger companies have higher budgets for innovation and usually adopt innovation sooner, when compared with medium to small sized companies. However, start-ups are not considered. When larger companies have created and/or adopted innovation, medium-sized companies will usually follow (Rogers, 1971). Another possibility to measure adoption is to focus on start-ups in blockchain technology. Start-ups are conceived to create non-probabilistic uncertainty, with some start-ups skyrocketing in a short period, some becoming small to medium companies and others sizzling out silently. In other words: start-ups create uncertainty (Pomerol, 2018). Large companies are deemed suitable for measuring adoption rate because they are usually risk-averse, limiting downside risks with diversification and larger research budgets. These research budgets contain substantial amounts because the overall budgets are large, allowing for experiments and pilots. Furthermore, large companies are known to take over successful start-ups, adding another reason to not focus on start-ups (Menezes et al., 1980).

#### **3.1 Qualitative methods**

Interviews have been held with a blockchain expert and with potential users and/or potential implementers of blockchain to find perceived characteristics of blockchain. Interview questions, proposed length of interviews and qualitative research methods such as coding schemes have been discussed with dr. S. van Lanen, specialist of qualitative methods at the University of Groningen and are based on literature from Doel (2016). The interview with the blockchain expert is to determine if there are possible lags -and therefore also potential gaps- in the literature and to compare the knowledge of the expert to the literature review and the quantitative results. Lags are needed to identify because blockchain is a new and upcoming technology and most literature is only from the past couple of years. When there is a new technology, such as blockchain, early disadvantages could be eliminated by

reinventing/adjusting the new technology (Hyysalo & Usenvuk, 2015). The adaptiveness of technologies is positively correlated to adoption rates (Rogers, 1971). The interviews are held with potential users to compare their answers to the quantitative findings and to make expectations on the implementation rate of blockchain. Potential users who are interviewed are: a bank official, two notaries and a real estate manager. During the interviews the following topics regarding blockchain have been gathered: (1) knowledge; (2) opinions; (3) expectations; (4) what is needed for blockchain to reach these expectations; (5) standing of company / interviewee regarding blockchain; (6) role of the government; (7) problems, hurdles or threats to overcome and (8) opportunities. Most of these topics are identified from the conceptual model in figure 1 and have been iteratively altered based on answers during the interview.

The interviews were semi-structured in-depth with six to eight open-ended questions of which the template can be found in appendix A and B. Every respondent will be interviewed for approximately 45-60 minutes. Respondents are asked to sign a consent form, which can be found in Appendix C. To ensure the privacy, which is also mentioned in the consent form, transcripts of the interviews and the signed consent forms are not added to this published thesis in the appendix, only the categorical and inferential coding tables. Integrity commissions and supervisors have received the transcripts and signed consent forms.

The transcripts of the interviews have been coded for categorical and inferential purposes based on the steps advised by Doel (chapter 14, 2016). The following steps for coding have been taken: (1) coding descriptively and (2) coding inferential/through patterns. First level coding will be done through descriptive low inference codes; useful for summarising. Later levels will be coded by interpretive, more inferential coding. General analysis structure: (1). Reading transcripts; (2) Label relevant pieces; (3) Relative importance; (4) Label and connecting themes and (5) Create hierarchy and code tree. A code tree for characteristics and another code tree for expectations and opinions have been made which can be found in appendix D. The coding tree has been pre-made but adjusted with new information when the interviews have been conducted. One downside of changing code trees iteratively is that there is a chance of changing the structure of the interviews from the position of the interviewer. To make sure the structure is equal, there has been no change in the main questions asked during the interview and a neutral position has been taken up. There is however the risk of unconsciously changing follow up questions between interviews (Doel, chapter 14, 2016).

Using the descriptive and inferential coding, a word count of these codes has been done per interviewee. Word counts are compared between interviewees and possible explanations of these differences are inferred. Because only one or two persons are interviewed per sector, no generalization for the entire sector is possible. This research only shows the viewpoint per interviewee and elaborates on quotes with a literature review. A word count is a useful text-analysis according to Leech & Onwuegbuzie (2007).

During the interviews, a neutral position regarding blockchain has been taken up. The interviewees have been selected through the professional network of the researcher, this creates a certain positionality. Due to the quantitative setting, which is explained in the following section, only larger companies have been interviewed. To safeguard the privacy of those that are interviewed, larger companies are defined by having thirty or more employees. A bank with only thirty employees might seem small however, a notary company in the Netherlands with thirty or more employees can be regarded as large (Advocatie, 2017). The reason for interviewing larger companies is because large companies usually have more funding to follow innovations when compared to middle-sized companies (Rogers, 1971). One might note that new start-ups also can follow innovations and perhaps even more by making it their core business. Start-ups are deemed unsuitable because they give high levels of uncertainty as can be read at the beginning of this chapter (Menezes et al., 1980).

### 3.2 Quantitative methods

This section shows the methodology to measure the adoption rate of blockchain in real estate companies and how indicators are identified based on quantitative methods. As can be read in the previous section, technology adoption frameworks and its extensions such as the Technology Acceptance Model, Theory of Planned Behaviour and Diffusion of Innovation theory each focuses on ready to use products and are based on surveys (Branchea et al., 1990; Ajzen 1991; Ceruzzi et al., 2007). These surveys contain questions on a wide spectrum of topics such as perceived ease of use, perceived behaviour, perceived characteristics and more (Koul et al., 2017; Rogers, 1962). Because blockchain is still in its emerging phase (Veuger, 2018); has many different uses (Swan, 2015) and several of those that are interviewed do not wish to share their companies progress (even anonymously) it is hard to create a substantial database, sizeable enough for statistical models through personalized surveys in the time available for this research. Furthermore, no blockchain application is already used market-wide for real estate management purposes because none are identified from investigating the 100 largest real estate companies as shown in Appendix F. Existing applications have small market shares (Spielman, 2016), therefore results regarding perceived ease of use are very hard, if not impossible, to gather for this particular research. The difference of blockchain technology with other innovations show that quantitative regression models following the technology adoption frameworks are deemed unsuitable for this particular research based on surveys. In a couple of years, when blockchain technology is more grounded, these frameworks might become possible. This study has created two ways of measuring the implementation which will be explained in detail in the following sections: (1) a matrix for the hundred largest banks and hundred largest real estate companies showing their implementation on blockchain; (2) a comparison of blockchain technology patent applications movements throughout years coming from the sectors: real estate, financial institutions, healthcare and the automobile industry.

To be able to compare two sectors on their adoption rate of blockchain technology, a matrix is logically the most suitable. As stated in the introduction of this chapter, this research focuses on the 100

largest banks and real estate companies worldwide based on their market capitalization value. By using market capitalization, only stock-based companies are used as they have clear market capitalized values. Finding the hundred largest banks worldwide is provided quickly because many companies create lists on these topics. This research uses the list from Relbanks (2018), that shows contains 70 largest market capitalized banks. Every bank on the list is verified through the S&P Global (2018) list which is one of the largest information and analysis companies worldwide, in which banks are ranked by asset holdings. Because the Relbanks (2018) list only shows the largest 70 market capitalized banks, the remaining thirty banks that have the largest asset value have been gathered from the S&P Global (2018) list to reach one hundred. Market capitalization values have been gathered and/or verified from Reuters (2019), Yahoo Finance (2019) or Bloomberg (2019). Only banks with market capitalization have been used, banks that are not stock-based are therefore excluded. Sources per bank can be found in appendix E.

Finding the hundred largest real estate companies worldwide is less straightforward because there are many types of real estate companies. Some type of real estate companies are: real estate investment trusts (REIT's), developers, designers, brokers, consultants, appraisers and property managers to name a few. This study uses one main source to compile the 100 largest real estate companies with the highest market capitalization (Value, 2019). Several other sources have been compared with this list (Lipseys report, 2019: NREI, 2019: Carleton Sheets, 2019: Property Manager Inside, 2019) and based on their market capitalization no changes have been made to the Value list. Only companies of the sources where the main goal appears to be real estate have been used. Several of the companies on the Value (2019) list have been disregarded because they appeared to have a different main function (for example a supermarket that handles its real estate). For every company on the list, the market capitalization has been updated through one or more of the following sources: Bloomberg (2019), Yahoo Finance (2019) and/or Reuters (2019). Furthermore, the number of employees and number of branches have been gathered on a separate search for every company using numerous sources. A direct link to these sources for every company can be found in appendix E and F. Note: these sources have not been added to the reference list due to the number of sources for clarity purposes, only the homepage has been added to the reference list.

- For every company on the list, a search on their progress of implementing blockchain has been done and has been given a code between 0 and 5. These codes are:  
0 = no findable public mention from the company on blockchain on company website, blogs or other official company sources.
- 1 = mention of blockchain on official website from the company.
- 2 = mention of creating blockchain programs to implement on news websites.
- 3 = mention of creating blockchain programs to implement on the official company website.
- 4 = mention of using blockchain on news websites.
- 5 = mention of using blockchain on the official company website.

A noteworthy remark is that a mention of using blockchain on the company website means that a successful pilot of testing the blockchain has been done or the company has fully implemented the blockchain technology.

The measured adoption per company results can be found in Appendix E for the list with banks and appendix F for the real estate companies. These appendixes also show the sources where the results are found, which are all retrieved in April and May 2019. There is a possibility that the websites have been changed, deleted or replaced. To access these sources, language packs might need to be installed to be able to view the website properly (for example when Chinese symbols are used in the webpage). Once a company webpage of using blockchain has been found, the search is halted because this is the highest obtainable level in this study. The search process is different in every search but comprises of the following steps: first, the company website has been sought up in an English version and a search on blockchain has been done throughout the website, if possible. Depending on the results, a search on different languages of the website has been done, for example, the native language (for example Chinese). The official native website has been found to often contain more information when compared to the English website (when the company is not originally from English speaking countries). For every language other than Dutch or English, the Google auto-translation program in the browser Chrome has been used. The term blockchain has also been auto translated to several languages to use as a search query on foreign language sites through the Google translation program. With no satisfactory results, a Google search has been done in separate ways by searching on the term 'blockchain' and one of the following: company name; website name; website URL; company's abbreviation. At least the first fifteen results of these pages have been investigated. With no satisfactory results, the search has been redone by replacing blockchain by: "proptech" or "fintech" (two terms that are used for property and financial technologies). These two terms are not necessarily blockchain technology, therefore all reports have been investigated to determine if it is blockchain or not and subsequently the adoption phase has been identified. The translation function of Google might contain translation errors, this risk has been accepted as a limitation of this research by the author.

The gathered data of implementation phase per company is ordinal on a six-point scale. Because there is no normal distribution of the six-point scale and the adoption rate can be measured as a probability between 0% and 100%, logistic regression seems most suitable. Alternatives are for example the Kruskal-Wallis test, which is a non-parametric test suitable for the ordinal dependent variable and is deemed less strong than logistic regression and is usually used for small samples (<30). Another example is the Chi-Square test, this test is based when both variables are ordinal (or nominal), because this research has ratio independent variables, this test is therefore deemed unsuitable. Mann-Whitney and Two-samples-number-of-runs test is directed towards two-sample tests and is unsuitable due to the intention to also run statistical tests on separate models (Burt et al., 2009).

Logistic regression requirements are: dependent variable needs to be binary, which is met due to transformation whereby blockchains is a 0 when not implemented and a 1 when implemented; observations should be independent of each other; independent variables should not be too highly correlated with each other which is met by removing the variable 'employees' from regression; independent variables need to be linearly related to log-odds, which is assumed to be true due to set up

off research; and finally, the logistic regression requires a high sample size with enough variation per independent variable. The sample size is usually described as a minimum of 100, this research has gathered 100 companies per sector. Banking and real estate have a least likely binary outcome of 15 and 13 per 100 respectively. The minimum of 10 least likely binary outcome per independent variable rule of thumb is used to decrease the chance of overfitting the model (Burt et al., 2009). This rule of thumb has been disputed by some researchers who argue to use the rule of thumb of 15 least likely binary outcomes per dependent variable (Harrel, 2015), others go even further with 20 to 1 (Ploeg, van der, et al., 2014) and some have created models to specify sample size and variation (Riley et al., 2018). The size of this research limits gathering extra data, therefore the rule of thumb of 10-1 is used which poses a potential overfitting risk. The variation of the data also creates the possibility of separation, when dichotomous outcomes are heavily influenced by the chosen group (Heinze, 2006). Separation is present because for banks 15% do not have implemented blockchain versus 87% of real estate companies that do not have implemented blockchain. To eliminate any chance of separation due to groups, this research has separated the models and run logistic regressions separately per sector. Which is also deemed logical, because the sectors differ highly in the found results.

To identify if company characteristics are significant indicators on the adoption rate of blockchain a logistic regression technique has been used. The Stata Do file to obtain the results can be found in appendix G with the used data in appendix E and F. The null hypothesis for the logistic regression model is: there is no relationship between the market capitalization and the number of branches of a company and the implementation speed of blockchain technology. For every parameter that is used, the null hypothesis is:  $H_0: \beta_i = 0, i^e$ .

As can be read at the beginning of this chapter, two possible ways of analysing adoption rates have been identified in this research. The second way of analysing the progress of blockchain implementation is through a patent search comparison. Comparing patent applications for blockchain technology can help to identify differences across sectors. Differences across sectors can, for example, be a difference in transparency. Different transparency levels can influence the results of the self-gathered public data. When one sector shares less about adoption, this could create skewed results. To identify possible skewed results, movements of patent applications are compared throughout four sectors. Literature often mentions that blockchain is a useful technology for several sectors including real estate. Three of the sectors that are found most commonly are used for comparison against real estate and are: financial institutions, healthcare and the automobile industry (Swan, 2015). Furthermore, also the type of company for the 20 largest patent applicants are identified, for example, a bank, a real estate company or an ICT/software company. For every sector, a patent search has been done with a specified search string. These search strings are used and compared to the text of patents to find new search words or to find out if the words used are synonyms and give wrong results, this has been an iterative process. Some examples of synonyms that cannot be used are: “house” because house can also mean that it provides storage on servers, “bank” because blockchain can be stored on data banks or

‘property’ because blockchains can have certain properties, also known as characteristics. The final search strings can be found in textbox 1. The search string shows that the results will contain blockchain (AND) from the left side of the search string and one of the other words (OR) from the right side. By using OR, the additional sector-specific words are used simultaneously but do not exclude one another. The addition OR makes sure that no patents will be counted twice and the search can be executed in one time per website.

*Textbox 1. Search strings for Lens (2019) patent database regarding blockchain.*

**Real estate:** Blockchain AND ( "Real Estate" OR "Housing Appraisal" OR "Dwelling" OR "Apartment" OR "Residential" OR "Property management" ).

**Financial institutions:** Blockchain AND ( "Banking" OR "Financial institution" OR "Financial organization" OR "Trust company" OR "central bank" ).

**Healthcare:** Blockchain AND ( "Healthcare" OR "Health" OR "Hospital" OR "Medicine" OR "Physician" ).

**Automobile industry:** Blockchain AND ( "Cars" OR "Car" OR "Vehicle" OR "Automobile" OR "self-driving" )

The above-mentioned search strings have been used on a large public patent website called Lens (2019). Other databases such as Espacenet (2019), Google Patents (2019), Patentscope (2019) and U.S. Patents have been considered and used but show fewer results when compared to Lens. The search string as above can be used directly in the database. The movements from the patents have been compared sector-wise in applied and granted patents. Because there are differences between the four sectors, which have not been explicitly identified in this research, only the movements of patent applications have been compared across sectors. To give more insight, the top twenty companies that applied for the most patents per sector have been identified and categorized. This categorization shows what kind of company’s apply for patents, for example: are these real estate companies applying for blockchain patents in the real estate sector or not.

## 4. Results

This chapter contains qualitative and quantitative results through four subchapters. In chapter 4.1 blockchain will be analysed by descriptions given from the market through interviews. The found adoption phase of blockchain in real estate compared to banking follows in 4.2, whereby the differences are explained with the help of the Diffusion of Innovations Theory following with found significant indicators of adoption rate. Chapter 4.3 elaborates on the found differences in the real estate sector itself. 4.4 concludes with a comparison of patent applications to identify possible differences across sectors in for example transparency.

### 4.1. Perceived characteristics of blockchain

Perceived characteristics, expectations and opinions are gathered through interviews with potential users of blockchain technology and from a blockchain expert. The interviews have been aggregated through coding, text-analysis and showing relevant quotes, as also explained in chapter 3.1, Qualitative methods. Coding has been done through two coding trees. The first way of coding is shown in table 1 and shows

the number of times interviewee's mention certain characteristics during the interviews. The second way of coding is shown in table 2 and shows the interviewees opinions and expectations of blockchain. The information from table 1 and 2 and other related parts have been translated from Dutch, therefore a possibility of translation errors occurs.

	Notaries (1,2)		Bank (3)		Blockchain expert (4)		Real estate manager (5)	
<b>Type</b>	<b>10</b>	<b>8,93%</b>	<b>12</b>	<b>12.24%</b>	<b>2</b>	<b>2.90%</b>	<b>4</b>	<b>6.90%</b>
Public	5		5		1		2	
Private	5		7		1		2	
<b>Compliance</b>	<b>37</b>	<b>33,04%</b>	<b>16</b>	<b>16.33%</b>	<b>26</b>	<b>37.68%</b>	<b>18</b>	<b>31.03%</b>
Privacy	8		3		7		7	
Security	11		9		11		7	
Need to know	5		2		3		3	
Law	13		2		5		1	
<b>Costs</b>	<b>11</b>	<b>9,82%</b>	<b>13</b>	<b>13.27%</b>	<b>6</b>	<b>8.70%</b>	<b>8</b>	<b>13.79%</b>
Employee costs	2		5		1		2	
Software costs	2		1		2		1	
Maintenance costs	0		1		1		0	
Implementation costs	2		2		0		1	
General costs	5		4		2		4	
<b>Continued use</b>	<b>9</b>	<b>8,04%</b>	<b>4</b>	<b>4.08%</b>	<b>7</b>	<b>10.14%</b>	<b>0</b>	<b>0.00%</b>
Energy use	3		1		2		0	
Scalability	4		3		3		0	
Sustainability	2		0		2		0	
<b>Process</b>	<b>32</b>	<b>28,57%</b>	<b>32</b>	<b>32.65%</b>	<b>18</b>	<b>26.09%</b>	<b>22</b>	<b>37.93%</b>
Speed	3		7		5		4	
Reducing human errors	4		2		2		2	
Automatization	14		8		6		9	
Process improvement	11		15		5		7	
<b>Data</b>	<b>13</b>	<b>11,61%</b>	<b>21</b>	<b>21.43%</b>	<b>10</b>	<b>14.49%</b>	<b>6</b>	<b>10.34%</b>
Verifiability	4		17		1		0	
Potential data adjustments	1		1		0		1	
Transparency	8		3		9		5	
<b>Total:</b>	<b>112</b>	<b>100,00%</b>	<b>98</b>	<b>100.00%</b>	<b>69</b>	<b>100.00%</b>	<b>58</b>	<b>100.00%</b>

Note: the code tree is categorized per type of the characteristics of blockchain and is the summation of the coding words below. A percentage of the total topic is calculated based on the total times a code is mentioned versus the number of times a coding group is mentioned per interview. Every interviewee is coded with a number, 1-5.

The most important perceived takeaways regarding blockchain are described as follows. The notaries believe blockchain has a lot of hurdles on the road towards compliance, security and privacy. The notaries expect that the most likely result that blockchain will succeed in the real estate sectors would be for a private blockchain, to safeguard the privacy of those involved and furthermore make sure that authorized persons have the correct permissions and can be controlled for their actions.

The banking official believes that we should start with pilots in private blockchains, when successful to change into large consortium blockchains and should preferably end in public blockchains. The bank official compares blockchain with the internet stating: "If we would make different types of internet ... and I should have internet A to visit web shop A and internet B to visit web shop B, that would not be useful". This quote suggests that we should create one large consortium where all parties can enter, eventually turning into one large public blockchain, instead of multiple separate blockchains. Furthermore, the banking official states that "Blockchain is just another technology", whereby the banking official suggests that blockchain sounds difficult for decision-makers. The main message here is to let programmers with high knowledge of blockchain create useful programs, according to what the

decision-making units want. Whereby decision-makers should not need to know everything by heart regarding the blockchain. While this sounds less transparent, the banking official states that most decision-makers and regular people also do not know how computers work exactly, only that it works.

The blockchain expert firmly believes in public blockchain and that all hurdles such as potential energy costs will be overcome in the future. The blockchain expert states: “Blockchain costs energy. When we talk about energy sustainability... once we do not need banks anymore, no extra buildings, fewer people ... this uses less energy... that is a comparison that is often forgotten”. The expert believes that blockchain will be able to remove many third parties regarding notaries, banks and more. By removing these third parties, energy costs will go down even when blockchain technologies may cost a lot of energy. Furthermore, it is stated that the technology is still quite new. The adaptiveness of blockchain is still underway, possibly creating solutions for energy and scalability problems that are perceived right now.

The real estate manager sees blockchain as a potential alternative for managing programs that their company is using right now. One of the main problems with current programs is that when there is a malfunction, the entire company comes to a halt. The real estate manager states that blockchain is perceived to practically always stay available, even when multiple computers malfunction. Additionally, the real estate manager believes that the market should initiate blockchain and that the government will follow. Consensus between all interviewees is that blockchain has the potential to automatize parts of the workload, to allow for higher specialization of specialists.

The previous paragraph has shown the perceived characteristics of blockchain, the inferential noted expectations and opinions per interviewee follows. A topic count per interviewee regarding expectations and opinions is shown in table 2. All interviewees state that the market is expected to create blockchain software programs and the government should join these programs by opening their registers, such as the Cadastre. The notaries believe that public blockchain is too anonymous to protect interests of the stakeholders and the government but at the same time not private enough because all data is publicly accessible. A private blockchain with mining is deemed not sustainable enough due to high energy costs. Therefore, the preference of interviewee 1 and 2 is a private blockchain without mining and they see high effects and potential for this blockchain. The blockchain expert and the bank believe that we should start in private blockchain but allow for reconfiguration towards consortium and in the end public blockchains, to allow for one universal blockchain program for all applicable parties.

Between all interviewees, there is a consensus that blockchain in the real estate sector is in an early conceptualization phase. The notaries, for example, are sceptical of publications from the real estate market regarding blockchain implementation. The interviewed notary's wonder if these publications actually use blockchain, and if so, what is the actual benefit of using blockchain for these processes. They state: “... now and then they (real estate companies) publicize something (regarding blockchain) ... I cannot see if this is blockchain and how this exactly works with blockchain...”. The notaries do not expect market-wide implementation of blockchain in the short term and they quote: “Ten

years (time blockchain is being used for bitcoin) ... That is a relatively short period and a lot has already changed. If we look at another ten years, I think that it is likely that blockchain will be used in a much broader way ...". The banking official states that for blockchain to be adopted properly in the real estate sector, a large consortium of banks should take the lead, allowing real estate companies to follow. The banking official expects that within two to five years a reasonable market share will probably be reached, following the initiative of the banks. The expert expects that blockchain in real estate will be implemented in approximately five years and the real estate manager between five to ten years. The previous information of perceived characteristics of blockchain and opinions and expectations by each potential user is summarized in table 3.

*Table 2: Topic count of blockchain expectations and opinions during interviews.*

<b>Blockchain expectations</b>	Notaries (1,2)		Bank (3)		Blockchain expert (4)		Real estate manager (5)	
<b>What is needed</b>	<b>10</b>	<b>17.54%</b>	<b>3</b>	<b>8.82%</b>	<b>5</b>	<b>12.50%</b>	<b>3</b>	<b>9.38%</b>
<i>Government should not play a role</i>	0		0		0		0	
<i>Government should play a large role</i>	7		1		2		3	
<i>Market should play a large role</i>	3		2		3		0	
<i>Market should not play a role</i>	0		0		0		0	
<b>Preference to blockchain type</b>	<b>4</b>	<b>7.02%</b>	<b>4</b>	<b>11.76%</b>	<b>1</b>	<b>2.50%</b>	<b>0</b>	<b>0.00%</b>
<i>Private with mining</i>	0		0		0		0	
<i>Private without mining</i>	4		0		0		0	
<i>Public blockchain</i>	0		0		1		0	
<i>No preference</i>	0		4		0		0	
<b>Expected implementation effect</b>	<b>7</b>	<b>12.28%</b>	<b>4</b>	<b>11.76%</b>	<b>6</b>	<b>15.00%</b>	<b>0</b>	<b>0.00%</b>
<i>High effect</i>	6		3		6		0	
<i>Neutral effect</i>	1		1		0		0	
<i>Low effect</i>	0		0		0		0	
<b>Opinion of type</b>	<b>15</b>	<b>26.32%</b>	<b>6</b>	<b>17.65%</b>	<b>3</b>	<b>7.50%</b>	<b>8</b>	<b>25.00%</b>
<i>Sceptical of private</i>	0		0		0		1	
<i>Sceptical of public</i>	6		0		0		1	
<i>Positive of private</i>	9		3		0		4	
<i>Positive of public</i>	0		3		3		2	
<i>Neutral of public</i>	0		0		0		0	
<i>Neutral of private</i>	0		0		0		0	
<b>Highest sector pressure for implementation</b>	<b>4</b>	<b>7.02%</b>	<b>2</b>	<b>5.88%</b>	<b>7</b>	<b>17.50%</b>	<b>4</b>	<b>12.50%</b>
<i>Real Estate</i>	0		0		0		0	
<i>Banking</i>	4		2		7		4	
<i>Both sectors feel equal pressure</i>	0		0		0		0	
<b>Opinion of sector news with implemented blockchain usefulness</b>	<b>11</b>	<b>19.30%</b>	<b>8</b>	<b>23.53%</b>	<b>11</b>	<b>27.50%</b>	<b>9</b>	<b>28.13%</b>
<i>Sceptical opinion</i>	10		5		3		1	
<i>Neutral opinion</i>	0		0		0		1	
<i>Positive opinion</i>	1		3		8		7	
<b>Implementation expectation</b>	<b>6</b>	<b>10.53%</b>	<b>7</b>	<b>20.59%</b>	<b>7</b>	<b>17.50%</b>	<b>8</b>	<b>25.00%</b>
<i>Blockchain will be integrated in our market long term</i>	4		0		3		5	
<i>Blockchain will be integrated in our market in short term</i>	2		7		4		0	
<i>Blockchain will not be integrated in our market</i>	0		0		0		0	
<i>Blockchain is already integrated in our market</i>	0		0		0		3	
<b>Total:</b>	<b>57</b>	<b>100.00%</b>	<b>34</b>	<b>100.00%</b>	<b>40</b>	<b>100.00%</b>	<b>32</b>	<b>100.00%</b>

*Note: the code tree is categorized with expectations and opinions of blockchain and shows the number of times this is mentioned during the interview. Data is either produced inferential or direct from the transcripts.*

*Table 3: Most important perceived characteristics and expectations interviews*

Interviewee:	Most important perceived hurdle:	Largest perceived benefit:	Highest sector pressure:	Most probable initiative taker:	Implementation expectation:
Notary 1	Privacy	Efficiency	Banking	Market	5-10 years
Notary 2	Privacy	Verifiability	Banking	Market	unknown
Bank	Image	Verifiability	Banking	Market	2-5 years
Blockchain expert	Image	Automatization	Banking	Market	0-5 years
Real estate manager	Technology adaption	Security	Banking	Market and government	5-10 years

#### 4.2. Adoption phase of blockchain in real estate compared to banks

This chapter shows the perceived current adoption rate of blockchain in real estate management and banking and identifies statistically significant variables to explain differences in adoption rates. Adoption rates of blockchain technology have been gathered through publicly accessible sources. Summarized adoption phase for the hundred largest banks are shown in table 4. 59 percent of banks state that they are already using blockchain on their official website, they have either successfully tested it or have permanently implemented blockchain in their services. When messages from other public websites are added with regards to the adoption of blockchain, the percentage of banks that are using blockchain rises to 86 percent. Even if several banks do not share their implementation of blockchain, most banks are using blockchain technology. Noteworthy is that every bank has written something regarding blockchain. One possible reason for the high number of adopters is the easily joinable consortium ‘Corda’ (2019) that is joined by over 50 of the largest banks.

*Table 4. Blockchain implementation status in the hundred largest banks*

Description:	Freq.	Impl.	Perc.	Cum.
No mention of blockchain on the company website.	0	0	0.00	0.00
Mention of blockchain on the company website.	2	0	2.00	2.00
Working on the implementation of blockchain on news website.	9	0	9.00	11.00
Working on the implementation of blockchain on the company website.	3	0	3.00	14.00
Mention of using and/or successfully testing blockchain on news website.	27	1	27.00	41.00
Mention of using and/or successfully testing blockchain on the company website.	59	1	59.00	100.00

*Note: input data and sources can be found in appendix E. Implemented is transformed binary with 0 not implemented publicly and 1 implemented publicly. Freq. = frequency, Impl. = implemented, Perc. = percentage and Cum. is cumulative percentage.*

The implementation status of blockchain in real estate companies is shown in table 5, this shows that there is a large difference between the adoption rate of banks and real estate companies. Only 8 percent of real estate companies have successfully tested or implemented blockchain and mention this on their company website. News sites not directly related to the specific bank report another 7 percent of real estate companies that are mentioned to have tested or implemented blockchain. The majority of 63 percent of real estate companies have been found to not mention or say anything about blockchain, on their official websites or other websites. 19 percent of these real estate companies mention something informative about blockchain on their respective company websites, such as how blockchain works and for what sectors blockchain might be appropriate.

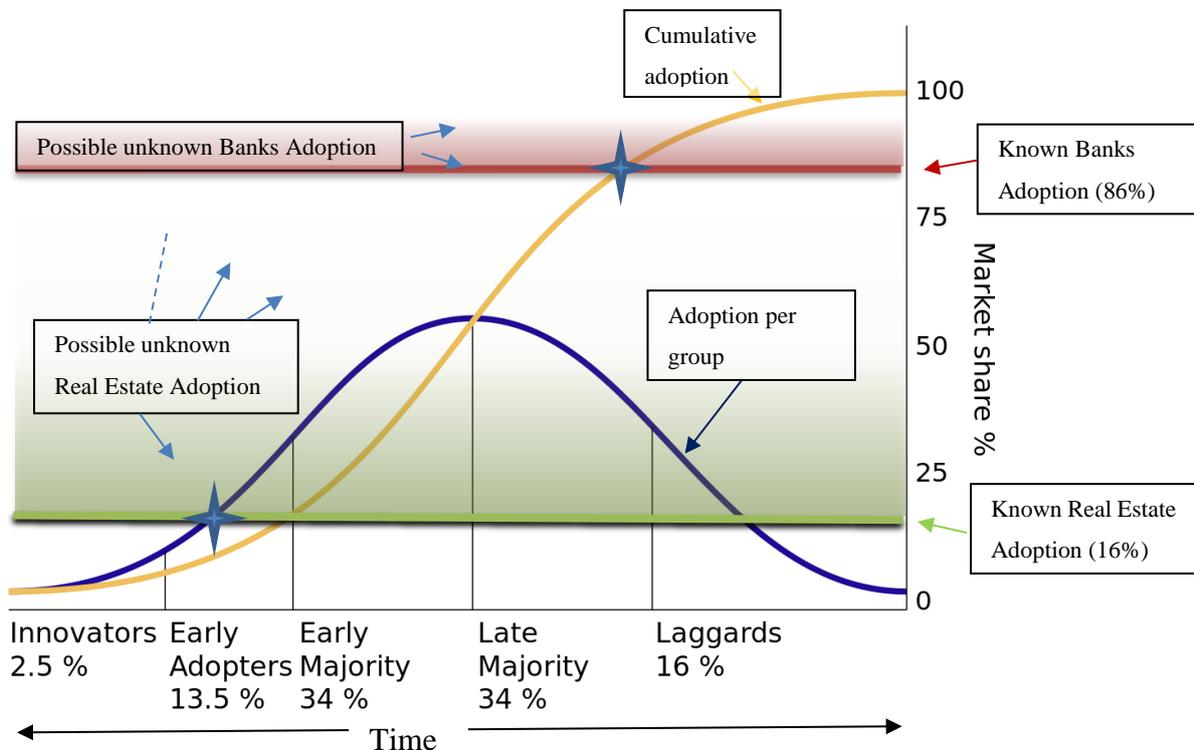
*Table 5. Blockchain implementation status in the hundred largest real estate companies*

Description:	Freq.	Impl.	Perc.	Cum.
No mention of blockchain on the company website.	63	0	63.00	63.00
Mention of blockchain on the company website.	19	0	19.00	82.00

Working on the implementation of blockchain on news website.	2	0	2.00	84.00
Working on the implementation of blockchain on the company website.	0	0	0.00	84.00
Mention of using and/or successfully testing blockchain on news website.	7	1	7.00	91.00
Mention of using and/or successfully testing blockchain on the company website.	9	1	8.00	100.00

*Note: input data and sources can be found in appendix F. Implemented is transformed binary with 0 not implemented publicly and 1 implemented publicly. Freq. = frequency, Impl. = implemented, Perc. = percentage and Cum. is cumulative percentage.*

The implementation phase of blockchain has been descriptively examined with the help of the adoption model of ‘The Diffusions of Innovations Theory’ (Rogers, 1971). Figure 2 shows how the Diffusions of Innovations Theory works and where the real estate companies and banks are standing. Because this section is showcased as more descriptive, in which generalizations are not possible, at the end of this chapter the statistical analysis is described. The cumulative adoption of the technology follows an s-shaped curve and will be between 0% (no adoption) and 100% (complete adoption) with usually the truth somewhere in between. Before reaching a market share of 50% the number of adoptors is accelerating, after reaching a market share of 50% the adoption rate gradually becomes slower. The maximum of 100% market share may not be reached, technologies can be re-invented, rejected and discontinued at any time or the market share will not go above a certain saturation percentage. According to the Diffusions of Innovations theory, there are five stages of adoptors across time: the first 2.5% are considered innovators; the second 13.5% early adopters; followed by 34% early majority; the fourth 34% the late majority and the fifth 16% to be considered laggards (Rogers, 1971).



*Figure 2. Cumulative Diffusion of innovation graph with section of adoptors and data from table 1 & 2 (Rogers, 1962, adjusted). The cumulative yellow line from 0-100 follows the market share in total in percentage. The blue line shows the percentage per group totalling at 100%, showing that the first 2.5% of adoptors are called innovators, second group of 13.5% called early adopters and so on.*

By adding the data from table 5 and 6 into the figure, the innovation phase per sector is identified. With an adoption rate of 86% of banks are in the latest phase, where the last 14% of banks are considered to be laggards. The Real Estate sector has a known adoption rate of 16% and appears, therefore, to still be in the early adoption phase. The gradient colour shifting in the figure shows the unknown true adoption rate. There might be companies that do not share implementations of technology publicly. The true percentage of adoption might, therefore, be higher. There is also a possibility that companies have tested the innovation and have already rejected them, in which case the true adoption rate might have decreased.

One of the previously mentioned reasons for the difference in the found adoption rate is a difference in transparency across sectors. There are however more differences within the sectors themselves. The found literature does not offer solid measurable differences between the real estate and banking sectors, because the sectors are in many parts intertwined. Almost all banks use real estate as collateral through either commercial or private loans/mortgages for example (Litan, 1992). One way of showing differences is through global values. Global real estate asset values are approximately 200 trillion euro's in 2016 (HSBC, 2017). One of the reasons for the high asset value is because real estate is durable, built to last over thirty years on average. The long-life expectancy also shows that new net supply is limited yearly. Furthermore, the mentioned values of real estate are for all real estate asset values combined, real estate service companies do not have this value themselves. Real estate assets are owned by a multitude of owners (Róka-Madarász, 2011). The global asset value of banks is estimated at 111 trillion euro's in 2018 (Deloitte, 2019). It appears that there is a difference between sectors based on the value, but it is hard to show differences between the 100 largest banks against the 100 largest real estate companies. A simple statistical test has been done on the self-gathered data to identify if the 100 largest real estate companies and 100 largest banks are significantly different from each other based on market capitalization, number of employees and number of branches. The results of this test are shown in table 6. Two models have been made, one with the number of branches and market capitalization in U.S. billion dollars and one with the number of employees due to high correlation when these variables are combined.

Dependent variable = type	(1)	(2)
Branches	0.00050*** (0.00017)	
MarketCap in U.S. Billion	0.06521*** (0.01153)	
Employees		0.00004*** (6.48e-06)
Pseudo R2	0.40828	0.25973
Prob > chi square	0.00000	0.00000
<i>Note: Dependent variable is type. Type: 0 = real estate companies, 1 = banks. N = 200, with 100 Real Estate companies and 100 Banks. *** p&lt;0.01, ** p&lt;0.05, * p&lt;0.1</i>		

The logistical test from table 6 shows that the 100 largest banks have significantly higher market capitalizations and a higher number of branches and employees when compared to the 100 largest real

estate companies. This shows that the biggest banks are significantly larger organizations when compared to the largest real estate companies.

Company sizes have consistently been found to be positively related to innovation and adoption rates in public companies (Rogers, 1971). Solely based on the previous test and the literature, we can expect higher adoption rates of blockchain technology in the largest banks. Size is mentioned to be a surrogate variable for total resources, resources for innovation, organizational structure and so on. Besides size and their surrogate variables, there are multiple variables of influence on innovation and adoption rates. Rogers (1971) state that organizational innovation is based on the following structural characteristics within organizations: leader characteristics, centralization, complexity, formalization, interconnectedness, organizational slack and openness. The level of organizational innovation each year logically influences the adoption of new technologies, with higher innovation resulting in higher adoption rates. This text continues by comparing the status of every variable per sector when possible, which is aggregated in table 4.

Leader characteristics show the attitude and behaviour towards innovation and should be measured on a per-company basis. The author could not find differences between sectors and it is unknown how this characteristic influences innovation in real estate or banking.

Centralization is the way power and control are structured in companies, if they are in the hands of few or many. Because all real estate companies and banks in this research are public stock-based, shareholders hold equal powers in companies. However, there are still hierarchical differences within companies. When power and control are in the hands of few, lower innovation levels are expected (Rogers, 1971). This research could not find a solid difference in power and control between the sectors, the found differences are more present when comparing countries (Hofstede, 1986).

Complexity is the degree to which employees of organizations possess a high level of expertise and knowledge. Complexity encourages innovation but usually makes it more difficult to achieve consensus in innovation. Real estate companies usually have higher complexity levels when compared to banks, mainly because transactional values are higher per transaction (Melson, 2018). Therefore, lower innovation levels can be expected in real estate companies.

Following rules and procedures strictly equals high formalization, inhibiting employees to consider innovation. However, through formalization innovation is also encouraged. Banks are known to have high formalization (Timo, 2019). Lower formalization is found in real estate companies (House, 1975). Rogers (1971) and other studies (Bodewes, 2002) are inconsistent regarding formalization influence towards innovation, therefore this research regards formalization influence as unknown.

Interconnectedness is the degree of interpersonal networks. When new ideas can flow more easily among employees and/or organizations, higher innovation is expected. Interconnectedness is usually measured in the literature in two ways: a comparison of two companies; or sector against sector. Banks show large differences in interconnectedness with other banks, depending highly on which bank

and situation (Geraci & Gnabo, 2018). It is unclear what the interconnectedness is from employees in banks and real estate companies.

Organizational slack is present when organizations have uncommitted resources and is positively related to innovation. Direct comparisons of organizational slack between real estate companies and banks are not found in the literature. However, organizational slack is found to have a positive relationship with organizational size (Mousa & Chowdury, 2014). This variable should be compared on a company basis because no solid differences between sectors have been identified in their organizational slack. Therefore, the influence of organizational slack is unknown for this research.

*Table 7: variables of influence on innovation in companies.*

<b>Variables:</b>	<b>Correlation to innovation:</b>	<b>Favouring innovation towards sector:</b>
Size	Positive	Banking
Leader characteristics	Unknown	Unknown
Centralization	Negative	Unknown
Complexity	Negative	Banking
Formalization	Unknown	Unknown
Interconnectedness	Positive	Unknown
Organizational slack	Positive	Unknown

*Note: Leader characteristics depend on behavioural characteristics from company leaders. Centralization is highest with power and control in few hands, complexity is higher when employees perform more complex tasks. Formalization is higher when rules and procedures are present and followed strictly. Interconnectedness is higher when it is easier to share ideas and knowledge easier through interpersonal networks. Organization slack are the uncommitted resources within companies.*

Higher innovation levels, and thus higher adoption rates, are expected in banking when compared to real estate companies. Two variables from table 7 are in favour of the banking industry for innovation levels. Five variables do not give clear results on which sector is expected to have higher innovation levels. The literature is in line with the gathered data. As seen in figure 1 at the start of this chapter, the banking industry has a found adoption rate of 86 of the 100 largest banks, whilst the 100 largest real estate companies have a found adoption rate of 16. It should be stated that difference of transparency levels between sectors may give skewed results, the real adoption rate could be higher or lower in both sectors.

Literature shows that size is an important indicator of adopting new technologies (Rogers, 1971), data has been gathered to find out if this is statistically true in this research. Three variables of size that are relatively easy to gather have been collected, namely: market capitalization in U.S. billion dollars; number of employees and number of branches. These variables have been gathered for the compiled list of 100 largest real estate companies and 100 largest banks based on their market capitalization. Publicized implementation status per company has been gathered. Table 8 shows six logistical regression models to identify possible statistically significant indicators of size towards the implementation of blockchain. The reason for splitting up the regression in six models is explained in the methodology chapter and has to do with the least likely outcome variance and separation requirements in logistical regressions.

The number of branches and market capitalization in U.S. billion dollars are statistically significant indicators of blockchain implementation in real estate companies at the 10% significance

level. The number of employees is not statistically significant. In the banking industry, no indicators are statistically significant. One possible explanation for the difference in significance is that the banking sector has reached a critical mass in adopting blockchain, allowing for smaller companies to easily join existing platforms. One example of this is the consortium called the Voltron initiative which is built upon the blockchain-based platform called Corda. Over 50 of the largest banks have already joined the Voltron initiative. The Voltron initiative has successfully completed global trials (R3, 2019).

*Table 8: Identifying indicators of size on implementation of blockchain through logistic regressions.*

Dependent variable = implemented	(1)	(2)	(3)	(4)	(5)	(6)
Branches	.0004532* (.0002699)			-5.71e-06 (.0000424)		
Employees		.0000103 (7.76e-06)			-7.41e-07 (2.92e-06)	
MarketCap in U.S. Billion			.0314037* (.0176674)			-.0038235 (.0031772)
Type used:	0	0	0	1	1	1
Pseudo R2	0.0883	0.0203	0.0390	0.0002	0.0007	0.0156
Prob > chi square	0.0090	0.2099	0.0825	0.8943	0.8027	0.2503

Note: type used: 0 = real estate companies, 1 = banks. Dependent variable is implementation status of blockchain, with 0 = not implemented and 1 = implemented and/or tested of blockchain technology. N = 100 of Real Estate companies and N = 100 of Banks.  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### 4.3 Real Estate differences within sector

The previous chapter has shown differences between the banking and real estate sector, because these sectors are large it is important to identify potential sector uniformity of companies or its lack thereof. This chapter shows the differences of companies within the real estate sector and why it is important to identify these differences. Literature has identified several types of real estate companies (Nozeman & van der Vlist, 2014). When going through the process of gathering data these sectors also became apparent. There is a large difference in uniformity of companies in the banking and real estate sector.

The services banks offer are mostly uniform across markets. Besides bank accounts, practically all financial institutions offer services such as insurances, mortgages, financing, wealth management, investment possibilities and more. The target group for most banks is also uniform, focusing on private and commercial parties (Beck et al., 2007).

Unlike banks, real estate companies are more dispersed in their main goals or the services they offer. There are real estate investment companies focusing on maximizing returns per investment for prespecified risks; real estate brokers that assist buyers/tenants or sellers/landlords; real estate managers offering maintenance and guidance services for owners; real estate developers that develop new real estate; municipality policymakers for zoning plans; real estate policy consultants that help with for example strategies and many more. These types of real estate companies show that there is a substantial difference in the sector of real estate itself and there are few, if all, real estate companies that offer all these services (Nozeman & van der Vlist, 2014; Bramble, 2019).

Besides the difference in services, real estate companies can focus and limit their services towards commercial, industrial, healthcare or residential real estate. The structure of real estate

companies is also different, some are stock-based and others are privately owned by shareholders. The target group therefore also differs, with companies that only focus on one or more strategic, tactical or operational services. One could imagine that there is a considerable amount of difference in transparency per company and the number of people they need to employ. Investment companies usually have few employees because due to outsourcing (Securities and Exchange Commission, 2019). Real estate developers that provide every step of the development from conceptualizing to construction usually have many more employees but do not necessarily have very higher market capitalization. These differences in company structures suggest a separate need for transparency to attract potential customers. The felt needs for technology adaption and innovation is, therefore, assumed logically to differ throughout the real estate sector. It is important to highlight these internal sector differences, because this research is based on public data. Data that can be gathered based on what a company wishes to share. It might be possible that sectors are further ahead with adopting technologies then they have made public suggesting a lack of transparency. Lack of transparency can also differ within the sector due to a large difference within the real estate sector. The size of this research has not allowed for testing internal sector differences, due to the complexity of categorization. Categorization is deemed complex because real estate companies have found to offer a multitude of services, often overlapping multiple internal sectors (own research appendix F).

#### 4.4 Patent applications comparison across sectors

Patent applications are compared through four sectors to identify possible transparency differences across sectors. The number of patent applications has been gathered for four sectors which are often mentioned in the literature to have potential benefits for implementing blockchain technology. The four sectors that are used are: real estate, banking, healthcare and vehicles (Swan, 2015). Because these sectors are quite different, no direct comparison in absolute numbers can be made. The movements of patent applications are therefore compared between sectors. Table 9 shows the applied patents applications per year which are graphically shown in figure 3. Table 10 shows the granted patents per year applications which are graphically shown in figure 4.

Patent	Patent Application search	2014	2015	2016	2017	2018	Total
Real Estate	Blockchain AND ( "Real Estate" OR "Housing Appraisal" OR "Dwelling" OR "Apartment" OR "Residential" OR "Property management" )	0	7	43	186	482	718
Banking	Blockchain AND ( "Banking" OR "Financial institution" OR "Financial organization" OR "Trust company" OR "central bank" )	2	29	98	450	1090	1669
Health	Blockchain AND ( "Healthcare" OR "Health" OR "Hospital" OR "Medicine" OR "Physician" )	1	11	42	177	701	932
Vehicles	Blockchain AND ( "Cars" OR "Car" OR "Vehicle" OR "Automobile" OR "self-driving" )	3	16	72	267	964	1322

*Note: search has been done on May 21, 2019 via: <https://www.lens.org/lens/new-search>*

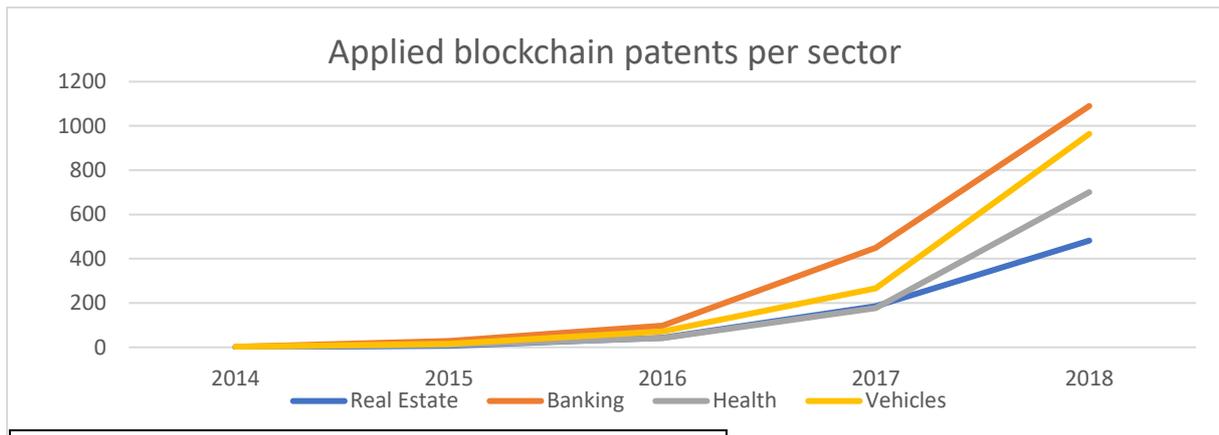


Figure 3. Sector comparison of applied patent applications per year.

Table 10. Granted patent application per year.

Patent	Granted Patent search	2014	2015	2016	2017	2018	Total
Real Estate	Blockchain AND ( "Real Estate" OR "Housing Appraisal" OR "Dwelling" OR "Apartment" OR "Residential" OR "Property management" )	0	0	3	16	44	63
Banking	Blockchain AND ( "Banking" OR "Financial institution" OR "Financial organization" OR "Trust company" OR "central bank" )	0	1	5	30	136	172
Health	Blockchain AND ( "Healthcare" OR "Health" OR "Hospital" OR "Medicine" OR "Physician" )	0	1	2	11	65	79
Vehicles	Blockchain AND ( "Cars" OR "Car" OR "Vehicle" OR "Automobile" OR "self-driving" )	0	1	2	17	108	128

Note: search has been done on May 21, 2019 via: <https://www.lens.org/lens/new-search>

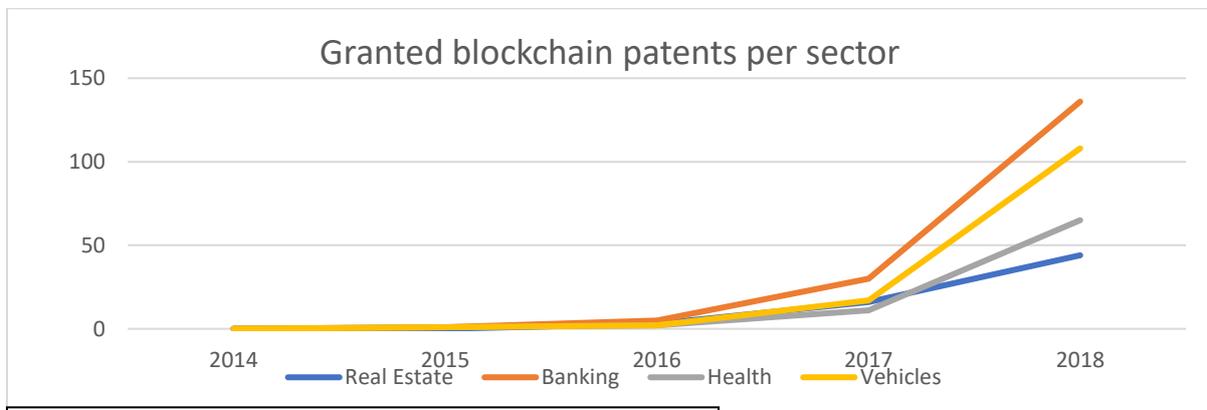


Figure 4. Sector comparison of granted patent applications per year.

The patent applications across time per sector appear to follow approximately equal movements. Exponential growth of patents has been set in place from 2016 till 2018. While the movements are approximately equal, hinting upon that sectors have an equal interest in blockchain, the type of applicant is different. Table 11 shows the aggregated information on the company type per patent applicant per sector for the twenty largest applicants, the data used for this table can be found in appendix H.

The applied patents are shown in table 11 for the twenty companies that applied for the most patents, to be able to identify which companies apply for the patents. Approximately 35% of all patent applications are applied for by twenty companies per sector. Software companies is the sector with the highest relative number of patents per sector. Software companies have 43 to 67 percent of the patents

from the twenty applicants with the highest number of patents in its sector. Companies from the sector real estate, healthcare and vehicles are not present in this list, but this does not mean that these sectors do not have patents on their name. This might only mean that these sectors create fewer patents absolute or are more scattered with few patents per company. There are three banks present on the list with a patent percentage of the top 20 patents of 16.29% in their sector, and three payment companies with a percentage of 23.11%. This implies that banks are in a further stage of implementation of blockchain technology, a side note to this implication is that banking companies could simply be larger and therefore have more financial budget, or felt pressure, to develop patent worthy applications.

Table 11. Patents per company type.

Type of company	Real Estate			Banks			Healthcare			Vehicles		
	No. comp.	No. pat.	Perc.	No. comp.	No. pat.	Perc.	No. comp.	No. pat.	Perc.	No. comp.	No. pat.	Perc.
Software companies	10	266	62.44%	8	363	43.47%	11	329	67.28%	9	360	52.94%
Advertising	1	15	3.52%	0	0	0.00%	0	0	0.00%	1	55	8.09%
Bank	1	11	2.58%	3	136	16.29%	1	13	2.66%	1	22	3.24%
Business Services	2	41	9.62%	5	124	14.85%	3	61	12.47%	4	107	15.74%
Energy	0	0	0.00%	0	0	0.00%	2	45	9.20%	1	29	4.26%
Exchange	1	19	4.46%	0	0	0.00%	0	0	0.00%	0	0	0.00%
Investment	1	16	3.76%	1	19	2.28%	0	0	0.00%	1	20	2.94%
Payments	1	23	5.40%	3	193	23.11%	1	14	2.86%	2	56	8.24%
Private person	2	26	6.10%	0	0	0.00%	1	15	3.07%	0	0	0.00%
Security	0	0	0.00%	0	0	0.00%	1	12	2.45%	0	0	0.00%
Supermarket	0	0	0.00%	0	0	0.00%	0	0	0.00%	1	31	4.56%
Unknown	1	9	2.11%	0	0	0.00%	0	0	0.00%	0	0	0.00%
<b>Total</b>	20	426	100%	20	835	100%	20	489	100%	20	680	100%
<b>Absolute total</b>	1077			2324			1404			1953		
<b>Percentage top 20 from total</b>	39.55%			35.93%			34.83%			34.82%		

Note: Twenty companies with the most patents are shown. "No. comp." shows the number of companies holding patents per sector. "No. pat." shows the number of patents in total per sector. "Perc." equals the percentage per sector compared to total found patents. The absolute total is found for all companies as also shown in table 8. By dividing 'total' by 'absolute total', the percentage of the top 20 patent appliers to the market patents is calculated. Only the top twenty companies have been measured due to the limited size of this research. The complexity of categorizing companies and the found problem that there are many patent applicants with only 1 patent applied for per company creates the problem of being time consuming.

## 5. Discussion

Thus far, adoption rates of blockchain in real estate companies have not been measured despite that the real estate sector is often seen as an excellent sector for implementation of blockchain technology in the literature. However, the real estate market appears to be substantially behind with implementation of blockchain when compared to banks. This appears to be logical to some extent since literature and those interviewed state that banks feel more pressure to adopt blockchain because financial services are already in place in blockchain. Adoption of blockchain technology in real estate is expected to happen

in approximately five years according to potential users of blockchain. Academic literature does not give solid statements about forecasting the implementation of blockchain. Commercial parties forecast blockchain to be implemented in real estate between 2024 and 2028, which is in line with the results gathered through interviews.

The gathered quantitative and qualitative results imply that the real estate sector is indeed lagging with adopting blockchain technology. When looking at patent applications, it appears that other major sectors do see a lot of potential for blockchain technology in real estate. The movement of patent applications appears to be approximately equal to the sectors healthcare, automobile industry and banking. Few blockchain technology patents for real estate are applied for from the real estate sector themselves, most have been applied for by sectors such as software companies, banks and advertisers. One reason for this might be that the real estate sector simply leans on other sectors for technology implementation, and the real estate sector only wishes to purchase ready to use blockchain applications for their sector from other players. Another reason might be that real estate is simply slower with adopting new technologies. The complexity of the real estate sector can be an explanation for lagging with adopting new technologies, creating software that meets the demands for complex tasks is expensive and is accompanied by high levels of risk. High levels of costs and risk are present due to the quick nature of technologies, the way the software works is usually hard to grasp for decision makers and additionally needs a lot of tailor-making especially in the early phases.

Blockchain technology is often described as being a public or private blockchain in the literature, with some exceptions in definitions. The literature does not mention the changeability of blockchain, in which types can be changed for example from private to public. Gathered from the interview with the blockchain expert, this is deemed to be possible as long as requirements are met. These requirements involve reaching consensus between authorized users, which are usually few in private blockchains but can be quite many in public blockchains. Furthermore, as with all useable software, the blockchain will only function when users stay on the blockchain when changes are implemented.

This research has used a mixed-methods approach, leaning on qualitative and quantitative self-gathered data. Mixed-methods is not yet widely used in real estate research. By using mixed-methods the results strengthen one another. Interviews are in line with the found results, such as that the banking sector feels more pressure to adopt blockchain and is therefore most likely to adopt sooner. Additionally, by comparing the literature to the answers of a blockchain expert more insight has been gathered of blockchain technology.

New technologies can have serious impact, such as the change that mobile telephony, the internet or even spreadsheet software brought forward. When adoption of blockchain rises due to potential benefits being perceived truthfully in major sectors and the real estate sector lags in adopting, investment could potentially shift toward other sectors. Therefore, it is useful to keep measuring adoption ratios, not only for blockchain technology but for other technologies as well. By creating new

manners of measuring adoption, sectors are being allowed to follow innovation more closely, taking action when needed. Furthermore, academics can receive more insight across multiple sectors in how markets operate with regards to innovation and which actors are deemed most important.

## **6. Conclusion**

This research has created a new way of measuring adoption rates, by focusing on public data of implementation instead of using surveys based on perceived characteristics and the year of adopting as measured by the user following adoption theory frameworks such as the Diffusion of Innovation theory.

Adoption of blockchain technology in the real estate sector has been compared with three major sectors via patent applications: healthcare, automobile industry and banking, in which banking is also compared quantitatively with a self-gathered database. Adoption of blockchain technology differs between real estate and banking due to the following found reasons. The first reason is the size difference, 100 companies from each sector with the highest market capitalization show that banks are significantly larger in the number of employees, the number of branches and their market capitalization. Size of companies are found to be significantly positively correlated to innovation and adoption rates according to the literature. The second reason is a found difference in complexity, with real estate companies often found to perform more complex services per transaction. Complexity levels are found to be negatively correlated to innovation. Furthermore, the real estate sector could simply be less transparent in their innovation rates.

Market capitalization and number of branches are found to be significant indicators for the implementation of blockchain technology in real estate companies. These indicators are not significant in the banking industry, most likely because the banking industry has reached a critical mass allowing for easy adoption through for example consortiums. Further investigation through patent movement comparisons show that the real estate sector is not among the top 20 of patent applications of blockchain in their sector, which banks are found to do. This could be explained by the difference in size. Based on the patent applications, most of which come from companies in the software creating sector, one could expect once these software companies publish ready to use software programs (for example similar applications such Excel, Windows, Gmail that would be based in blockchain), adoption rates will increase substantially across all sectors.

One noteworthy comment about blockchain structuring is that the structure can be changed as long as consensus is reached. Consensus can be reached most easily in private blockchains where authorized users are few and most difficult in large public blockchains where authorized users are many (as seen with the bitcoin fork in 2017).

Further research could focus on one of the limitations of this research: the gathered data is public data only, internal company data could eliminate the possibility of difference in transparency. One way of doing this is by creating large scale surveys distributed to companies. Another way could be to categorize real estate companies and identify if there are differences of adoption within the real estate

sector. Once blockchain is grounded in the real estate sector, adoption theory frameworks could be used to forecast further adoption. Additional research can also be done if the real estate sector follows new technologies in general by awaiting software productions by software companies, potentially suggesting that the real estate sector is more risk averse when compared to other sectors.

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*Additional references in appendixes are not shown in this section and can be found in the corresponding appendix.*

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## **Appendix A: Interview questions for blockchain expert**

Dutch translation follows English. Interviews have been held in Dutch, note that translation error might be present.

### *Opening*

Thank for time and possibility to interview. Explain the topic of the research (What is the future of blockchain within the real estate management process?). Explain that the information from this interview will be compared to the literature.

Explain and show consent form.

Do you have any questions before we start?

### *Questions for blockchain experts*

What is your relation to blockchain?

What are your expectations for blockchain?

Can you tell me something about blockchain implementation within real estate management processes?

What are the largest problems or hurdles to overcome for blockchain?

Are there other opportunities for real estate management processes within blockchain?

Are there any gaps regarding blockchain in the literature?

What can you tell me about the difference between permissioned and permissionless (public) blockchains?

Are companies transparent about blockchain?

### *Closing*

General questions such as: did we miss something? Do you have comments regarding this interview?

Do you wish to receive transcript of this interview? Do you wish to receive the final research? Thank you for your time.

## **Dutch version: interview vragen voor blockchain experts:**

### *Opening*

Dank u voor uw tijd en de mogelijkheid voor dit interview. Leg het onderwerp van de scriptie uit (wat is de toekomst van blockchain binnen het vastgoedmanagement proces?). Leg uit dat het doel van dit interview is om de vergaarde informatie te vergelijken met de literatuur.

Leg het toestemmingsformulier uit en toon deze.

Heeft u vragen voordat wij starten?

### *Vragen voor blockchain experts:*

Wat is uw relatie tot blockchain?

Wat zijn uw verwachtingen van blockchain?

Kunt u mij iets vertellen over blockchain implementatie binnen het vastgoed management proces?

Wat zijn de grootste problemen of drempels die overkomen dienen te worden voor blockchain? Zijn er andere mogelijkheden voor blockchain binnen het vastgoedmanagent proces?

Zijn er gaten in de huidige literatuur over blockchain?

Wat kunt u mij vertellen over de verschillen tussen de zogenaamde private en publieke blockchain?

Zijn bedrijven transparant over blockchain?

### *Afsluiting*

Algemene vragen zoals: hebben we iets gemist? Heeft u opmerkingen over dit interview? Wenst u een transcriptie van dit interview te ontvangen? Wenst u het onderzoeksrapport te ontvangen zodra deze is afgerond? Dank u voor uw tijd.

## **Appendix B: Interview questions for potential users of blockchain**

Dutch translation follows English. Interviews have been held in Dutch, note that translation error might be present.

### *Opening*

Thank for time and possibility to interview. Explain the topic of the research (What is the future of blockchain within the real estate management process?). Explain that the goals of this interview is to find out the future of blockchain in the real estate management process. To do this, this interview tries to map opinions, feelings, benefits and knowledge regarding blockchain from potential users.

Explain and show consent form (Appendix C).

Do you have any questions before we start?

### *Questions:*

What do you know about blockchain?

What is your opinion on blockchain for real estate management processes?

What are your expectations for blockchain within real estate management?

What do you think is needed for blockchain within real estate management services to reach these expectations?

Where do you think your company stands with blockchain in the real estate management process?

What do you think the role of the government should be?

Are there other problems or hurdles to overcome with regards to blockchain in the real estate management process?

Are there other opportunities for real estate management processes within blockchain?

### *Closing*

General questions such as: did we miss something? Do you have comments regarding this interview?

Do you wish to receive transcript of this interview? Do you wish to receive the final research? Thank you for your time.

**Dutch version: interview vragen voor mogelijke gebruikers / implementeerdere van blockchain in het vastgoedmanagement proces:**

*Opening*

Dank u voor uw tijd en de mogelijkheid voor dit interview. Leg het doel van de scriptie uit (wat is de toekomst van blockchain binnen het vastgoedmanagement proces). Leg uit dat het doel van dit interview is om de vergaare informatie te vergelijken met de literatuur.

Leg consent formulier uit en toon deze.

Heeft u vragen voordat wij starten?

*Vragen:*

Wat weet u van blockchain af?

Hoe denkt u over blockchain binnen het vastgoed management proces?

Wat zijn uw verwachtingen voor blockchain in het vastgoedmanagement proces?

Wat denkt u dat er nodig is voor blockchain binnen het vastgoedmanagement proces om deze verwachtingen te behalen?

Waar denkt u dat uw bedrijf staat met blockchain in het vastgoedmanagement proces?

Wat denkt u dat de rol van de overheid dient te zijn met blockchain binnen het vastgoedmanagement proces?

Zijn er andere problemen of drempels die overkomen dienen te worden voor blockchain in het vastgoedmanagement proces?

Zijn er nog andere mogelijkheden voor blockchain in het vastgoedmanagement proces?

*Afsluiting*

Algemene vragen zoals: hebben we iets gemist? Heeft u opmerkingen over dit interview? Wenst u een transcriptie van dit interview te ontvangen? Wenst u het onderzoeksrapport te ontvangen zodra deze is afgerond? Dank u voor uw tijd.

## Appendix C: Informed Consent Form for interviews

Dutch version follows English version. The signed versions are confidential as they give away the names of those that are interviewed. Because the interviewees are Dutch, the signed versions are also in Dutch and therefore there is a potential translation risk. Some interviewees have added their personal wishes to the following consent form, for example only agree to participate in the research when the transcript is approved by the interviewee(s).

### INFORMED CONSENT FORMULIER

<b>Name of research</b>	Blockchain in the real estate management process
<b>Goals of the research</b>	The goal of this research is to gain knowledge regarding upcoming technologies, in this case specifically blockchain within the real estate management process.
<b>Procedure during the research</b>	<p>You are taking part in an interview in which you will be asked questions regarding the technology blockchain. An example of a typical question that might asked is: <i>"What are your expectations for blockchain in the real estate management process?"</i></p> <p>During the interview, questions will be asked based on a topic list and we will elaborate on blockchain. An audio recording will be made of the interview, so that the conversation can later be worked out ad-verbatim (word for word). This transcript is subsequently used in the further investigation..</p>
<b>Potential risks and inconveniences</b>	There are no physical, legal or economic risks associated with your participation in this study. You do not have to answer questions that you do not want to answer. Your participation is voluntary and you can stop your participation at any time.
<b>Reimbursement</b>	You will not receive a reimbursement for participation in this study.
<b>Confidentiality of data</b>	<p>Your privacy is and remains fully protected. No confidential information or personal data from or about you is brought out in any way, so that someone will be able to recognize you. Before our research data is released, your data will be made anonymous. Some simple examples of making your data anonymously:</p> <ul style="list-style-type: none"> <li>- your name will be replaced by anonymous, in itself meaningless combination of numbers.</li> <li>- your place of residence will not be used, but the province in which you live or work.</li> <li>- A general name of your position can be shared in the research report.</li> </ul> <p>At the start of our research your name will immediately be given a pseudonym. Either anonymous data or pseudonyms will be used in a publication. The audio recordings, forms and other documents that are made or collected as part of this study are stored at a secure location at the University of Groningen and on the secure (encrypted) computer(s) of the researcher, Daan Bartels.</p> <p>The research data, such as the transcript of the interview, are made available to persons if necessary (for example for a check on scientific integrity at the University of Groningen) and only in an anonymous form. This document (consent form) can be shared with the assessors of the University of Groningen.</p>

<p><b>Voluntarity</b></p>	<p>Participation in this study is entirely voluntary. As a participant, you can stop your participation in the study at any time, or refuse that your data may be used for the study, without stating reasons.</p> <p>This means that if you decide not to participate in this study prior to the study, this will in no way affect you. You can also withdraw the permission that you have given to use your data up to 5 working days (reflection time) after the interview. In this case your data will be deleted from our files and destroyed.</p> <p>If, during the investigation, after the reflection period of 5 working days, you decide to terminate your cooperation, this will in no way affect you. However: the data that you have provided until your participation ends will be used in the study, including the protection of your privacy as described above. Naturally no new data is collected or used.</p>
<p><b>Declaration of permission</b></p>	<p>By signing this document you indicate that you are at least 18 years old; that you are well informed about the research, the way in which the research data is collected, used and treated and what possible risks you could incur by participating in this research.</p> <p>If you had any questions, indicate that by signing this document that you were able to ask these questions and that these questions were answered clearly and understandable. You indicate that you voluntarily agree with your participation in this study. You will receive a copy of this signed consent form.</p> <p>I agree to participate in the research of Daan Bartels. The purpose of this document is to establish the conditions of my participation in the project.</p> <ol style="list-style-type: none"> <li>1. I have received sufficient information about this research project. The purpose of my participation as an interviewee in this project has been clearly explained to me and I know what this means to me.</li> <li>2. My participation as an interviewee in this project is voluntary. There is no explicit or implicit compulsion for me to participate in this study.</li> <li>3. My participation means that I am being interviewed by Daan Bartels. The interview will last approximately 45-60 minutes. I give the researcher permission to make audio recordings and take written notes during the interview. It is clear to me that if I do object with one or more points as mentioned above, I can stop my participation at any time, without giving a reason.</li> <li>4. I have the right not to answer questions. If I feel uncomfortable during the interview, I have the right to stop my participation in the interview.</li> <li>5. I have received the explicit guarantee from the researcher (Daan Bartels) that the researcher ensures that I am not identifiable in data released by the research, reports or articles. My privacy is guaranteed as a participant in this study.</li> <li>6. I have read and understood this form. All my questions have been answered to my satisfaction and I voluntarily agree to participate in this study.</li> <li>8. I have received a copy of this consent form that has also been signed by the interviewer.</li> </ol>
<p><b>Clients research and stakeholders</b></p>	<p>This research is carried out for the completion of the master thesis for the Real Estate Studies course at the University of Groningen.</p>

<b>Signature and date</b>	<b>Name interviewee</b>	<b>Name researcher</b>
	<b>Signature</b>	<b>Signature</b>
	<b>Date</b>	<b>Date</b>

### GEÏNFORMEERD TOESTEMMINGSFORMULIR NEDERLANDS

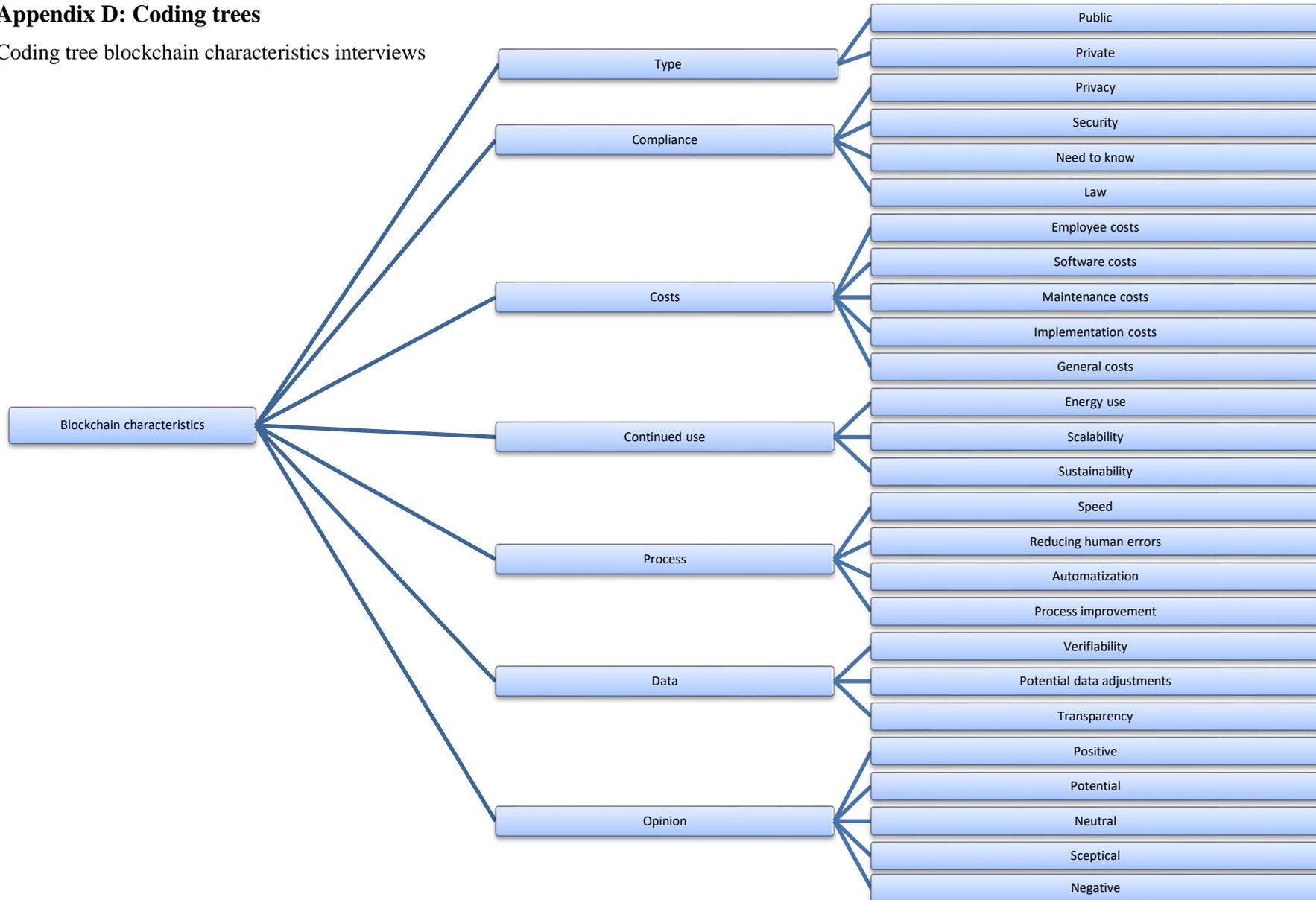
<b>Naam van het onderzoeksproject</b>	Blockchain in het vastgoedmanagement proces
<b>Doel van het onderzoek</b>	Het doel van dit onderzoek is om inzicht te krijgen in opkomende technologieën, in dit geval specifiek blockchain binnen het vastgoed management proces.
<b>Gang van zaken tijdens het onderzoek</b>	<p>U neemt deel aan een interview waarin aan u vragen zullen worden gesteld over blockchain. Een voorbeeld van een typische vraag die u zal worden gesteld: <i>“Wat zijn uw verwachtingen voor blockchain in het vastgoedmanagement proces?”</i></p> <p>Tijdens het interview zal, aan de hand van een topic list, dieper worden ingegaan op blockchain. Van het interview zal een audio-opname worden gemaakt, zodat het gesprek later ad-verbatim (woord voor woord) kan worden uitgewerkt. Dit transcript wordt vervolgens gebruikt in het verdere onderzoek.</p>
<b>Potentiële risico's en ongemakken</b>	Er zijn geen fysieke, juridische of economische risico's verbonden aan uw deelname aan deze studie. U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Uw deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen.
<b>Vergoeding</b>	U ontvangt voor deelname aan dit onderzoek geen vergoeding.
<b>Vertrouwelijkheid van gegevens</b>	<p>Uw privacy is en blijft maximaal beschermd. Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen. Voordat onze onderzoeksgegevens naar buiten gebracht worden, worden uw gegevens anoniem gemaakt: geanonimiseerd. Enkele eenvoudige voorbeelden hiervan:</p> <ul style="list-style-type: none"> <li>- Uw naam wordt vervangen door anonieme, op zichzelf betekenisloze, combinatie van getallen.</li> <li>- Uw woonplaats wordt niet gebruikt, maar de provincie waarin u woont of werkt.</li> <li>- Een algemene naam van uw functie kan worden gedeeld in het onderzoeksrapport.</li> </ul> <p>Bij de start van ons onderzoek krijgt uw naam direct een pseudoniem; ofwel ‘versleuteld’. In een publicatie zullen of anonieme gegevens of pseudoniemen worden gebruikt. De audio-opnamen, formulieren en andere documenten die in het kader van deze studie worden gemaakt of verzameld, worden opgeslagen op een beveiligde locatie bij de Rijksuniversiteit Groningen en op de beveiligde (versleutelde) computer(s) van de onderzoeker, Daan Bartels.</p>

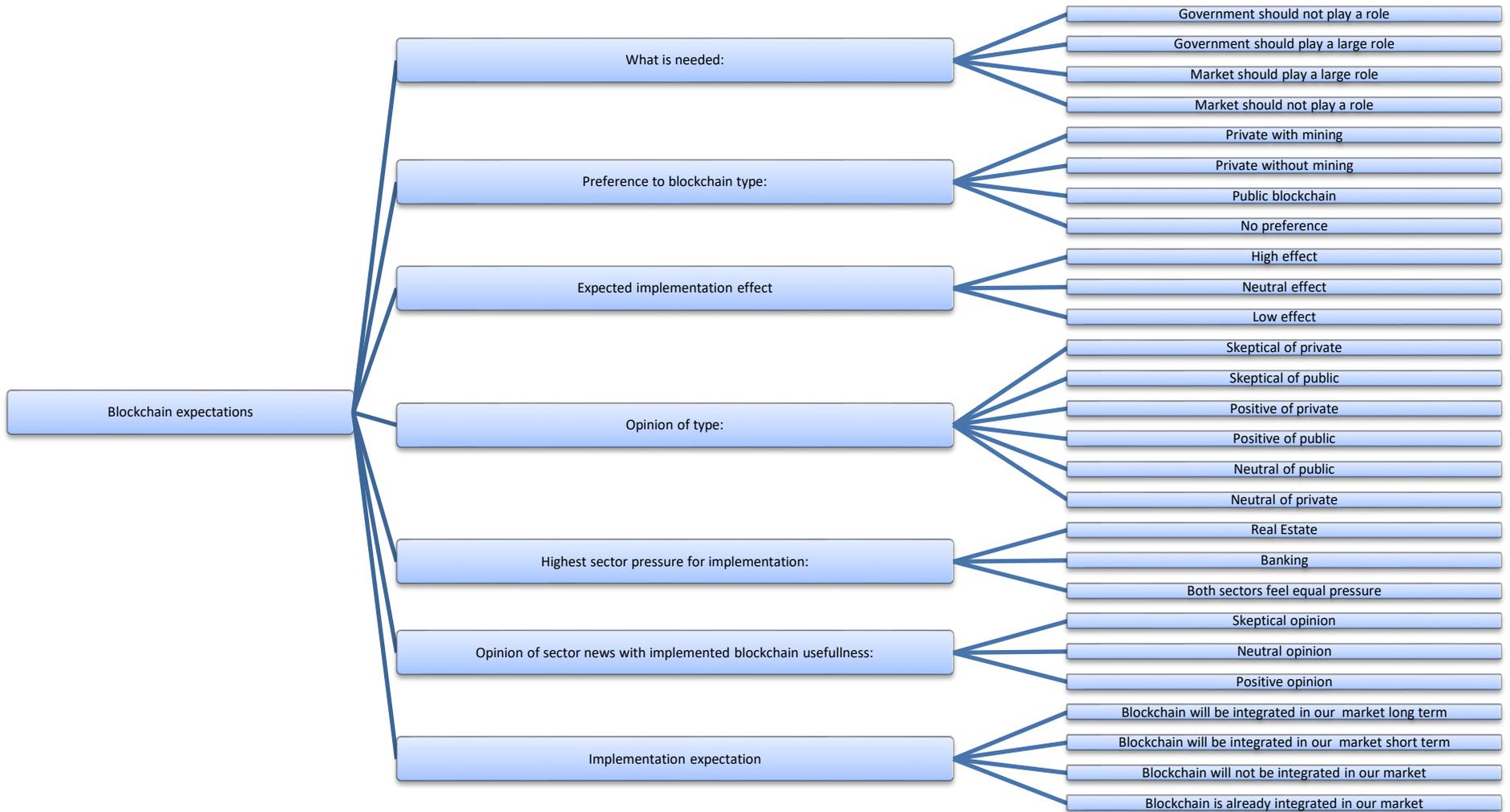
	<p>De onderzoeksgegevens zoals het transcript van het interview worden indien nodig (bijvoorbeeld voor een controle op wetenschappelijke integriteit bij de Rijksuniversiteit Groningen) en alleen in anonieme vorm ter beschikking gesteld aan personen. Dit document (consent formulier) kan gedeeld worden met de beoordelaars van de Universiteit Groningen.</p>
<b>Vrijwilligheid</b>	<p>Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen, of weigeren dat uw gegevens voor het onderzoek mogen worden gebruikt, zonder opgaaf van redenen.</p> <p>Dit betekent dat als u voorafgaand aan het onderzoek besluit om af te zien van deelname aan dit onderzoek, dit op geen enkele wijze gevolgen voor u zal hebben. Tevens kunt u tot 5 werkdagen (bedenktijd) na het interview alsnog de toestemming intrekken die u heeft gegeven om gebruik te maken van uw gegevens. In dit geval zullen uw gegevens uit onze bestanden worden verwijderd en vernietigd.</p> <p>Als u tijdens het onderzoek, na de bedenktijd van 5 werkdagen, besluit om uw medewerking te staken, zal dat eveneens op geen enkele wijze gevolgen voor u hebben. Echter: de gegevens die u heeft verstrekt tot aan het moment waarop uw deelname stopt, zal in het onderzoek gebruikt worden, inclusief de bescherming van uw privacy zoals hierboven beschreven. Er worden uiteraard geen nieuwe gegevens verzameld of gebruikt.</p>
<b>Toestemmingsverklaring</b>	<p>Met uw ondertekening van dit document geeft aan dat u minstens 18 jaar oud bent; dat u goed bent geïnformeerd over het onderzoek, de manier waarop de onderzoeksgegevens worden verzameld, gebruikt en behandeld en welke eventuele risico's u zou kunnen lopen door te participeren in dit onderzoek.</p> <p>Indien u vragen had, geeft u bij ondertekening aan dat u deze vragen heeft kunnen stellen en dat deze vragen helder en duidelijk zijn beantwoord. U geeft aan dat u vrijwillig akkoord gaat met uw deelname aan dit onderzoek. U ontvangt een kopie van dit ondertekende toestemmingsformulier.</p> <p>Ik ga akkoord met deelname aan het onderzoek van Daan Bartels. Het doel van dit document is om de voorwaarden van mijn deelname aan het project vast te leggen.</p> <ol style="list-style-type: none"> <li>1. Ik kreeg voldoende informatie over dit onderzoeksproject. Het doel van mijn deelname als een geïnterviewde in dit project is voor mij helder uitgelegd en ik weet wat dit voor mij betekent.</li> <li>2. Mijn deelname als geïnterviewde in dit project is vrijwillig. Er is geen expliciete of impliciete dwang voor mij om aan dit onderzoek deel te nemen.</li> <li>3. Mijn deelname houdt in dat ik word geïnterviewd door Daan Bartels. Het interview zal ongeveer 45-60 minuten duren. Ik geef de onderzoeker (s) toestemming om tijdens het interview audio opnames te maken en schriftelijke notities te nemen. Het is mij duidelijk dat, als ik toch bezwaar heb met een of meer punten zoals hierboven benoemd, ik op elk moment mijn deelname, zonder opgaaf van reden, kan stoppen.</li> <li>4. Ik heb het recht om vragen niet te beantwoorden. Als ik me tijdens het interview ongemakkelijk voel, heb ik het recht om mijn deelname aan het interview te stoppen.</li> <li>5. Ik heb van de onderzoeker (Daan Bartels) de uitdrukkelijke garantie gekregen dat de onderzoeker er zorg voor draagt dat ik niet ben te identificeren in door het onderzoek naar buiten gebrachte gegevens, rapporten of artikelen. Mijn privacy is gewaarborgd als deelnemer aan dit onderzoek.</li> <li>6. Ik heb dit formulier gelezen en begrepen. Al mijn vragen zijn naar mijn tevredenheid beantwoord en ik ben vrijwillig akkoord met deelname aan dit onderzoek.</li> </ol>

	8. Ik heb een kopie ontvangen van dit toestemmingsformulier dat ook ondertekend is door de interviewer.	
<b>Opdrachtgevers onderzoek en betrokkenen</b>	Dit onderzoek wordt uitgevoerd voor invulling van de master scriptie voor de opleiding Real Estate Studies bij de Rijksuniversiteit Groningen.	
<b>Handtekening en datum</b>	<b>Naam deelnemer</b>	<b>Naam onderzoeker</b>
	<b>Handtekening</b>	<b>Handtekening</b>
	<b>Datum</b>	<b>Datum</b>

## Appendix D: Coding trees

Coding tree blockchain characteristics interviews





## Appendix E: Financial institutions and their public statements on blockchain.

ID:	Bank name:	Index:	Main Location:	Number of locations	Number of employees	Market cap. (US Billion)	Source (Retrieved in April 2019):
1	JPMorgan Chase & Co	5	U.S.	5100	255998	390.934	<a href="https://www.jpmorgan.com/country/US/en/detail/1320566740924">https://www.jpmorgan.com/country/US/en/detail/1320566740924</a>
2	Industrial & Commercial Bank of China	5	China	21000	449296	345.214	<a href="http://www.icbc.com.cn/icbc/%E5%B7%A5%E8%A1%8C%E9%A3%8E%E8%B2%8C/%E5%B7%A5%E8%A1%8C%E5%BF%AB%E8%AE%AF/%E5%B7%A5%E8%A1%8C%E8%BF%90%E7%94%A8%E5%8C%BA%E5%9D%97%E9%93%BE%E6%8A%80%E6%9C%AF%E5%88%9B%E6%96%B0%E5%B0%8F%E5%BE%AE%E4%BC%81%E4%B8%9A%E4%BE%9B%E5%BA%94%E9%93%BE%E8%9E%8D%E8%B5%84.htm">http://www.icbc.com.cn/icbc/%E5%B7%A5%E8%A1%8C%E9%A3%8E%E8%B2%8C/%E5%B7%A5%E8%A1%8C%E5%BF%AB%E8%AE%AF/%E5%B7%A5%E8%A1%8C%E8%BF%90%E7%94%A8%E5%8C%BA%E5%9D%97%E9%93%BE%E6%8A%80%E6%9C%AF%E5%88%9B%E6%96%B0%E5%B0%8F%E5%BE%AE%E4%BC%81%E4%B8%9A%E4%BE%9B%E5%BA%94%E9%93%BE%E8%9E%8D%E8%B5%84.htm</a>
							<a href="https://www.bianews.com/news/details?id=19673">https://www.bianews.com/news/details?id=19673</a>
3	Bank of America	2	U.S.	4411	205000	325.331	<a href="http://fortune.com/2018/06/20/bank-of-america-blockchain-patent-why/">http://fortune.com/2018/06/20/bank-of-america-blockchain-patent-why/</a>
							<a href="http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;p=1&amp;u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&amp;r=1&amp;f=G&amp;l=50&amp;co1=AND&amp;d=PTXT&amp;s1=%22bank+of+america%22&amp;s2=blockchain&amp;OS=%22bank+of+america%22+AND+blockchain&amp;RS=%22bank+of+america%22+AND+blockchain">http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;p=1&amp;u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&amp;r=1&amp;f=G&amp;l=50&amp;co1=AND&amp;d=PTXT&amp;s1=%22bank+of+america%22&amp;s2=blockchain&amp;OS=%22bank+of+america%22+AND+blockchain&amp;RS=%22bank+of+america%22+AND+blockchain</a>
4	Wells Fargo	2	U.S.	8050	262100	308.013	<a href="http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;p=1&amp;u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&amp;r=1&amp;f=G&amp;l=50&amp;co1=AND&amp;d=PTXT&amp;s1=%22wells+fargo%22&amp;s2=blockchain&amp;OS=%22wells+fargo%22+AND+blockchain&amp;RS=%22wells+fargo%22+AND+blockchain">http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;p=1&amp;u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&amp;r=1&amp;f=G&amp;l=50&amp;co1=AND&amp;d=PTXT&amp;s1=%22wells+fargo%22&amp;s2=blockchain&amp;OS=%22wells+fargo%22+AND+blockchain&amp;RS=%22wells+fargo%22+AND+blockchain</a>
							<a href="https://cryptovest.com/news/wells-fargo-bank-of-america-apply-for-blockchain-related-patents/">https://cryptovest.com/news/wells-fargo-bank-of-america-apply-for-blockchain-related-patents/</a>
5	China Construction Bank Corp	5	China	15000	345971	257.399	<a href="http://group1.ccb.com/cn/ccbtoday/newsv3/20180108_1515403842.html">http://group1.ccb.com/cn/ccbtoday/newsv3/20180108_1515403842.html</a>
6	HSBC Holdings	5	U.K.	3900	238359	219.270	<a href="https://www.hsbc.com/news-and-insight/2018/your-face-is-your-password">https://www.hsbc.com/news-and-insight/2018/your-face-is-your-password</a>
							<a href="https://www.hsbc.com/media/media-releases/2018/hsbc-trade-blockchain-transaction-press-release">https://www.hsbc.com/media/media-releases/2018/hsbc-trade-blockchain-transaction-press-release</a>
7	Agricultural Bank of China	5	China	23612	473691	203.244	<a href="http://www.abchina.com/cn/AboutABC/nonghzx/NewsCenter/201708/t20170816_1122899.htm">http://www.abchina.com/cn/AboutABC/nonghzx/NewsCenter/201708/t20170816_1122899.htm</a>

8	Citigroup Inc	5	U.S.	4600	203000	203.165	<a href="https://www.citigroup.com/citi/news/2017/170522a.htm">https://www.citigroup.com/citi/news/2017/170522a.htm</a>
9	China Everbright Bank	5	China	950	45326	194.341	<a href="http://www.cebbank.com/site/gdywz/CEB_Homepage/Annual%20Report%20of%20CEB/64069240/2018032822304882332.pdf">http://www.cebbank.com/site/gdywz/CEB_Homepage/Annual%20Report%20of%20CEB/64069240/2018032822304882332.pdf</a>
							<a href="https://www.relbanks.com/asia/china">https://www.relbanks.com/asia/china</a>
10	Bank of China	5	China	145	310119	181.469	<a href="http://www.bankofchina.com/aboutboc/ab8/201804/t20180425_12087080.html?keywords=blockchain">http://www.bankofchina.com/aboutboc/ab8/201804/t20180425_12087080.html?keywords=blockchain</a>
							<a href="http://www.boc.cn/en/aboutboc/ab6/200812/t20081216_494257.html">http://www.boc.cn/en/aboutboc/ab6/200812/t20081216_494257.html</a>
11	China Merchants Bank	5	China	1800	74590	122.616	<a href="http://www.cmbchina.com/cmbinfo/news/newsinfo.aspx?guid=63cf2eb4-b968-4467-a236-f7b54191212b">http://www.cmbchina.com/cmbinfo/news/newsinfo.aspx?guid=63cf2eb4-b968-4467-a236-f7b54191212b</a>
							<a href="http://english.cmbchina.com/CmbInfo/About/">http://english.cmbchina.com/CmbInfo/About/</a>
12	Royal Bank of Canada	2	Canada	1775	82108	122.564	<a href="http://appft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;u=%2Fnetahtml%2FFPTO%2Fsearch-adv.html&amp;r=1&amp;p=1&amp;f=G&amp;l=50&amp;d=PG01&amp;S1=20180075527.PG.NR.&amp;OS=dn/20180075527&amp;RS=DN/20180075527">http://appft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;u=%2Fnetahtml%2FFPTO%2Fsearch-adv.html&amp;r=1&amp;p=1&amp;f=G&amp;l=50&amp;d=PG01&amp;S1=20180075527.PG.NR.&amp;OS=dn/20180075527&amp;RS=DN/20180075527</a>
13	HDFC	4	India	5103	84325	115.755	<a href="https://www.bloomberg.com/quote/HDB:US">https://www.bloomberg.com/quote/HDB:US</a>
							<a href="https://www.hdfcbank.com/aboutus/general/distribution_network.htm">https://www.hdfcbank.com/aboutus/general/distribution_network.htm</a>
							<a href="https://www.indiatoday.in/india/story/hdfc-bank-staff-fiscal-year-2017-employee-strength-972867-2017-04-22">https://www.indiatoday.in/india/story/hdfc-bank-staff-fiscal-year-2017-employee-strength-972867-2017-04-22</a>
							<a href="https://yourstory.com/2019/01/india-banks-blockchain-linked-funding">https://yourstory.com/2019/01/india-banks-blockchain-linked-funding</a>
14	Banco Santander	5	Spain	12000	202484	115.696	<a href="https://www.bancosantander.es/es/particulares/banca-online/one-pay?campana=banca_online&amp;origen=blog&amp;posicion=link&amp;contenido=one_pay">https://www.bancosantander.es/es/particulares/banca-online/one-pay?campana=banca_online&amp;origen=blog&amp;posicion=link&amp;contenido=one_pay</a>
15	Commonwealth Bank of Australia	5	Australia	1000	42519	112.227	<a href="https://www.commbank.com.au/guidance/newsroom/commonwealth-bank-completes-new-blockchain-enabled-global-trade--201807.html">https://www.commbank.com.au/guidance/newsroom/commonwealth-bank-completes-new-blockchain-enabled-global-trade--201807.html</a>
							<a href="https://www.cio.com.au/article/644931/branches-call-centres-remain-part-cba-digital-leading-future/">https://www.cio.com.au/article/644931/branches-call-centres-remain-part-cba-digital-leading-future/</a>
16	Mitsubishi UFJ Financial Group	3	Japan	2280	106800	111.660	<a href="https://www.mufg.jp/dam/pressrelease/2018/pdf/pressrelease-20180521-002_ja.pdf">https://www.mufg.jp/dam/pressrelease/2018/pdf/pressrelease-20180521-002_ja.pdf</a>

17	Toronto-Dominion Bank	2	Canada	2450	87568	108.449	<a href="https://www.td.com/document/PDF/corporateresponsibility/2017-Final-CRR_EN.pdf">https://www.td.com/document/PDF/corporateresponsibility/2017-Final-CRR_EN.pdf</a>
							<a href="http://appft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;u=%2Fnethtml%2FFPTO%2Fsearch-adv.html&amp;r=1&amp;p=1&amp;f=G&amp;l=50&amp;d=PG01&amp;S1=20180089645.PG.NR.&amp;OS=dn/20180089645&amp;RS=DN/20180089645">http://appft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&amp;Sect2=HITOFF&amp;u=%2Fnethtml%2FFPTO%2Fsearch-adv.html&amp;r=1&amp;p=1&amp;f=G&amp;l=50&amp;d=PG01&amp;S1=20180089645.PG.NR.&amp;OS=dn/20180089645&amp;RS=DN/20180089645</a>
18	BNP Paribas	5	France	2200	202000	103.258	<a href="https://group.bnpparibas/en/press-release/bnp-paribas-ey-explore-private-blockchain-optimize-bank-s-global-internal-treasury-operations">https://group.bnpparibas/en/press-release/bnp-paribas-ey-explore-private-blockchain-optimize-bank-s-global-internal-treasury-operations</a>
19	Goldman Sachs Group	5	U.S.	86	35900	100.705	<a href="https://www.ubs.com/magazines/innovation/en/our-approach/2016/path-finding.html">https://www.ubs.com/magazines/innovation/en/our-approach/2016/path-finding.html</a>
							<a href="https://www.goldmansachs.com/our-firm/locations.html">https://www.goldmansachs.com/our-firm/locations.html</a>
20	POA Sberbank of Russia	5	Russia	16342	291297	99.840	<a href="https://www.sberbank.ru/en/press_center/all/article?newsID=bfbc4479-6a04-46f2-9d52-0b81093590aa&amp;blockID=1539&amp;regionID=77&amp;lang=en">https://www.sberbank.ru/en/press_center/all/article?newsID=bfbc4479-6a04-46f2-9d52-0b81093590aa&amp;blockID=1539&amp;regionID=77&amp;lang=en</a>
							<a href="https://www.sberbank.ru/en/about/about_sberbank">https://www.sberbank.ru/en/about/about_sberbank</a>
21	Morgan Stanley	4	U.S.	500	60469	99.651	<a href="https://www.coindesk.com/goldman-morgan-stanley-go-live-with-cls-ibm-powered-blockchain">https://www.coindesk.com/goldman-morgan-stanley-go-live-with-cls-ibm-powered-blockchain</a>
							<a href="https://www.morganstanley.com/people-opportunities/students-graduates/program-detail-cities/north-america/multiple-locations">https://www.morganstanley.com/people-opportunities/students-graduates/program-detail-cities/north-america/multiple-locations</a>
22	U.S. Bancorp	4	U.S.	3050	73333	94.558	<a href="https://www.americanbanker.com/news/blockchain-tested-for-making-mortgage-securities-easier-to-track">https://www.americanbanker.com/news/blockchain-tested-for-making-mortgage-securities-easier-to-track</a>
							<a href="https://www.usbank.com/content/usbank/annual-report/2018/pdf/2018_USBancorp_Overview.pdf">https://www.usbank.com/content/usbank/annual-report/2018/pdf/2018_USBancorp_Overview.pdf</a>
							<a href="https://www.usbank.com/about-us-bank.html">https://www.usbank.com/about-us-bank.html</a>
23	Itau Unibanco Holding SA	4	Brazil	5000	100300	86.203	<a href="https://www.reuters.com/article/us-itaunibanco-hldg-standard-chartered-b/ita-and-stanchart-launch-blockchain-platform-for-loans-in-latin-america-idUSKBN1O22DK">https://www.reuters.com/article/us-itaunibanco-hldg-standard-chartered-b/ita-and-stanchart-launch-blockchain-platform-for-loans-in-latin-america-idUSKBN1O22DK</a>
							<a href="https://www.relbanks.com/brazil/itau-unibanco">https://www.relbanks.com/brazil/itau-unibanco</a>
24	Westpac Banking Corp	5	Australia	1204	31007	84.560	<a href="https://www.westpac.com.au/about-westpac/media/media-releases/2017/10-july-1/?searchsource=search-results&amp;kw=blockchain&amp;cat=news-%26-media-releases&amp;rank=2&amp;result-type=natural">https://www.westpac.com.au/about-westpac/media/media-releases/2017/10-july-1/?searchsource=search-results&amp;kw=blockchain&amp;cat=news-%26-media-releases&amp;rank=2&amp;result-type=natural</a>
							<a href="https://www.westpac.com.au/about-westpac/global-locations/">https://www.westpac.com.au/about-westpac/global-locations/</a>
25	Bank of Nova Scotia	5	Canada	3000	98508	78.947	<a href="https://www.coindesk.com/canadas-scotiabank-completes-blockchain-trial-for-trade-reports">https://www.coindesk.com/canadas-scotiabank-completes-blockchain-trial-for-trade-reports</a>
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26	ING Groep NV	5	Netherlands	739	52658	78.920	<a href="https://www.ing.com/Newsroom/All-news/ING-Ventures-invests-in-API-and-blockchain-powered-trade-platform-TradeIX.htm">https://www.ing.com/Newsroom/All-news/ING-Ventures-invests-in-API-and-blockchain-powered-trade-platform-TradeIX.htm</a>
							<a href="https://www.ing.nl/nieuws/feiten_en_cijfers/index.html">https://www.ing.nl/nieuws/feiten_en_cijfers/index.html</a>
27	Groupe BPCE	5	France	8200	105000	76.884	<a href="https://www.groupebpce.fr/Journaliste/Actus-et-Communiqués-de-Presses/Groupe/Open-innovation-le-Groupe-BPCE-lance-un-Startup-PASS-et-devient-la-première-banque-en-France-a-s-engager-dans-une-démarche-d-open-data">https://www.groupebpce.fr/Journaliste/Actus-et-Communiqués-de-Presses/Groupe/Open-innovation-le-Groupe-BPCE-lance-un-Startup-PASS-et-devient-la-première-banque-en-France-a-s-engager-dans-une-démarche-d-open-data</a>
							<a href="https://www.groupebpce.fr/Journaliste/Actus-et-Communiqués-de-Presses/Strategie/Natixis-rejoint-le-consortium-Blockchain-de-R3">https://www.groupebpce.fr/Journaliste/Actus-et-Communiqués-de-Presses/Strategie/Natixis-rejoint-le-consortium-Blockchain-de-R3</a>
							<a href="http://fortune.com/global500/groupe-bpce/">http://fortune.com/global500/groupe-bpce/</a>
28	UBS Group AG	3	Switzerland	1260	67481	75.482	<a href="https://www.ubs.com/magazines/innovation/en/into-the-future/2017/secure-payments-on-the-go.html">https://www.ubs.com/magazines/innovation/en/into-the-future/2017/secure-payments-on-the-go.html</a>
							<a href="https://www.ubs.com/locations.html#switzerland/en/nsnf/all/">https://www.ubs.com/locations.html#switzerland/en/nsnf/all/</a>
29	PNC Financial Services Group	4	U.S.	2400	50928	72.246	<a href="https://www.reuters.com/article/us-blockchain-ripple/blockchain-startup-ripple-signs-up-pnc-as-a-customer-for-its-payment-tech-idUSKCNILZ1W9">https://www.reuters.com/article/us-blockchain-ripple/blockchain-startup-ripple-signs-up-pnc-as-a-customer-for-its-payment-tech-idUSKCNILZ1W9</a>
							<a href="https://www.finextra.com/newsarticle/33262/pnc-and-ibm-back-health-insurers-blockchain-project">https://www.finextra.com/newsarticle/33262/pnc-and-ibm-back-health-insurers-blockchain-project</a>
							<a href="https://www.pnc.com/content/dam/pnc-com/pdf/aboutpnc/Fact%20Sheets/CorporateProfile.pdf">https://www.pnc.com/content/dam/pnc-com/pdf/aboutpnc/Fact%20Sheets/CorporateProfile.pdf</a>
30	Lloyds Banking Group	2	U.K.	2000	64928	71.253	<a href="https://www.computerweekly.com/news/450422267/Lloyds-Bank-joins-Swift-blockchain-proof-of-concept-project">https://www.computerweekly.com/news/450422267/Lloyds-Bank-joins-Swift-blockchain-proof-of-concept-project</a>
							<a href="https://www.lloydsbankinggroup.com/media/media-kit/faqs/lloyds-banking-group-fast-facts/">https://www.lloydsbankinggroup.com/media/media-kit/faqs/lloyds-banking-group-fast-facts/</a>
31	Sumitomo Mitsui Financial Group	5	Japan	444	73000	67.328	<a href="https://www.smfg.co.jp/news_e/e110076_01.html">https://www.smfg.co.jp/news_e/e110076_01.html</a>
32	Bank of Communications	4	China	3270	92746	67.078	<a href="http://www.chinabankingnews.com/2018/09/28/bank-communications-issues-residential-mortgage-backed-securities-via-jucai-blockchain/">http://www.chinabankingnews.com/2018/09/28/bank-communications-issues-residential-mortgage-backed-securities-via-jucai-blockchain/</a>
							<a href="https://ventureseed.com/china-banks/bank-of-communications-bocom/">https://ventureseed.com/china-banks/bank-of-communications-bocom/</a>

33	Australia & New Zealand Banking Group	4	Australia	1200	37364	66.448	<a href="https://www.coindesk.com/anz-and-ibm-building-blockchain-solution-for-insurance-industry">https://www.coindesk.com/anz-and-ibm-building-blockchain-solution-for-insurance-industry</a>
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34	Banco Bradesco SA	4	Brazil	4480	98605	64.816	<a href="https://U.K..reuters.com/article/us-r3-cev-blockchain-fundraising-idU.K.KBN18J1T6">https://U.K..reuters.com/article/us-r3-cev-blockchain-fundraising-idU.K.KBN18J1T6</a>
							<a href="https://www.reuters.com/finance/stocks/company-profile/BBD">https://www.reuters.com/finance/stocks/company-profile/BBD</a>
35	National Australia Bank	5	Australia	1700	33790	63.794	<a href="https://news.nab.com.au/nab-ventures-backs-san-francisco-payments-fintech/">https://news.nab.com.au/nab-ventures-backs-san-francisco-payments-fintech/</a>
							<a href="https://www.relbanks.com/oceania/australia/national-australia-bank">https://www.relbanks.com/oceania/australia/national-australia-bank</a>
36	Intesa Sanpaolo	4	Italy	4100	91328	62.032	<a href="https://blockchainflashnews.com/intesa-sanpaolo-blockchain/">https://blockchainflashnews.com/intesa-sanpaolo-blockchain/</a>
							<a href="https://www.economyup.it/fintech/intesa-sanpaolo-blockchain/">https://www.economyup.it/fintech/intesa-sanpaolo-blockchain/</a>
							<a href="https://www.group.intesasnpaolo.com/script/Isir0/si09/chi_siamo/eng_wp_chi_siamo.jsp#/chi_siamo/eng_wp_chi_siamo.jsp">https://www.group.intesasnpaolo.com/script/Isir0/si09/chi_siamo/eng_wp_chi_siamo.jsp#/chi_siamo/eng_wp_chi_siamo.jsp</a>
37	Banco Bilbao Vizcaya Argentaria SA	5	Argentine	7963	125749	60.678	<a href="https://www.bbva.com/en/bbva-leads-the-way-in-the-use-of-blockchain-according-to-forbes/">https://www.bbva.com/en/bbva-leads-the-way-in-the-use-of-blockchain-according-to-forbes/</a>
							<a href="https://www.bbva.com/en/bbva-and-madrids-government-close-the-first-blockchain-powered-sustainable-schuldschein-loan/">https://www.bbva.com/en/bbva-and-madrids-government-close-the-first-blockchain-powered-sustainable-schuldschein-loan/</a>
							<a href="https://www.cnmv.es/AUDITA/2018/17810.pdf">https://www.cnmv.es/AUDITA/2018/17810.pdf</a>
38	Japan Post Bank	2	Japan	24060	229421	60.525	<a href="https://cryptonomist.ch/en/2019/02/25/j-coin-pay-payment-service-blockchain/">https://cryptonomist.ch/en/2019/02/25/j-coin-pay-payment-service-blockchain/</a>
39	Bank of New York Mellon Corp	5	U.S.	157	49800	59.823	<a href="https://www.bnymellon.com/global-assets/pdf/our-thinking/reinventing-payments-in-an-era-of-modernization.pdf">https://www.bnymellon.com/global-assets/pdf/our-thinking/reinventing-payments-in-an-era-of-modernization.pdf</a>
							<a href="https://www.bnymellon.com/us/en/location-directory.jsp">https://www.bnymellon.com/us/en/location-directory.jsp</a>

40	Shanghai Pudong Development Bank	4	China	38	55692	58.796	<a href="https://www.chinaknowledge.com/News/DetailNews?id=78797">https://www.chinaknowledge.com/News/DetailNews?id=78797</a>
							<a href="https://banksdaily.com/info/spdbank">https://banksdaily.com/info/spdbank</a>
41	Charles Schwab	1	U.S.	346	19500	58.527	<a href="https://finance.yahoo.com/quote/SCHW/">https://finance.yahoo.com/quote/SCHW/</a>
							<a href="https://www.bloomberg.com/profile/company/SCHW:US">https://www.bloomberg.com/profile/company/SCHW:US</a>
							<a href="https://www.sec.gov/Archives/edgar/data/316709/000031670918000009/schw-12312017x10k.htm">https://www.sec.gov/Archives/edgar/data/316709/000031670918000009/schw-12312017x10k.htm</a>
							<a href="https://www.schwab.com/active-trader/insights/content/what-is-blockchain-and-how-will-it-affect-future-trading">https://www.schwab.com/active-trader/insights/content/what-is-blockchain-and-how-will-it-affect-future-trading</a>
42	Industrial Bank Co. Ltd	4	China	1910	56985	57.388	<a href="https://www.chaindd.com/nictation/3184060.html">https://www.chaindd.com/nictation/3184060.html</a>
43	Bank of Montreal	5	Canada	900	45454	53.181	<a href="https://newsroom.bmo.com/2018-04-19-First-pilot-client-transactions-successfully-executed-on-Batavia-global-trade-finance-platform">https://newsroom.bmo.com/2018-04-19-First-pilot-client-transactions-successfully-executed-on-Batavia-global-trade-finance-platform</a>
							<a href="https://www.bmo.com/main/personal">https://www.bmo.com/main/personal</a>
44	Credit Agricole Group	5	France	11100	72510	52.141	<a href="https://www.credit-agricole.com/en/news-channels/the-channels/newsflash/Credit-Agricole-experimenting-with-Ripple-blockchain-money-transfer-technology">https://www.credit-agricole.com/en/news-channels/the-channels/newsflash/Credit-Agricole-experimenting-with-Ripple-blockchain-money-transfer-technology</a>
45	Bank Central Asia	4	Indonesia	1235	27561	52.025	<a href="https://finance.yahoo.com/quote/PBCRF/">https://finance.yahoo.com/quote/PBCRF/</a>
							<a href="https://e27.co/exploring-potential-blockchain-implementation-indonesia-20180409/">https://e27.co/exploring-potential-blockchain-implementation-indonesia-20180409/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=1945186">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=1945186</a>
							<a href="https://www.indonesia-investments.com/business/indonesian-companies/bank-central-asia/item193?">https://www.indonesia-investments.com/business/indonesian-companies/bank-central-asia/item193?</a>
46	DBS Group Holdings	5	Singapore	280	26964	51.475	<a href="https://www.dbs.com/annualreports/2018/making-banking-invisible.html">https://www.dbs.com/annualreports/2018/making-banking-invisible.html</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=874047">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=874047</a>
47	Nordea	5	Sweden	450	29284	51.185	<a href="https://www.nordea.com/en/about-nordea/who-we-are/our-organisation/">https://www.nordea.com/en/about-nordea/who-we-are/our-organisation/</a>
							<a href="https://www.nordea.com/en/investor-relations/nordea-in-figures/fact-sheet/">https://www.nordea.com/en/investor-relations/nordea-in-figures/fact-sheet/</a>

48	Capital One Financial Corporation	5	U.S.	755	48800	51.107	<a href="https://www.capitalone.com/commercial/insights/surprising-opportunities-banks-benefits-fintech/">https://www.capitalone.com/commercial/insights/surprising-opportunities-banks-benefits-fintech/</a>
							<a href="https://www.capitalone.com/local/">https://www.capitalone.com/local/</a>
49	Royal Bank of Scotland Group	5	U.K.	700	66900	50.490	<a href="https://www.rbs.com/rbs/news/2018/11/natwest-extends-digital-loans-to-p750k-for-business-customers.html">https://www.rbs.com/rbs/news/2018/11/natwest-extends-digital-loans-to-p750k-for-business-customers.html</a>
50	Mizuho Financial Group	5	Japan	515	59132	50.018	<a href="https://search.www.mizuho-fg.com/click?url=https%3A%2F%2Fwww.mizuho-fg.com%2Frelease%2Fpdf%2F20170223release_eng.pdf&amp;query=blockchain&amp;charset=UTF-8&amp;site=AQ83RXG5&amp;group=2">https://search.www.mizuho-fg.com/click?url=https%3A%2F%2Fwww.mizuho-fg.com%2Frelease%2Fpdf%2F20170223release_eng.pdf&amp;query=blockchain&amp;charset=UTF-8&amp;site=AQ83RXG5&amp;group=2</a>
							<a href="https://search.www.mizuho-fg.com/click?url=https%3A%2F%2Fwww.mizuho-fg.com%2Frelease%2Fpdf%2F20180518release_eng.pdf&amp;query=blockchain&amp;charset=UTF-8&amp;site=AQ83RXG5&amp;group=2">https://search.www.mizuho-fg.com/click?url=https%3A%2F%2Fwww.mizuho-fg.com%2Frelease%2Fpdf%2F20180518release_eng.pdf&amp;query=blockchain&amp;charset=UTF-8&amp;site=AQ83RXG5&amp;group=2</a>
51	Credit Suisse Group	4	Switzerland	700	45680	48.462	<a href="https://www.internationalinvestment.net/news/4000859/credit-suisse-brands-blockchain-game-changer-successful-test">https://www.internationalinvestment.net/news/4000859/credit-suisse-brands-blockchain-game-changer-successful-test</a>
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							<a href="https://www.relbanks.com/europe/switzerland/credit-suisse">https://www.relbanks.com/europe/switzerland/credit-suisse</a>
52	Postal Savings Bank of China	4	China	40000	170809	47.948	<a href="https://www.asiacryptoday.com/postal-savings-bank-of-china-completed-the-first-multi-bank-transaction-using-the-blockchain/">https://www.asiacryptoday.com/postal-savings-bank-of-china-completed-the-first-multi-bank-transaction-using-the-blockchain/</a>
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53	China Minsheng Banking Corp	4	China	733	55338	47.921	<a href="http://en.cmbc.com.cn/upload/2018/2/e_598200_(China%20Minsheng%20Eng)_AsPrint_Fullset_1837.pdf">http://en.cmbc.com.cn/upload/2018/2/e_598200_(China%20Minsheng%20Eng)_AsPrint_Fullset_1837.pdf</a>
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							<a href="https://pitchbook.com/profiles/company/59009-50">https://pitchbook.com/profiles/company/59009-50</a>
54	UniCredit S.p.A.	5	Italy	12000	86232	47.777	<a href="https://www.unicreditgroup.eu/content/dam/unicreditgroup-eu/documents/en/sustainability/sustainability-reports/2016/singole_sezioni/BI2016_Intellectual_Capital.pdf">https://www.unicreditgroup.eu/content/dam/unicreditgroup-eu/documents/en/sustainability/sustainability-reports/2016/singole_sezioni/BI2016_Intellectual_Capital.pdf</a>

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55	China CITIC Bank Corp	4	China	1400	56415	47.451	<a href="http://www.theasianbanker.com/updates-and-articles/china-citic-bank-awarded-the-best-blockchain-initiative-application-or-programme-for-2018-at-the-asian-banker-financial-technology-innovation-awards-2018">http://www.theasianbanker.com/updates-and-articles/china-citic-bank-awarded-the-best-blockchain-initiative-application-or-programme-for-2018-at-the-asian-banker-financial-technology-innovation-awards-2018</a>
							<a href="https://www.relbanks.com/asia/china/china-citic-bank">https://www.relbanks.com/asia/china/china-citic-bank</a>
56	Hang Seng Bank	4	Hong Kong	100	10352	47.284	<a href="https://finance.yahoo.com/quote/0011.HK/">https://finance.yahoo.com/quote/0011.HK/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=874380">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=874380</a>
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57	Qatar National Bank	4	Qatar	1100	30000	47.181	<a href="https://www.qnb.com/cs/Satellite/QNBGlobal/en/enGlobalHome">https://www.qnb.com/cs/Satellite/QNBGlobal/en/enGlobalHome</a>
							<a href="https://www.qnb.com/cs/Satellite/QNBQatar/en_QA/enAboutQNB">https://www.qnb.com/cs/Satellite/QNBQatar/en_QA/enAboutQNB</a>
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58	Société Générale	5	France	2869	149000	46.051	<a href="https://www.societegenerale.com/en/digital-and-innovation/tech-culture-it/blockchain-innovation">https://www.societegenerale.com/en/digital-and-innovation/tech-culture-it/blockchain-innovation</a>
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59	Barclays PLC	5	U.K.	1344	83500	45.850	<a href="https://home.barclays/news/2018/08/barclays-in-the-news-an-app-store-for-banks/#back=%2Fcontent%2Fhome-barclays%2Fen%2Fhome%2Fresults.html%3Fq%3Dblockchain%26_charset_%3DUTF-8%26offset%3D0%26origin%3Dhelp.barclays.co.U.K.">https://home.barclays/news/2018/08/barclays-in-the-news-an-app-store-for-banks/#back=%2Fcontent%2Fhome-barclays%2Fen%2Fhome%2Fresults.html%3Fq%3Dblockchain%26_charset_%3DUTF-8%26offset%3D0%26origin%3Dhelp.barclays.co.U.K.</a>
							<a href="https://barclays.banklocationmaps.com/">https://barclays.banklocationmaps.com/</a>

60	Canadian Imperial Bank of Commerce	5	Canada	1048	43815	43.544	<a href="https://www.cibc.com/en/privacy-security/verified-me.html">https://www.cibc.com/en/privacy-security/verified-me.html</a>
							<a href="https://lobbycanada.gc.ca/app/secure/ocl/lrs/do/clntAddr?cid=5064&amp;sMdKy=1370055659008">https://lobbycanada.gc.ca/app/secure/ocl/lrs/do/clntAddr?cid=5064&amp;sMdKy=1370055659008</a>
61	BOC Hong Kong	4	Hong Kong	200	14046	40.591	<a href="https://www.bochk.com/en/aboutus/ir/factsheet.html">https://www.bochk.com/en/aboutus/ir/factsheet.html</a>
							<a href="https://www.bloomberg.com/quote/2388:HK">https://www.bloomberg.com/quote/2388:HK</a>
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62	State Bank of India	4	India	24000	264041	40.562	<a href="https://www.indiabitcoin.com/sbi-takes-lead-in-blockchain-to-use-it-to-prevent-fraud/">https://www.indiabitcoin.com/sbi-takes-lead-in-blockchain-to-use-it-to-prevent-fraud/</a>
							<a href="https://sbi.co.in/group/about-us.html">https://sbi.co.in/group/about-us.html</a>
63	State Street Corp	5	U.S.	88	40000	39.769	<a href="https://newsroom.statestreet.com/press-release/corporate/peernova-engages-state-street-prototype-tracking-capital-lineage-blockchain-">https://newsroom.statestreet.com/press-release/corporate/peernova-engages-state-street-prototype-tracking-capital-lineage-blockchain-</a>
							<a href="http://www.statestreet.com/about/office-locations.html">http://www.statestreet.com/about/office-locations.html</a>
64	Deutsche Bank	3	Germany	2057	91737	38.649	<a href="https://www.deutsche-bank.de/pfb/content/unternehmerwissen_blockchain-die-naechste-revolution.html">https://www.deutsche-bank.de/pfb/content/unternehmerwissen_blockchain-die-naechste-revolution.html</a>
65	KBC Group NV	5	Belgium	1400	34546	38.394	<a href="https://www.kbc.com/nl/system/files/doc/newsroom/pressreleases/2016/20160712_DTC_NL.pdf">https://www.kbc.com/nl/system/files/doc/newsroom/pressreleases/2016/20160712_DTC_NL.pdf</a>
							<a href="https://www.kbc.com/nl/wie-zijn-we">https://www.kbc.com/nl/wie-zijn-we</a>
66	Danske Bank	5	Denmark	431	20978	38.223	<a href="https://danskebank.com/news-and-insights/news-archive/news/2018/24102018">https://danskebank.com/news-and-insights/news-archive/news/2018/24102018</a>
							<a href="https://www-2.danskebank.com/link/groupoverview">https://www-2.danskebank.com/link/groupoverview</a>
67	Ping An Bank	5	China	1095	38600	37.993	<a href="http://tech.pingan.com/en/index.html">http://tech.pingan.com/en/index.html</a>
							<a href="https://www.coindesk.com/ping-ans-new-pitch-for-blockchain-shared-ledger-but-banks-keep-clients">https://www.coindesk.com/ping-ans-new-pitch-for-blockchain-shared-ledger-but-banks-keep-clients</a>
							<a href="https://bank.pingan.com/about/en/index.shtml">https://bank.pingan.com/about/en/index.shtml</a>

68	Branch Banking and Trust Company	4	U.S.	2044	35852	37.400	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=19109">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=19109</a>
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69	Standard Chartered Plc	5	U.K.	1429	82827	37.319	<a href="https://www.sc.com/en/media/press-release/standard-chartered-to-be-first-custodian-bank-to-join-equichains-user-group/">https://www.sc.com/en/media/press-release/standard-chartered-to-be-first-custodian-bank-to-join-equichains-user-group/</a>
							<a href="https://www.sc.com/en/media/press-release/standard-chartered-advances-digitalisation-of-trade-finance-with-two-strategic-partnerships/">https://www.sc.com/en/media/press-release/standard-chartered-advances-digitalisation-of-trade-finance-with-two-strategic-partnerships/</a>
							<a href="https://www.relbanks.com/oceania/australia/westpac">https://www.relbanks.com/oceania/australia/westpac</a>
70	United Overseas Bank (UOB)	5	Singapore	568	26651	35.128	<a href="https://www.uobgroup.com/web-resources/uobgroup/pdf/newsroom/2018/media-release-uob-and-pintec-join-forces-to-launch-next-generation-digital-credit-assessment-solution.pdf">https://www.uobgroup.com/web-resources/uobgroup/pdf/newsroom/2018/media-release-uob-and-pintec-join-forces-to-launch-next-generation-digital-credit-assessment-solution.pdf</a>
							<a href="https://sgbanks.com/banks/uob-singapore">https://sgbanks.com/banks/uob-singapore</a>
71	Bank Rakyat Indonesia	2	Indonesia	446	61010	34.404	<a href="https://www.indonesia-investments.com/business/indonesian-companies/bank-rakyat-indonesia/item209?">https://www.indonesia-investments.com/business/indonesian-companies/bank-rakyat-indonesia/item209?</a>
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							-
72	Oversea-Chinese Banking Corp (OCBC)	5	Singapore	500	29958	33.141	<a href="https://www.ocbc.com/group/media/release/2017/ocbc-hsbc-mufg-kyc-blockchain.html">https://www.ocbc.com/group/media/release/2017/ocbc-hsbc-mufg-kyc-blockchain.html</a>
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73	DnB ASA	2	Norway	139	9225	29.746	<a href="https://blog.iota.org/dnb-teams-up-with-iota-to-explore-the-economy-of-things-and-mydata-gdpr-as-an-opportunity-20c41461e3f5?gi=e5df19d6e835">https://blog.iota.org/dnb-teams-up-with-iota-to-explore-the-economy-of-things-and-mydata-gdpr-as-an-opportunity-20c41461e3f5?gi=e5df19d6e835</a>
							<a href="https://www.bitspace.com/bitspace-working-with-norways-largest-bank-dnb/">https://www.bitspace.com/bitspace-working-with-norways-largest-bank-dnb/</a>
							<a href="https://www.dnb.no/en/about-us/global-network/norway.html">https://www.dnb.no/en/about-us/global-network/norway.html</a>
74	DZ Bank AG	5	Germany	11500	25468	29.682	<a href="https://innovationsblog.dzbank.de/2018/07/09/fail-fast-and-learn-corda-technologie-in-der-foerderlandschaft/">https://innovationsblog.dzbank.de/2018/07/09/fail-fast-and-learn-corda-technologie-in-der-foerderlandschaft/</a>
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							<a href="https://www.nasdaq.com/quotes/institutional-portfolio/dz-bank-ag-deutsche-zentral-genossenschafts-bank-frankfurt-1015816">https://www.nasdaq.com/quotes/institutional-portfolio/dz-bank-ag-deutsche-zentral-genossenschafts-bank-frankfurt-1015816</a>
75	CaixaBank	5	Spain	5103	37503	27.260	<a href="https://www.caixabank.com/comunicacion/noticia/first-pilot-client-transactions-successfully-executed-on-batavia-global-trade-finance-platform_en.html?id=40856">https://www.caixabank.com/comunicacion/noticia/first-pilot-client-transactions-successfully-executed-on-batavia-global-trade-finance-platform_en.html?id=40856</a>
							<a href="https://www.caixabank.es/particular/general/reconocimientos/mejorbancoeuromoney_es.html">https://www.caixabank.es/particular/general/reconocimientos/mejorbancoeuromoney_es.html</a>
							<a href="https://www.caixabank.com/informacioncorporativa/datosclave_en.html">https://www.caixabank.com/informacioncorporativa/datosclave_en.html</a>
76	Banco do Brasil SA	4	Brazil	5400	96889	25.952	<a href="https://canaltech.com.br/blockchain/banrisul-bb-caixa-sicoob-e-santander-se-unem-em-projeto-de-blockchain-114768/">https://canaltech.com.br/blockchain/banrisul-bb-caixa-sicoob-e-santander-se-unem-em-projeto-de-blockchain-114768/</a>
							<a href="https://www.relbanks.com/brazil/banco-do-brasil">https://www.relbanks.com/brazil/banco-do-brasil</a>
77	Skandinaviska Enskilda Banken	5	Sweden	670	15000	24.212	<a href="https://sebgroupp.com/press/news/global-blockchain-network-now-being-launched">https://sebgroupp.com/press/news/global-blockchain-network-now-being-launched</a>
							<a href="http://www.company-histories.com/Skandinaviska-Enskilda-Banken-AB-Company-History.html">http://www.company-histories.com/Skandinaviska-Enskilda-Banken-AB-Company-History.html</a>
78	Nomura Holdings	5	Japan	160	28000	22.352	<a href="https://www.nomuraholdings.com/news/nr/holdings/20170601/20170601_a.pdf">https://www.nomuraholdings.com/news/nr/holdings/20170601/20170601_a.pdf</a>
							<a href="https://nomura.com/amhr-recruiting-brochure/files/assets/common/downloads/Nomura_Americas_Recruiting_Brochure.pdf">https://nomura.com/amhr-recruiting-brochure/files/assets/common/downloads/Nomura_Americas_Recruiting_Brochure.pdf</a>
79	Shinhan Financial Group	4	South Korea	1405	13400	20.791	<a href="https://blocktribune.com/south-korea-to-implement-blockos-blockchain-system-to-process-real-estate-data/">https://blocktribune.com/south-korea-to-implement-blockos-blockchain-system-to-process-real-estate-data/</a>
							<a href="http://www.shinhangroup.com/en/common/download/commonDownload.jsp?actionValue=PDF&amp;pathKey=CSRREPORT_SUB&amp;rid=247">http://www.shinhangroup.com/en/common/download/commonDownload.jsp?actionValue=PDF&amp;pathKey=CSRREPORT_SUB&amp;rid=247</a>

80	Svenska Handelsbanken	1	Sweden	826	12394	20.378	<a href="https://borsrum.handelsbanken.se/Borsflodet/Blogginlagg/Mats-Nyman/Vad-ar-pengar--egentligen/">https://borsrum.handelsbanken.se/Borsflodet/Blogginlagg/Mats-Nyman/Vad-ar-pengar--egentligen/</a>
							<a href="https://www.handelsbanken.com/shb/inet/.../hb_2017_eng_annualreport.pdf">https://www.handelsbanken.com/shb/inet/.../hb_2017_eng_annualreport.pdf</a>
81	Cathay Financial Holding	4	Taiwan	700	54520	19.082	<a href="https://cloudblogs.microsoft.com/industry-blog/financial-services/2016/12/16/microsoft-and-amis-announce-asias-first-blockchain-consortium/">https://cloudblogs.microsoft.com/industry-blog/financial-services/2016/12/16/microsoft-and-amis-announce-asias-first-blockchain-consortium/</a>
							<a href="https://www.cathayholdings.com/en/holdings/intro/intro/about">https://www.cathayholdings.com/en/holdings/intro/intro/about</a>
82	Bank of Shanghai	4	China	101	10459	18.070	<a href="https://news.8btc.com/bank-of-shanghai-and-ccb-launch-chinas-first-blockchain-based-lc">https://news.8btc.com/bank-of-shanghai-and-ccb-launch-chinas-first-blockchain-based-lc</a>
							<a href="http://www.boc.cn/en/about/boc/ab6/">http://www.boc.cn/en/about/boc/ab6/</a>
83	Bank of Beijing	4	China	650	10400	17.940	<a href="http://www.chinabankingnews.com/2019/04/23/beijing-launches-chinas-first-blockchain-driven-notarization-service/">http://www.chinabankingnews.com/2019/04/23/beijing-launches-chinas-first-blockchain-driven-notarization-service/</a>
							<a href="http://www.bankofbeijing.com.cn/en2011/about/index.shtml">http://www.bankofbeijing.com.cn/en2011/about/index.shtml</a>
84	Erste Group Bank AG	5	Austria	2507	47248	17.919	<a href="https://www.erstegroup.com/content/dam/at/eh/www_erstegroup_com/de/Presse/Pressemeldungen/2018/10-okt/Erste%20Group_Schuldscheindarlehen%20auf%20Blockchain-Basis_20181023.pdf">https://www.erstegroup.com/content/dam/at/eh/www_erstegroup_com/de/Presse/Pressemeldungen/2018/10-okt/Erste%20Group_Schuldscheindarlehen%20auf%20Blockchain-Basis_20181023.pdf</a>
							<a href="https://www.erstegroup.com/en/about-us">https://www.erstegroup.com/en/about-us</a>
85	Swedbank	5	Sweden	302	14955	16.890	<a href="https://www.swedbank.com/share/layer-content/open-banking/swedbank-open-banking-event-banking-on-blockchain--how-the-financial-industry-views-blockchain-technology.html">https://www.swedbank.com/share/layer-content/open-banking/swedbank-open-banking-event-banking-on-blockchain--how-the-financial-industry-views-blockchain-technology.html</a>
							<a href="http://startupwiseguys.com/fintech/">http://startupwiseguys.com/fintech/</a>
							<a href="https://www.swedbank.com/about-swedbank/quick-facts.html">https://www.swedbank.com/about-swedbank/quick-facts.html</a>
86	Hua Xia Bank	4	China	505	41283	16.660	<a href="http://afrview.com/a/yaowen/2018/1127/276.html">http://afrview.com/a/yaowen/2018/1127/276.html</a>
							<a href="http://www.hxb.com.cn/en/about-hua-xia-bank/general-description/bank-profile/index.shtml">http://www.hxb.com.cn/en/about-hua-xia-bank/general-description/bank-profile/index.shtml</a>
87	KB Financial Group	2	South Korea	1130	26000	15.994	<a href="https://usethebitcoin.com/korean-firm-wins-blockchain-patent-to-improve-fintech-security/">https://usethebitcoin.com/korean-firm-wins-blockchain-patent-to-improve-fintech-security/</a>
							<a href="https://www.reuters.com/finance/stocks/companyProfile/KB">https://www.reuters.com/finance/stocks/companyProfile/KB</a>
88	Sumitomo Mitsui Trust Holdings	5	Japan	138	22351	13.660	<a href="https://search.smth.jp/?go=https%3A%2F%2Fwww.smth.jp%2Fen%2Fcsr%2Freport%2F2018%2F13.pdf%26f%3Dr&amp;rid=1312969301780883&amp;ref=https%3A%2F%2Fwww.smth.jp%2Fen%2F">https://search.smth.jp/?go=https%3A%2F%2Fwww.smth.jp%2Fen%2Fcsr%2Freport%2F2018%2F13.pdf%26f%3Dr&amp;rid=1312969301780883&amp;ref=https%3A%2F%2Fwww.smth.jp%2Fen%2F</a>
							<a href="https://www.smbctb.co.jp/en/branch/">https://www.smbctb.co.jp/en/branch/</a>

89	BFA Sociedad Tenedora de Acciones SAU	5	Spain	2298	15925	12.999	<a href="http://www.bfatenedoradeacciones.com/es/bfa/inicio">http://www.bfatenedoradeacciones.com/es/bfa/inicio</a>
							<a href="https://stockmind.io/en/">https://stockmind.io/en/</a>
							<a href="https://www.reuters.com/finance/stocks/overview/BKIA.MC">https://www.reuters.com/finance/stocks/overview/BKIA.MC</a>
							<a href="https://www.bankia.com/en/who-we-are/about-us/key-figures/">https://www.bankia.com/en/who-we-are/about-us/key-figures/</a>
90	Bank of Jiangsu	5	China	540	15026	12.270	<a href="http://www.jsbchina.cn/data/tosend/resource/upload/2017Report.pdf">http://www.jsbchina.cn/data/tosend/resource/upload/2017Report.pdf</a>
							<a href="https://www.marketscreener.com/BANK-OF-JIANGSU-CO-35806841/company/">https://www.marketscreener.com/BANK-OF-JIANGSU-CO-35806841/company/</a>
91	Hana Financial Group	5	South Korea	1150	12380	11.710	<a href="http://www.hanafn.com/eng/pr/news/newsDetail.do?seq=3352&amp;page=1">http://www.hanafn.com/eng/pr/news/newsDetail.do?seq=3352&amp;page=1</a>
							<a href="https://www.relbanks.com/asia/south-korea/hana-bank">https://www.relbanks.com/asia/south-korea/hana-bank</a>
92	Banco Sabadell	5	Spain	1174	26177	10.384	<a href="http://prensa.bancosabadell.com/en/News/2017/05/banco-sabadell-founding-member-of-red-lyra--a-multisector-spanish-blockchain-network-and-a-global-reference">http://prensa.bancosabadell.com/en/News/2017/05/banco-sabadell-founding-member-of-red-lyra--a-multisector-spanish-blockchain-network-and-a-global-reference</a>
							<a href="https://alastria.io/nuestra-tecnologia/">https://alastria.io/nuestra-tecnologia/</a>
							<a href="https://www.grupbancosabadell.com/en/INVERSORES/RESUMEN_EJECUTIVO/print.html">https://www.grupbancosabadell.com/en/INVERSORES/RESUMEN_EJECUTIVO/print.html</a>
93	ABN AMRO Group NV	5	Netherlands	183	18962	10.037	<a href="https://www.abnamro.com/nl/newsroom/persberichten/2018/eerste-landbouwgrondstoffen-transactie-via-de-blockchain.html">https://www.abnamro.com/nl/newsroom/persberichten/2018/eerste-landbouwgrondstoffen-transactie-via-de-blockchain.html</a>
							<a href="https://www.abnamro.com/nl/newsroom/persberichten/2016/blockchain-experiment-commercieel-vastgoed-sector.html">https://www.abnamro.com/nl/newsroom/persberichten/2016/blockchain-experiment-commercieel-vastgoed-sector.html</a>
							<a href="https://www.abnamro.nl/nl/prive/service-en-contact/pinautomaat-of-kantoor-zoeken.html">https://www.abnamro.nl/nl/prive/service-en-contact/pinautomaat-of-kantoor-zoeken.html</a>
94	Resona Holdings Inc.	5	Japan	1450	16785	9.791	<a href="https://sitesearch.resona-gr.co.jp/RedirectURL.asp?url=https%3A%2F%2Fwww%2Eresona%2Dgr%2Eco%2Ejp%2Fholdings%2Fenglish%2Finvestors%2Fir%2Fpresentation%2Fpdf%2F201701%5Fen%2Epdf&amp;sid=144_145_97_139_1_20190430213050_8708936&amp;origin=34&amp;redirect=2&amp;title=Aiming+at+Becoming+No%2E1+Retail+Bank+%28PDF%3A2%2E30MB%29">https://sitesearch.resona-gr.co.jp/RedirectURL.asp?url=https%3A%2F%2Fwww%2Eresona%2Dgr%2Eco%2Ejp%2Fholdings%2Fenglish%2Finvestors%2Fir%2Fpresentation%2Fpdf%2F201701%5Fen%2Epdf&amp;sid=144_145_97_139_1_20190430213050_8708936&amp;origin=34&amp;redirect=2&amp;title=Aiming+at+Becoming+No%2E1+Retail+Bank+%28PDF%3A2%2E30MB%29</a>
							<a href="https://www.relbanks.com/asia/japan/resona-holdings">https://www.relbanks.com/asia/japan/resona-holdings</a>
95	Commerzbank	5	Germany	1057	48891	9.538	<a href="https://www.commerzbank.de/de/hauptnavigation/presse/pressemitteilungen/archiv1/2018/quartal_1_8_02/presse_archiv_detail_18_02_75402.html">https://www.commerzbank.de/de/hauptnavigation/presse/pressemitteilungen/archiv1/2018/quartal_1_8_02/presse_archiv_detail_18_02_75402.html</a>

							<a href="https://www.commerzbank.com/en/hauptnavigation/konzern/commerzbank_im_berblick/zahlen_fakten/fakten.html">https://www.commerzbank.com/en/hauptnavigation/konzern/commerzbank_im_berblick/zahlen_fakten/fakten.html</a>
96	Woori Bank	4	South Korea	1179	14939	7.885	<a href="https://iconow.net/korean-woori-bank-testing-ripples-blockchain-technology/">https://iconow.net/korean-woori-bank-testing-ripples-blockchain-technology/</a> <a href="https://www.relbanks.com/asia/south-korea/woori-bank">https://www.relbanks.com/asia/south-korea/woori-bank</a>
97	Norinchukin Bank	2	Japan	8000	3608	7.750	<a href="https://www.ledgerinsights.com/jp-morgan-blockchain-network-banks/">https://www.ledgerinsights.com/jp-morgan-blockchain-network-banks/</a> <a href="https://www.nochubank.or.jp/en/faq/">https://www.nochubank.or.jp/en/faq/</a> <a href="https://www.mizuho-fg.com/investors/ir/briefing/pdf/201709_2.pdf">https://www.mizuho-fg.com/investors/ir/briefing/pdf/201709_2.pdf</a> <a href="https://www.nasdaq.com/quotes/institutional-portfolio/norinchukin-bank-the-833945">https://www.nasdaq.com/quotes/institutional-portfolio/norinchukin-bank-the-833945</a>
98	Industrial Bank of Korea	5	South Korea	667	53457	6.713	<a href="http://eng.ibk.co.kr/upload/all/annualreport/2016_Annual_Report.pdf">http://eng.ibk.co.kr/upload/all/annualreport/2016_Annual_Report.pdf</a> <a href="https://www.coindesk.com/korean-banks-can-use-blockchain-to-verify-customer-ids-from-july">https://www.coindesk.com/korean-banks-can-use-blockchain-to-verify-customer-ids-from-july</a> <a href="https://www.fdic.gov/regulations/reform/resplans/plans/ibk-165-1812.pdf">https://www.fdic.gov/regulations/reform/resplans/plans/ibk-165-1812.pdf</a>
99	Credit Mutuel	4	France	4587	82177	3.168	<a href="https://www.coindesk.com/ibm-completes-blockchain-trial-french-bank-credit-mutuel">https://www.coindesk.com/ibm-completes-blockchain-trial-french-bank-credit-mutuel</a> <a href="https://www.creditmutuel.fr/fr/vitrine/medias/docs/groupe/communiqués-de-presse/2017-02-23-resultats-2016-cm-cic-en.pdf">https://www.creditmutuel.fr/fr/vitrine/medias/docs/groupe/communiqués-de-presse/2017-02-23-resultats-2016-cm-cic-en.pdf</a> <a href="https://www.creditmutuel.fr/partage/.../rapport-annuel-2017_en_global-final.pdf">https://www.creditmutuel.fr/partage/.../rapport-annuel-2017_en_global-final.pdf</a>
100	Nationwide Building Society	4	U.K.	683	18148	2.210	<a href="https://www.ledgerinsights.com/jp-morgan-blockchain-network-banks/">https://www.ledgerinsights.com/jp-morgan-blockchain-network-banks/</a> <a href="https://www.nationwide.co.U.K./branch#~">https://www.nationwide.co.U.K./branch#~</a>

*Note: See chapter methodology for explanation of search method. Websites can be found in different languages which are translated personally or through Google Translator. This list is comprised of the 70 largest banks by Market Cap found by link: <https://www.relbanks.com/worlds-top-banks/market-cap>. This source only contains 70 banks with highest market capitalization. Following thirty are comprised of 100 largest banks by asset holding worldwide from 2018 according to: <https://platform.mi.spglobal.com/web/client?auth=inherit#news/article?id=44027195&cid=A-44027195-11060>. Doubles are deleted. Only banks are used that have a market cap and all information could be found as used in table. Market Cap and Employee values have been gathered through Reuters.com and/or Finance.Yahoo.com and/or Bloomberg.com or are shown behind the company in the source list. Data has been gathered in April and May 2019. Index number are categorized as follows:*

*0 = no findable public mention from company on blockchain on company website, blogs or other official company sources.*

*1 = mention of blockchain on official website from company.*

*2 = mention of creating blockchain programs to implement on news websites.*

*3 = mention of creating blockchain programs to implement on company website*

*4 = mention of using blockchain on news websites.*

*5 = mention of using blockchain on company website*

*All data has been retrieved between April and June 2019.*

## Appendix F: Real Estate companies and their public statements on blockchain

Id:	Real estate company name:	Index:	Main location:	Number of branches	Number of employees	Market cap. (U.S. Billions)	Source:
1	American Tower Corporation	5	U.S.	26	5026	88.701	<a href="https://www.prnewswire.com/news-releases/american-tower-and-ruckus-networks-announce-first-commercial-cbrs-deployment-at-ism-raceway-300747791.html">https://www.prnewswire.com/news-releases/american-tower-and-ruckus-networks-announce-first-commercial-cbrs-deployment-at-ism-raceway-300747791.html</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=24766">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=24766</a>
							<a href="https://www.bloomberg.com/quote/AMT:US">https://www.bloomberg.com/quote/AMT:US</a>
							<a href="https://www.americantower.com/company/our-global-presence/office-locations.html">https://www.americantower.com/company/our-global-presence/office-locations.html</a>
2	Simon Property Group	4	U.S.	3	5000	53.048	<a href="https://www.forbes.com/sites/erikamorph/2015/02/11/bitcoin-comes-to-the-mall/#682dd5a718f1">https://www.forbes.com/sites/erikamorph/2015/02/11/bitcoin-comes-to-the-mall/#682dd5a718f1</a>
							<a href="https://www.bloomberg.com/quote/SPG:US">https://www.bloomberg.com/quote/SPG:US</a>
							<a href="https://www.bloomberg.com/profile/company/SPG:US">https://www.bloomberg.com/profile/company/SPG:US</a>
							<a href="https://www.simon.com/contact">https://www.simon.com/contact</a>
3	Crown Castle International Corporation	0	U.S.	100	5000	52.645	<a href="https://www.bloomberg.com/quote/CCI:US">https://www.bloomberg.com/quote/CCI:US</a>
							<a href="https://www.crowncastle.com/about-us">https://www.crowncastle.com/about-us</a>
4	Blackstone Real Estate	1	U.S.	23	2500	51.232	<a href="https://www.blackstone.com/media/press-releases/article/another-good-year-ahead">https://www.blackstone.com/media/press-releases/article/another-good-year-ahead</a>
							<a href="https://www.bloomberg.com/quote/BX:US">https://www.bloomberg.com/quote/BX:US</a>
							<a href="https://www.blackstone.com/the-firm/overview">https://www.blackstone.com/the-firm/overview</a>
5	Prologis	1	U.S.	72	1617	48.280	<a href="https://www.prologis.fr/en/logistics-industry-feature/talking-about-change-whats-new">https://www.prologis.fr/en/logistics-industry-feature/talking-about-change-whats-new</a>
							<a href="https://www.bloomberg.com/quote/PLD:US">https://www.bloomberg.com/quote/PLD:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=330123">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=330123</a>
							<a href="https://www.prologis.com/contact-us/offices">https://www.prologis.com/contact-us/offices</a>
6	Vanke	0	China	68	104300	43.169	<a href="https://www.bloomberg.com/quote/2202:HK">https://www.bloomberg.com/quote/2202:HK</a>
							<a href="https://www.forbes.com/companies/china-vanke/#480a718151db">https://www.forbes.com/companies/china-vanke/#480a718151db</a>
							<a href="https://www.vanke.com/en/contact.aspx">https://www.vanke.com/en/contact.aspx</a>
7	Equinix	5	U.S.	42	7903	41.530	<a href="https://blog.equinix.com/blog/tag/blockchain/">https://blog.equinix.com/blog/tag/blockchain/</a>
							<a href="https://blog.equinix.com/blog/2018/05/16/accelerating-blockchain-technology-adoption/">https://blog.equinix.com/blog/2018/05/16/accelerating-blockchain-technology-adoption/</a>
							<a href="https://www.bloomberg.com/quote/EQIX:US">https://www.bloomberg.com/quote/EQIX:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=28202">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=28202</a>

8	PGIM Investments	4	U.S.	37	1250	39.715	<a href="http://www.pgimjp.com/outlook/pdf/2018/The_Technology_Frontier_E.pdf">http://www.pgimjp.com/outlook/pdf/2018/The_Technology_Frontier_E.pdf</a>
							<a href="https://www.pgim.com/about-pgim">https://www.pgim.com/about-pgim</a>
							<a href="https://www.coindesk.com/prudential-starhub-to-launch-blockchain-trade-platform-in-singapore">https://www.coindesk.com/prudential-starhub-to-launch-blockchain-trade-platform-in-singapore</a>
							<a href="https://finance.yahoo.com/quote/pru/">https://finance.yahoo.com/quote/pru/</a>
							<a href="https://medium.com/altcoin-magazine/new-pgim-report-1-2-trillion-giant-bet-on-blockchain-6a87860e085a">https://medium.com/altcoin-magazine/new-pgim-report-1-2-trillion-giant-bet-on-blockchain-6a87860e085a</a>
							<a href="https://www.prudential.com/institutions/investment-management">https://www.prudential.com/institutions/investment-management</a>
9	Sands China LTD	0	China	170	28304	39.011	<a href="https://www.bloomberg.com/quote/1928:HK">https://www.bloomberg.com/quote/1928:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=79094759">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=79094759</a>
							<a href="https://www.marketscreener.com/SANDS-CHINA-LTD-5774271/company/">https://www.marketscreener.com/SANDS-CHINA-LTD-5774271/company/</a>
10	Evergrande	0	China	160	140000	34.864	<a href="https://www.bloomberg.com/quote/3333:HK">https://www.bloomberg.com/quote/3333:HK</a>
							<a href="https://www.forbes.com/companies/china-evergrande-group/#41003a2e5668">https://www.forbes.com/companies/china-evergrande-group/#41003a2e5668</a>
11	Welltower	0	U.S.	4	384	32.484	<a href="https://www.bloomberg.com/quote/WELL:US">https://www.bloomberg.com/quote/WELL:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=277914">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=277914</a>
							<a href="https://craft.co/welltower">https://craft.co/welltower</a>
12	China Resources Land	0	China	50	46518	30.212	<a href="https://www.bloomberg.com/quote/CRBJY:US">https://www.bloomberg.com/quote/CRBJY:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=882571">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=882571</a>
							<a href="https://crland-umb.azurewebsites.net/en/investors/company-profile/">https://crland-umb.azurewebsites.net/en/investors/company-profile/</a>
							<a href="http://www.crland.com.hk/1jwm/hrzd/fazlc/">http://www.crland.com.hk/1jwm/hrzd/fazlc/</a>
13	Country Garden	0	China	5	131387	29.190	<a href="https://www.bloomberg.com/quote/2007:HK">https://www.bloomberg.com/quote/2007:HK</a>
							<a href="http://www.countrygarden.com.au/contact-us">http://www.countrygarden.com.au/contact-us</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29328657">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29328657</a>
							<a href="https://en.bgy.com.cn/about.aspx?type=5">https://en.bgy.com.cn/about.aspx?type=5</a>
14	Equity Residential	0	U.S.	8	2700	28.398	<a href="https://www.bloomberg.com/quote/EQR:US">https://www.bloomberg.com/quote/EQR:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=28209">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=28209</a>
							<a href="https://craft.co/equity-residential/locations">https://craft.co/equity-residential/locations</a>
15	AvalonBay Communities	0	U.S.	96	3087	28.342	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=329141">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=329141</a>
							<a href="https://www.bloomberg.com/quote/AVB:US">https://www.bloomberg.com/quote/AVB:US</a>

							<a href="https://craft.co/avalonbay-communities/locations?page=3">https://craft.co/avalonbay-communities/locations?page=3</a>
16	Vonovia SE NA	0	Germany	45	9925	28.252	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=5537158">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=5537158</a>
							<a href="https://www.bloomberg.com/quote/VNNVF:US">https://www.bloomberg.com/quote/VNNVF:US</a>
							<a href="https://www.vonovia.de/ihre-services/kontakt">https://www.vonovia.de/ihre-services/kontakt</a>
17	CK Asset	0	China	4	18900	27.942	<a href="https://www.bloomberg.com/quote/1113:HK">https://www.bloomberg.com/quote/1113:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=281571109">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=281571109</a>
							<a href="https://www.ckah.com/eng/contact.html">https://www.ckah.com/eng/contact.html</a>
18	Henderson Land	0	China	5	8954	27.596	<a href="https://www.bloomberg.com/profile/company/12:HK">https://www.bloomberg.com/profile/company/12:HK</a>
							<a href="https://www.bloomberg.com/quote/HLDCY:US">https://www.bloomberg.com/quote/HLDCY:US</a>
							<a href="https://www.google.com/search?tbm=lcl&amp;ei=wXL3XPbSHIXOwALk7aqoAw&amp;q=henderson+land+development+china&amp;oq=henderson+land+development+china&amp;gs_l=psy-ab..33i22i29i30k1l2.1405.2509.0.2667.11.9.1.0.0.0.129.542.4j2.6.0....0...1c.1.64.psy-ab..4.5.411...0i19k1j0i22i30i19k1j33i160k1.0.LkG4V5W98pw#rlfi=hd.:si.:mv:!1m2!1d43.88641854568416!2d145.31924819671872!2m2!1d12.152661322990438!2d79.40127944671872!4m2!1d29.234170496202598!2d112.36026382171872!5i5">https://www.google.com/search?tbm=lcl&amp;ei=wXL3XPbSHIXOwALk7aqoAw&amp;q=henderson+land+development+china&amp;oq=henderson+land+development+china&amp;gs_l=psy-ab..33i22i29i30k1l2.1405.2509.0.2667.11.9.1.0.0.0.129.542.4j2.6.0....0...1c.1.64.psy-ab..4.5.411...0i19k1j0i22i30i19k1j33i160k1.0.LkG4V5W98pw#rlfi=hd.:si.:mv:!1m2!1d43.88641854568416!2d145.31924819671872!2m2!1d12.152661322990438!2d79.40127944671872!4m2!1d29.234170496202598!2d112.36026382171872!5i5</a>
19	Mitsubishi Estate Company, Limited	2	Japan	39	8856	26.453	<a href="https://www.newsweek.com/tokyo-2020-olympics-blockchain-could-make-games-tourists-dream-928721">https://www.newsweek.com/tokyo-2020-olympics-blockchain-could-make-games-tourists-dream-928721</a>
							<a href="http://www.mec.co.jp/e/about/index.html">http://www.mec.co.jp/e/about/index.html</a>
							<a href="https://www.bloomberg.com/quote/8802:JP">https://www.bloomberg.com/quote/8802:JP</a>
							<a href="https://finance.yahoo.com/quote/mitey/">https://finance.yahoo.com/quote/mitey/</a>
							<a href="https://www.forbes.com/companies/mitsubishi-estate/">https://www.forbes.com/companies/mitsubishi-estate/</a>
20	Digital Realty Trust	1	U.S.	5	1530	25.771	<a href="https://www.digitalrealty.nl/blog/blockchain-who-what-where-why-and-how">https://www.digitalrealty.nl/blog/blockchain-who-what-where-why-and-how</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=11041860">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=11041860</a>
							<a href="https://www.bloomberg.com/quote/DLR:US">https://www.bloomberg.com/quote/DLR:US</a>
							<a href="https://www.digitalrealty.nl/contact">https://www.digitalrealty.nl/contact</a>
21	Merchant Shekou	0	China	3202	8856	24.706	<a href="https://www.bloomberg.com/quote/8802:JP">https://www.bloomberg.com/quote/8802:JP</a>
							<a href="https://eng.yidaiyilu.gov.cn/info/iList.jsp?tm_id=139&amp;cat_id=10080&amp;info_id=2070">https://eng.yidaiyilu.gov.cn/info/iList.jsp?tm_id=139&amp;cat_id=10080&amp;info_id=2070</a>
							<a href="https://www.bloomberg.com/profile/company/MITEY:US">https://www.bloomberg.com/profile/company/MITEY:US</a>
							<a href="https://www.reuters.com/finance/stocks/overview/001979.SZ">https://www.reuters.com/finance/stocks/overview/001979.SZ</a>

22	Swire Properties	0	China	9	5000	24.185	<a href="https://www.bloomberg.com/quote/1972:HK">https://www.bloomberg.com/quote/1972:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=23110294">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=23110294</a>
							<a href="https://www.swireproperties.com/en/contact-us.aspx">https://www.swireproperties.com/en/contact-us.aspx</a>
23	SBA Communications Corporation	0	U.S.	40	1347	23.360	<a href="https://www.bloomberg.com/quote/SBAC:US">https://www.bloomberg.com/quote/SBAC:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=34071">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=34071</a>
							<a href="https://craft.co/sba-communications-c">https://craft.co/sba-communications-c</a>
24	Ventas	0	U.S.	3	500	23.270	<a href="https://www.bloomberg.com/quote/VTR:US">https://www.bloomberg.com/quote/VTR:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=398549">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=398549</a>
							<a href="https://www.ventasreit.com/contact-us">https://www.ventasreit.com/contact-us</a>
25	Boston Properties	0	U.S.	6	760	22.699	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=368278">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=368278</a>
							<a href="http://www.bostonproperties.com/pages/contact/office-locations">http://www.bostonproperties.com/pages/contact/office-locations</a>
							<a href="https://finance.yahoo.com/quote/BXP/">https://finance.yahoo.com/quote/BXP/</a>
26	Longfor Group	0	China	48	27101	22.173	<a href="http://www.longfor.com/en/">http://www.longfor.com/en/</a>
							<a href="https://finance.yahoo.com/quote/0960.HK/?guccounter=1">https://finance.yahoo.com/quote/0960.HK/?guccounter=1</a>
27	Realty Income	0	U.S.	1	165	22.064	<a href="https://www.bloomberg.com/quote/O:US">https://www.bloomberg.com/quote/O:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=339305">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=339305</a>
28	Wharf REIC	0	China	6	2900	21.488	<a href="https://www.bloomberg.com/quote/1997:HK">https://www.bloomberg.com/quote/1997:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=533844287">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=533844287</a>
							<a href="https://www.wharfreic.com/en/contact-us">https://www.wharfreic.com/en/contact-us</a>
							<a href="https://www.wharfreic.com/en/about/structure">https://www.wharfreic.com/en/about/structure</a>
29	Unibail Rodamco	0	France	13	3606	20.981	<a href="https://www.bloomberg.com/quote/URW:NA">https://www.bloomberg.com/quote/URW:NA</a>
							<a href="https://www.bloomberg.com/profile/company/UL:NA">https://www.bloomberg.com/profile/company/UL:NA</a>
							<a href="https://www.urw.com/en/locations">https://www.urw.com/en/locations</a>
30	Daiwa House Industry Co.	4	Japan	82	42460	20.211	<a href="https://news.bitcoin.com/japan-falling-behind-blockchain-shortage/">https://news.bitcoin.com/japan-falling-behind-blockchain-shortage/</a>
							<a href="https://www.bloomberg.com/quote/1925:JP">https://www.bloomberg.com/quote/1925:JP</a>
							<a href="https://www.forbes.com/companies/daiwa-house-industry/#1eaf88dc1fd2">https://www.forbes.com/companies/daiwa-house-industry/#1eaf88dc1fd2</a>
							<a href="https://www.daiwahouse.co.jp/English/data/index.html">https://www.daiwahouse.co.jp/English/data/index.html</a>

31	Essex Property Trust	0	U.S.	1	1826	19.584	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=332646">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=332646</a>
							<a href="https://finance.yahoo.com/quote/ESS/">https://finance.yahoo.com/quote/ESS/</a>
							<a href="https://www.essexapartmenthomes.com/contact">https://www.essexapartmenthomes.com/contact</a>
32	Brookfield Properties	0	U.S.	161	19000	19.360	<a href="https://www.brookfieldpropertiesretail.com/about-us.html">https://www.brookfieldpropertiesretail.com/about-us.html</a>
							<a href="https://www.bloomberg.com/quote/BPY:US">https://www.bloomberg.com/quote/BPY:US</a>
							<a href="https://bpy.brookfield.com/~media/Files/B/Brookfield-BPY-IR-V2/Annual%20Reports/BPY-2018-20F-with-Cover.pdf">https://bpy.brookfield.com/~media/Files/B/Brookfield-BPY-IR-V2/Annual%20Reports/BPY-2018-20F-with-Cover.pdf</a>
33	CoStar	4	U.S.	36	3705	19.292	<a href="https://therealdeal.com/2018/03/30/knotel-takes-on-costar-with-blockchain-based-leasing-data-platform/">https://therealdeal.com/2018/03/30/knotel-takes-on-costar-with-blockchain-based-leasing-data-platform/</a>
							<a href="https://www.bloomberg.com/quote/CSGP:US">https://www.bloomberg.com/quote/CSGP:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=387127">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=387127</a>
							<a href="http://origin-www-vi.costar.com/contactus/offices.aspx">http://origin-www-vi.costar.com/contactus/offices.aspx</a>
34	Poly Real Estate Group	0	China	600	60000	19.048	<a href="https://www.bloomberg.com/quote/600048:CH">https://www.bloomberg.com/quote/600048:CH</a>
							<a href="http://www.poly.com.cn/english/1659.html">http://www.poly.com.cn/english/1659.html</a>
35	Sunac	0	China	8	38040	18.244	<a href="https://www.bloomberg.com/quote/1918:HK">https://www.bloomberg.com/quote/1918:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29545876">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29545876</a>
							<a href="http://www.sunac.com.cn/en/contact.aspx">http://www.sunac.com.cn/en/contact.aspx</a>
36	Sumitomo Realty Corporation	0	Japan	132	12934	18.036	<a href="https://www.bloomberg.com/quote/8830:JP">https://www.bloomberg.com/quote/8830:JP</a>
							<a href="https://www.sumitomocorp.com/en/us/about">https://www.sumitomocorp.com/en/us/about</a>
							<a href="https://www.bloomberg.com/profile/company/8830:JP">https://www.bloomberg.com/profile/company/8830:JP</a>
							<a href="http://www.sumitomo-rd.co.jp/english/corporate/outline.html">http://www.sumitomo-rd.co.jp/english/corporate/outline.html</a>
37	Goodman	1	U.S.	34	1100	17.310	<a href="https://be.goodman.com/blog/blog/blockchain">https://be.goodman.com/blog/blog/blockchain</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=876923">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=876923</a>
							<a href="https://www.goodman.com/who-we-are/contact-us/office-locations-sweden">https://www.goodman.com/who-we-are/contact-us/office-locations-sweden</a>
							<a href="https://www.bloomberg.com/quote/GMG:AU">https://www.bloomberg.com/quote/GMG:AU</a>
38	Alexandria Real Estate Equities	0	U.S.	7	386	16.439	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=365138">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=365138</a>
							<a href="https://www.bloomberg.com/quote/ARE:US">https://www.bloomberg.com/quote/ARE:US</a>
							<a href="http://www.are.com/contact-us.html">http://www.are.com/contact-us.html</a>

39	Lennar Corporation	0	U.S.	810	11626	16.339	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=30763">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=30763</a>
							<a href="https://www.bloomberg.com/quote/LEN:US">https://www.bloomberg.com/quote/LEN:US</a>
							<a href="http://www.hoovers.com/company-information/cs/company-profile.lennar_corporation.497729fe3e15c748.html">http://www.hoovers.com/company-information/cs/company-profile.lennar_corporation.497729fe3e15c748.html</a>
							-
40	New World Dev	5	China	1	45000	15.999	<a href="https://www.nwd.com.hk/content/new-world-collaborates-astri-create-hong-kong%E2%80%99s-first-property-purchase-blockchain-platfor-0">https://www.nwd.com.hk/content/new-world-collaborates-astri-create-hong-kong%E2%80%99s-first-property-purchase-blockchain-platfor-0</a>
							<a href="https://www.bloomberg.com/quote/NDVLY:US">https://www.bloomberg.com/quote/NDVLY:US</a>
							<a href="https://www.bloomberg.com/profile/company/17:HK">https://www.bloomberg.com/profile/company/17:HK</a>
							<a href="https://craft.co/new-world-development">https://craft.co/new-world-development</a>
							<a href="https://finance.yahoo.com/quote/NDVLY/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xILmNvbS8&amp;guce_referrer_sig=AQAAAEhvyyvVhPIXz9jN2f2C27kJM2OacDfV8dnemadtvcCNP6ietuIFVwvOnIebRC9jkCNlkvX2xgGKKyBGMm0zsudEWo4xt94DFyR1OCHK71BworKV0S7hg_2UmHIZm7VQxo4woetS2m4AQ0UpddhTeOEUxSZO1SNIZK-Y0PBb9">https://finance.yahoo.com/quote/NDVLY/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xILmNvbS8&amp;guce_referrer_sig=AQAAAEhvyyvVhPIXz9jN2f2C27kJM2OacDfV8dnemadtvcCNP6ietuIFVwvOnIebRC9jkCNlkvX2xgGKKyBGMm0zsudEWo4xt94DFyR1OCHK71BworKV0S7hg_2UmHIZm7VQxo4woetS2m4AQ0UpddhTeOEUxSZO1SNIZK-Y0PBb9</a>
41	CBRE	1	U.S.	450	90000	15.903	<a href="https://tech.cbre.com/megatrends/blockchain/">https://tech.cbre.com/megatrends/blockchain/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4204816">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4204816</a>
							<a href="https://www.cbre.com/about/2016-annual-report/global-presence">https://www.cbre.com/about/2016-annual-report/global-presence</a>
42	HCP	0	U.S.	1	201	14.975	<a href="https://www.bloomberg.com/profile/company/HCP:US">https://www.bloomberg.com/profile/company/HCP:US</a>
							<a href="https://www.bloomberg.com/quote/HCP:US">https://www.bloomberg.com/quote/HCP:US</a>
							<a href="http://ir.hepi.com/contact-faqs">http://ir.hepi.com/contact-faqs</a>
43	Host Hotels & Resorts	0	U.S.	4	205	14.166	<a href="https://www.bloomberg.com/quote/HST:US">https://www.bloomberg.com/quote/HST:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29574">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=29574</a>
							<a href="https://www.hosthotels.com/our-company/contact-us">https://www.hosthotels.com/our-company/contact-us</a>
44	Wheelock and Company Limited	0	China	1	12800	14.028	<a href="https://www.bloomberg.com/quote/20:HK">https://www.bloomberg.com/quote/20:HK</a>
							<a href="http://www.wheelock-company.com/investors/2014/WAC_AR_2014_E.pdf">www.wheelock-company.com/investors/2014/WAC_AR_2014_E.pdf</a>
							<a href="http://www.wheelock-company.com/investors/2014/WAC_AR_2014_E.pdf">http://www.wheelock-company.com/investors/2014/WAC_AR_2014_E.pdf</a>
45	W.P. Carey INC	0	U.S.	4	206	14.017	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=24043">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=24043</a>
							<a href="https://www.bloomberg.com/quote/WPC:US">https://www.bloomberg.com/quote/WPC:US</a>
							<a href="http://www.wpcarey.com/Contact-Us">http://www.wpcarey.com/Contact-Us</a>

46	Annaly Capital Management	0	U.S.	1	170	13.543	<a href="https://www.bloomberg.com/quote/NLY:US">https://www.bloomberg.com/quote/NLY:US</a>
							<a href="https://www.forbes.com/companies/annaly-capital-management/#3950b8a030f3">https://www.forbes.com/companies/annaly-capital-management/#3950b8a030f3</a>
							<a href="https://www.annaly.com/contact-us/investor-contact">https://www.annaly.com/contact-us/investor-contact</a>
47	Invitation Homes INC	0	U.S.	21	1231	13.351	<a href="https://www.bloomberg.com/quote/INVH:US">https://www.bloomberg.com/quote/INVH:US</a>
							<a href="https://www.bloomberg.com/profile/company/INVH:US">https://www.bloomberg.com/profile/company/INVH:US</a>
							<a href="https://lease.invitationhomes.com/offices">https://lease.invitationhomes.com/offices</a>
48	Mid-America Apartment Communities INC	0	U.S.	34	2508	13.047	<a href="https://www.bloomberg.com/quote/MAA:US">https://www.bloomberg.com/quote/MAA:US</a>
							<a href="https://www.maac.com/about-us/">https://www.maac.com/about-us/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=332358">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=332358</a>
49	Vornado Realty Trust	0	U.S.	4	3928	12.813	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=312648">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=312648</a>
							<a href="https://www.bloomberg.com/quote/VNO:US">https://www.bloomberg.com/quote/VNO:US</a>
							<a href="https://www.vno.com/contact-us/general-contact">https://www.vno.com/contact-us/general-contact</a>
50	UDR Inc	0	U.S.	5	1405	12.653	<a href="https://www.bloomberg.com/quote/UDR:US">https://www.bloomberg.com/quote/UDR:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=310667">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=310667</a>
							<a href="https://www.udr.com/office-locations/">https://www.udr.com/office-locations/</a>
51	China Fortune Land Development	0	China	15	26779	12.631	<a href="https://www.bloomberg.com/quote/600340:CH">https://www.bloomberg.com/quote/600340:CH</a>
							<a href="https://www.forbes.com/companies/china-fortune-land-development/">https://www.forbes.com/companies/china-fortune-land-development/</a>
							<a href="https://www.forbes.com/companies/china-fortune-land-development/">https://www.forbes.com/companies/china-fortune-land-development/</a>
52	Greenland Holdings	0	China	15	39091	11.720	<a href="http://www.greenlandsc.com/En/World Asia.aspx">http://www.greenlandsc.com/En/World Asia.aspx</a>
							<a href="http://www.greenlandsc.com/Default.aspx">http://www.greenlandsc.com/Default.aspx</a>
							<a href="https://www.bloomberg.com/quote/600606:CH">https://www.bloomberg.com/quote/600606:CH</a>
							<a href="https://www.bloomberg.com/profile/company/600606:CH">https://www.bloomberg.com/profile/company/600606:CH</a>
53	Hong Kong Land Holdings LD	0	China	15	2090	11.511	<a href="https://www.bloomberg.com/quote/HKL:SP">https://www.bloomberg.com/quote/HKL:SP</a>
							<a href="https://www.bloomberg.com/profile/company/HKLB:LN">https://www.bloomberg.com/profile/company/HKLB:LN</a>

							<a href="https://www.hkland.com/en/about/contact-us.html">https://www.hkland.com/en/about/contact-us.html</a>
54	Equity Lifestyle Properties	0	U.S.	5	4100	11.482	<a href="https://www.equitylifestyleproperties.com/our-company/our-offices">https://www.equitylifestyleproperties.com/our-company/our-offices</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=31097">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=31097</a>
							<a href="https://finance.yahoo.com/quote/ELS/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&amp;guce_referrer_sig=AQAAAEumSmbtfkEbOJWjam6jE2zE4pT33Q5TfI5qOd-NO4vL9-EJl2cJdTnF9hm-SYN2fSdRypfkGwcOEc-D8KWXaaE73lAtL-Dskl4Xt7PIBjEj_ML9w4V2N0VzANSv3tViVHVjbMhkI9hwn9BzywtZ8VaRmyZPaQ7IwtZ4aKDEHo7">https://finance.yahoo.com/quote/ELS/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&amp;guce_referrer_sig=AQAAAEumSmbtfkEbOJWjam6jE2zE4pT33Q5TfI5qOd-NO4vL9-EJl2cJdTnF9hm-SYN2fSdRypfkGwcOEc-D8KWXaaE73lAtL-Dskl4Xt7PIBjEj_ML9w4V2N0VzANSv3tViVHVjbMhkI9hwn9BzywtZ8VaRmyZPaQ7IwtZ4aKDEHo7</a>
55	Sino Land	1	China	6	7050	11.378	<a href="https://www.sino.com/en-US/Media-Center/Press-Release/Corporate-Information/2018/%E6%8F%90%E4%BE%9B%E5%B9%B3%E5%8F%B0%E8%88%87%E7%A7%91%E6%8A%80%E4%BC%81%E6%A5%AD%E5%90%88%E4%BD%9C%E3%80%80%E4%BF%83%E9%80%B2%E5%95%86%E6%A5%AD%E6%87%89%E7%94%A8%E5%8F%8A%E6%8E%A8%E5%8B%95%E7%A7%91%E7%A0%94%E7%99%BC%E5%B1%95.aspx">https://www.sino.com/en-US/Media-Center/Press-Release/Corporate-Information/2018/%E6%8F%90%E4%BE%9B%E5%B9%B3%E5%8F%B0%E8%88%87%E7%A7%91%E6%8A%80%E4%BC%81%E6%A5%AD%E5%90%88%E4%BD%9C%E3%80%80%E4%BF%83%E9%80%B2%E5%95%86%E6%A5%AD%E6%87%89%E7%94%A8%E5%8F%8A%E6%8E%A8%E5%8B%95%E7%A7%91%E7%A0%94%E7%99%BC%E5%B1%95.aspx</a>
							<a href="https://www.bloomberg.com/quote/83:HK">https://www.bloomberg.com/quote/83:HK</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=875493">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=875493</a>
							<a href="https://sino.com/en-US/Special-Pages/Contact-Us">https://sino.com/en-US/Special-Pages/Contact-Us</a>
56	Gecina Nom	5	France	1	510	11.110	<a href="https://press.gecina.fr/blockchain/">https://press.gecina.fr/blockchain/</a>
							<a href="https://www.bloomberg.com/quote/GFC:FP">https://www.bloomberg.com/quote/GFC:FP</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=878991">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=878991</a>
							-
57	Duke Realty Corporation	0	U.S.	14	400	10.998	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=267906">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=267906</a>
							<a href="https://craft.co/duke-realty">https://craft.co/duke-realty</a>
							<a href="https://www.bloomberg.com/quote/DRE:US">https://www.bloomberg.com/quote/DRE:US</a>
							<a href="https://www.dukerealty.com/markets/">https://www.dukerealty.com/markets/</a>
58	Sun Communities Inc	0	U.S.	6	2784	10.220	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=331908">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=331908</a>
							<a href="http://www.annualreports.com/Click/22020">www.annualreports.com/Click/22020</a>
59	Kleppiere SA	0	France	57	1103	10.220	<a href="https://www.bloomberg.com/quote/LI:FP">https://www.bloomberg.com/quote/LI:FP</a>
							<a href="https://www.kleppiere.com/en/portfolio/">https://www.kleppiere.com/en/portfolio/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=879146">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=879146</a>

60	Camden Property Trust	0	U.S.	46	1600	10.099	<a href="https://craft.co/camden-property-trust">https://craft.co/camden-property-trust</a>
							<a href="https://finance.yahoo.com/quote/CPT/">https://finance.yahoo.com/quote/CPT/</a>
							<a href="https://www.google.com/search?q=Camden+Property+Trust+bloomberg&amp;aq=chrome..69i57.1188j0j4&amp;sourceid=chrome&amp;ie=UTF-8">https://www.google.com/search?q=Camden+Property+Trust+bloomberg&amp;aq=chrome..69i57.1188j0j4&amp;sourceid=chrome&amp;ie=UTF-8</a>
61	Federal Realty Investment Trust	0	U.S.	5	298	9.810	<a href="http://www.federalrealty.com/contact/">http://www.federalrealty.com/contact/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=271305">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=271305</a>
							<a href="https://finance.yahoo.com/quote/FRT/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&amp;guce_referrer_sig=AQAAABkJFsXKTwnoDhFdLqC6KXrJQBZ8xOulVBwSuE1fOMQAOGjQXh6NqNQ2ZRt79jJ8uu10-bU6TXJP9KieHeoDHAVpRui_0ePc0JouGQeaq6wB8dNtYxnh3E6DwQFMe0w0p9EB4XE4cCXPRkmXXDZFuAnwBwh3wDeM7IRLY1lxwmYM">https://finance.yahoo.com/quote/FRT/?guccounter=1&amp;guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&amp;guce_referrer_sig=AQAAABkJFsXKTwnoDhFdLqC6KXrJQBZ8xOulVBwSuE1fOMQAOGjQXh6NqNQ2ZRt79jJ8uu10-bU6TXJP9KieHeoDHAVpRui_0ePc0JouGQeaq6wB8dNtYxnh3E6DwQFMe0w0p9EB4XE4cCXPRkmXXDZFuAnwBwh3wDeM7IRLY1lxwmYM</a>
62	Capitaland Limited	2	Singapore	8	8498	9.803	<a href="http://investor.capitaland.com/newsroom/20171207_183149_C31_THUHG7N9UOYHJXCB.1.pdf">http://investor.capitaland.com/newsroom/20171207_183149_C31_THUHG7N9UOYHJXCB.1.pdf</a>
							<a href="https://www.capitaland.com/international/en/search.html?str=blockchain">https://www.capitaland.com/international/en/search.html?str=blockchain</a>
							<a href="https://www.bloomberg.com/quote/CAPL:SP">https://www.bloomberg.com/quote/CAPL:SP</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=2445778">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=2445778</a>
							<a href="https://www.capitaland.com/international/en/contact-us/ask-a-question.html">https://www.capitaland.com/international/en/contact-us/ask-a-question.html</a>
63	AGNC Investment Corp	0	U.S.	1	56	9.700	<a href="https://www.forbes.com/companies/agnc-investment/">https://www.forbes.com/companies/agnc-investment/</a>
							-
64	Segro PLC	0	U.K.	15	300	9.680	<a href="http://www.segro.com/csr/people/overview?sc_lang=en">http://www.segro.com/csr/people/overview?sc_lang=en</a>
							<a href="https://www.bloomberg.com/quote/SGRO:LN">https://www.bloomberg.com/quote/SGRO:LN</a>
							<a href="http://www.segro.com/site-services/contacts/our-offices?sc_lang=en">http://www.segro.com/site-services/contacts/our-offices?sc_lang=en</a>
65	Aroundtown SA	0	Cyprus	2	374	9.357	<a href="https://www.aroundtown.de/contact/">https://www.aroundtown.de/contact/</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=58830719">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=58830719</a>
							<a href="https://www.bloomberg.com/quote/ATI:GR">https://www.bloomberg.com/quote/ATI:GR</a>
66	Vici Properties Inc.	0	U.S.	1	140	8.980	<a href="https://craft.co/vici-properties">https://craft.co/vici-properties</a>
							<a href="https://viciproperties.com/about-us-vici-properties/">https://viciproperties.com/about-us-vici-properties/</a>
							<a href="https://finance.yahoo.com/quote/VICI/">https://finance.yahoo.com/quote/VICI/</a>

67	National Retail Properties	0	U.S.	1	68	8.656	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=275573">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=275573</a>
							<a href="https://finance.yahoo.com/quote/nnn?ltr=1">https://finance.yahoo.com/quote/nnn?ltr=1</a>
68	Taisei Corporation	0	Japan	28	8490	8.536	<a href="https://www.taisei.co.jp/english/profile/corp_data.html">https://www.taisei.co.jp/english/profile/corp_data.html</a>
							<a href="https://www.bloomberg.com/quote/1801:JP">https://www.bloomberg.com/quote/1801:JP</a>
69	Vereit Inc.	0	U.S.	3	180	8.525	<a href="https://www.vereit.com/contact">https://www.vereit.com/contact</a>
							<a href="https://www.vereit.com/about-us">https://www.vereit.com/about-us</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=127095032">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=127095032</a>
70	Omega Healthcare Investors	0	U.S.	1	51	7.896	<a href="http://www.omegahealthcare.com/portfolio/map-of-our-locations">http://www.omegahealthcare.com/portfolio/map-of-our-locations</a>
							<a href="https://finance.yahoo.com/quote/OHI/">https://finance.yahoo.com/quote/OHI/</a>
71	Leg Immobilien AG	0	Germany	8	1380	7.784	<a href="https://www.bloomberg.com/quote/LEG:GR">https://www.bloomberg.com/quote/LEG:GR</a>
							<a href="https://www.forbes.com/companies/leg-immobilien-ag/#1e23f6ef5251">https://www.forbes.com/companies/leg-immobilien-ag/#1e23f6ef5251</a>
							<a href="https://craft.co/leg-immobilien">https://craft.co/leg-immobilien</a>
							<a href="https://www.leg-wohnen.de/en/corporation/press/press-releases/archive-details/news/leg-immobilien-ag-lars-von-lackum-to-take-over-as-ceo-earnings-growth-as-planned/?no_cache=1&amp;tx_news_pi1%5Bcontroller%5D=News&amp;tx_news_pi1%5Baction%5D=detail&amp;cHash=a5f0f1af1">https://www.leg-wohnen.de/en/corporation/press/press-releases/archive-details/news/leg-immobilien-ag-lars-von-lackum-to-take-over-as-ceo-earnings-growth-as-planned/?no_cache=1&amp;tx_news_pi1%5Bcontroller%5D=News&amp;tx_news_pi1%5Baction%5D=detail&amp;cHash=a5f0f1af1</a>
72	SL Green Realty	0	U.S.	1	1058	7.687	<a href="https://slgreen.com/contact">https://slgreen.com/contact</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=364744">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=364744</a>
							<a href="https://finance.yahoo.com/quote/slg/news?ltr=1">https://finance.yahoo.com/quote/slg/news?ltr=1</a>
73	Store Capital Group	0	U.S.	1	92	7.665	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=129158437">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=129158437</a>
							<a href="https://www.storecapital.com/who-we-are/">https://www.storecapital.com/who-we-are/</a>
							<a href="https://finance.yahoo.com/quote/STOR/">https://finance.yahoo.com/quote/STOR/</a>
74	Kilroy Realty Corporation	0	U.S.	4	276	7.557	<a href="https://www.kilroyrealty.com/company-contact-us">https://www.kilroyrealty.com/company-contact-us</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=355505">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=355505</a>
							<a href="https://finance.yahoo.com/quote/KRC?ltr=1">https://finance.yahoo.com/quote/KRC?ltr=1</a>

75	Kimco Realty Corporation	1	U.S.	28	533	7.453	<a href="https://www.kimcorealty.com/blog/post/bitcoin-blockchain-and-cryptocurrencies-oh-my/2141/view">https://www.kimcorealty.com/blog/post/bitcoin-blockchain-and-cryptocurrencies-oh-my/2141/view</a>
							<a href="https://www.kimcorealty.com/contact">https://www.kimcorealty.com/contact</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=320371">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=320371</a>
							<a href="https://finance.yahoo.com/quote/KIM/">https://finance.yahoo.com/quote/KIM/</a>
76	CPI Property GRP	0	Luxembourg	5	3891	7.230	<a href="https://www.bloomberg.com/quote/O5G:GR">https://www.bloomberg.com/quote/O5G:GR</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=36769828">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=36769828</a>
							<a href="https://www.cpipg.com/contacts-en">https://www.cpipg.com/contacts-en</a>
77	Swiss Prime Site AG	5	Switzerland	3	5115	6.540	<a href="https://www.bloomberg.com/quote/SPSN:SW">https://www.bloomberg.com/quote/SPSN:SW</a>
							<a href="https://www.bloomberg.com/profile/company/SPSN:SW">https://www.bloomberg.com/profile/company/SPSN:SW</a>
							<a href="https://www.sps.swiss/en">https://www.sps.swiss/en</a>
							<a href="https://www.sps.swiss/en/media/media-releases/first-blockchain-application-for-swiss-prime-site-thanks-to-strategic-partnership-with-inacta">https://www.sps.swiss/en/media/media-releases/first-blockchain-application-for-swiss-prime-site-thanks-to-strategic-partnership-with-inacta</a>
78	British Land Company PLC	0	U.K.	1	558	6.380	<a href="https://www.bloomberg.com/quote/BLND:LN">https://www.bloomberg.com/quote/BLND:LN</a>
							<a href="https://citywire.co.uk/new_model_adviser/share-prices-and-performance/share-factsheet.aspx?InstrumentID=508">https://citywire.co.uk/new_model_adviser/share-prices-and-performance/share-factsheet.aspx?InstrumentID=508</a>
							<a href="https://www.britishland.com/about-us">https://www.britishland.com/about-us</a>
79	Empire Company Limited	0	Canada	1850	125000	6.380	<a href="https://www.bloomberg.com/quote/EMP/A:CN">https://www.bloomberg.com/quote/EMP/A:CN</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=7683267">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=7683267</a>
80	Starwood Property Trust	0	U.S.	5	290	6.349	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=59665769">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=59665769</a>
							<a href="https://www.bloomberg.com/quote/STWD:US">https://www.bloomberg.com/quote/STWD:US</a>
							<a href="https://www.starwoodpropertytrust.com/contact/">https://www.starwoodpropertytrust.com/contact/</a>
81	JLL	5	U.S.	200	90000	5.958	<a href="https://www.jll.com/co/en/trends-and-insights/investor/blockchain-gains-ground-in-europes-real-estate-markets">https://www.jll.com/co/en/trends-and-insights/investor/blockchain-gains-ground-in-europes-real-estate-markets</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=363003">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=363003</a>
							<a href="https://www.bloomberg.com/quote/JLL:US">https://www.bloomberg.com/quote/JLL:US</a>
							<a href="http://www.jll.eu/emea/en-gb/careers/our-global-presence">http://www.jll.eu/emea/en-gb/careers/our-global-presence</a>

82	Logan Property Holdings	0	China	3	3219	5.862	<a href="http://www.loganestate.com/html/contact.php">http://www.loganestate.com/html/contact.php</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=250419969">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=250419969</a>
							<a href="https://www.reuters.com/finance/stocks/overview/3380.HK">https://www.reuters.com/finance/stocks/overview/3380.HK</a>
83	Canadian Apartment Properties REIT	0	Canada	4	917	5.700	<a href="https://www.bloomberg.com/quote/CAR-U:CN">https://www.bloomberg.com/quote/CAR-U:CN</a>
							<a href="https://www.bloomberg.com/profile/company/CAR-U:CN">https://www.bloomberg.com/profile/company/CAR-U:CN</a>
							<a href="https://www.caprent.com/about-capreit/">https://www.caprent.com/about-capreit/</a>
84	Castellum	0	Sweden	18	400	5.080	<a href="https://www.bloomberg.com/quote/CAST:SS">https://www.bloomberg.com/quote/CAST:SS</a>
							<a href="https://www.castellum.se/en/about-castellum/">https://www.castellum.se/en/about-castellum/</a>
							<a href="https://www.castellum.se/en/contact-us2/">https://www.castellum.se/en/contact-us2/</a>
85	DLF LTD.	0	India	24	1717	5.050	<a href="http://www.dlf.in/overview.aspx">http://www.dlf.in/overview.aspx</a>
							<a href="http://www.dlf.in/images/downloads/DLF_Annual-Report-2016-17-Final.pdf">www.dlf.in/images/downloads/DLF_Annual-Report-2016-17-Final.pdf</a>
86	Derwent London PLC	0	U.K.	2	124	4.840	<a href="https://www.bloomberg.com/quote/DLN:LN">https://www.bloomberg.com/quote/DLN:LN</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=877845">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=877845</a>
							<a href="https://www.derwentlondon.com/contact">https://www.derwentlondon.com/contact</a>
87	Nepi Rockcastle	0	Isle of Man	13	400	4.786	<a href="https://www.euronext.com/products/equities/IM00BDD7WV31-XAMS/quotes">https://www.euronext.com/products/equities/IM00BDD7WV31-XAMS/quotes</a>
							<a href="https://nepirockcastle.com/about-us/company-information/">https://nepirockcastle.com/about-us/company-information/</a>
							<a href="https://www.beursgorilla.nl/504964/nepi-rockcastle/fundamenteel">https://www.beursgorilla.nl/504964/nepi-rockcastle/fundamenteel</a>
							<a href="https://nepirockcastle.com/contact/corporate-offices/">https://nepirockcastle.com/contact/corporate-offices/</a>
88	Grand City Properties	0	Luxembourg	14	922	4.293	<a href="https://www.bloomberg.com/quote/GYC:GR">https://www.bloomberg.com/quote/GYC:GR</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=207701627">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=207701627</a>
							<a href="https://www.grandcityproperties.com/CompanyPresentation.pdf">https://www.grandcityproperties.com/CompanyPresentation.pdf</a>
89	Cushman & Wakefield	1	U.S.	400	51000	3.904	<a href="http://www.cushmanwakefield.com/en/research-and-insight/2018/ifm-technologies">http://www.cushmanwakefield.com/en/research-and-insight/2018/ifm-technologies</a>
							<a href="https://www.bloomberg.com/quote/CWK:US">https://www.bloomberg.com/quote/CWK:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=877111">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=877111</a>
							<a href="http://www.cushmanwakefield.com/en/about-us">http://www.cushmanwakefield.com/en/about-us</a>
90	Fabege	0	Sweden	5	184	3.900	<a href="https://www.forbes.com/companies/fabege-ab/#6ae5bc3b5af5">https://www.forbes.com/companies/fabege-ab/#6ae5bc3b5af5</a>
							<a href="https://craft.co/fabege-ab-npy">https://craft.co/fabege-ab-npy</a>

							<a href="https://www.fabege.se/en/about-fabege/">https://www.fabege.se/en/about-fabege/</a>
91	Two Harbors Investment	0	U.S.	2	103	3.514	<a href="https://www.bloomberg.com/quote/TWO:US">https://www.bloomberg.com/quote/TWO:US</a>
							<a href="https://twoharborsinvestment.com/contact/">https://twoharborsinvestment.com/contact/</a>
							<a href="https://www.zoominfo.com/pic/two-harbors-investment-corp/345500255">https://www.zoominfo.com/pic/two-harbors-investment-corp/345500255</a>
92	Chimera Investment	0	U.S.	1	38	3.513	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=36344150">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=36344150</a>
							<a href="https://www.bloomberg.com/quote/CIM:US">https://www.bloomberg.com/quote/CIM:US</a>
							<a href="https://www.chimerareit.com/websites/chimera/English/1000/investor-relations.html">https://www.chimerareit.com/websites/chimera/English/1000/investor-relations.html</a>
93	Zall Group	4	China	2	1919	2.980	<a href="https://www.enterpriseinnovation.net/article/cic-launches-blockchain-powered-global-physical-commodities-e-trading-platform-1493314732">https://www.enterpriseinnovation.net/article/cic-launches-blockchain-powered-global-physical-commodities-e-trading-platform-1493314732</a>
							<a href="http://en.zallcn.com/contact.php">http://en.zallcn.com/contact.php</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=136757669">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=136757669</a>
							<a href="https://www.unlock-bc.com/news/2018-07-24/singapores-gets-launches-worlds-first-cross-border-blockchain-trade">https://www.unlock-bc.com/news/2018-07-24/singapores-gets-launches-worlds-first-cross-border-blockchain-trade</a>
							<a href="https://www.reuters.com/finance/stocks/overview/2098.HK">https://www.reuters.com/finance/stocks/overview/2098.HK</a>
94	Colliers	1	Canada	100	13927	2.431	<a href="https://www2.colliers.com/en-NL/Search#q=blockchain&amp;sort=relevancy">https://www2.colliers.com/en-NL/Search#q=blockchain&amp;sort=relevancy</a>
							<a href="https://www.colliers.com/-/media/files/apac/india/market%20insights/2018-colliers-radar-impact-of-blockchain-on-indian-real-estate1.pdf?la=en-gb">https://www.colliers.com/-/media/files/apac/india/market%20insights/2018-colliers-radar-impact-of-blockchain-on-indian-real-estate1.pdf?la=en-gb</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=369303">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=369303</a>
							<a href="https://www.bloomberg.com/quote/CIGI:US">https://www.bloomberg.com/quote/CIGI:US</a>
							<a href="http://www.colliers.com/en-gb/emea/about/our-offices">http://www.colliers.com/en-gb/emea/about/our-offices</a>
95	Newmark Grubb Knight Frank (NGKF)	1	U.S.	430	16000	2.084	<a href="http://www.ngkf.com/home/search-results.aspx?s=blockchain">http://www.ngkf.com/home/search-results.aspx?s=blockchain</a>
							<a href="https://finance.yahoo.com/quote/NMRK/">https://finance.yahoo.com/quote/NMRK/</a>
							<a href="http://www.ngkf.com/home/about-our-firm/company-overview.aspx">http://www.ngkf.com/home/about-our-firm/company-overview.aspx</a>
96	HFF	1	U.S.	26	1080	1.751	<a href="https://www.hfflp.com/blog/2018/april/blockchain-and-its-importance-to-the-commercial-real-estate-indu.html">https://www.hfflp.com/blog/2018/april/blockchain-and-its-importance-to-the-commercial-real-estate-indu.html</a>
							<a href="https://www.bloomberg.com/quote/HF:US">https://www.bloomberg.com/quote/HF:US</a>
							<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=38442952">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=38442952</a>
							<a href="https://www.hfflp.com/locations.html">https://www.hfflp.com/locations.html</a>
97	Marcus & Millichap	0	U.S.	83	831	1.287	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4249042">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4249042</a>
							<a href="https://www.bloomberg.com/quote/MMI:US">https://www.bloomberg.com/quote/MMI:US</a>

							<a href="https://www.marcusmillichap.com/about-us/offices">https://www.marcusmillichap.com/about-us/offices</a>
98	Savills Studley	1	U.S.	600	37000	1.140	<a href="https://www.savills.com/impacts/new-technology/blockchain-buildings.html">https://www.savills.com/impacts/new-technology/blockchain-buildings.html</a>
							<a href="https://finance.yahoo.com/quote/SVSL/">https://finance.yahoo.com/quote/SVSL/</a>
							<a href="https://www.savills.com/impacts/natural-forces/7-tech-trends-reshaping-rural.html">https://www.savills.com/impacts/natural-forces/7-tech-trends-reshaping-rural.html</a>
							<a href="http://ir.savills.com/company-information">http://ir.savills.com/company-information</a>
99	RE/MAX Commercial	4	U.S.	7400	120000	0.978	<a href="https://medium.com/xyonetnetwork/xyo-and-re-max-mexico-a-blockchain-partnership-to-reshape-the-real-estate-industry-122d2b2f601b">https://medium.com/xyonetnetwork/xyo-and-re-max-mexico-a-blockchain-partnership-to-reshape-the-real-estate-industry-122d2b2f601b</a>
							<a href="https://www.bloomberg.com/quote/RMAX:US">https://www.bloomberg.com/quote/RMAX:US</a>
							<a href="https://www.remax.com/newsroom/company-info/">https://www.remax.com/newsroom/company-info/</a>
							<a href="https://remax.co.uk/branch/homepage~bid=18,page=1">https://remax.co.uk/branch/homepage~bid=18,page=1</a>
							<a href="https://www.cryptoninjas.net/2018/10/12/xyo-network-and-re-max-mexico-to-bring-blockchain-transactions-to-real-estate-sales/">https://www.cryptoninjas.net/2018/10/12/xyo-network-and-re-max-mexico-to-bring-blockchain-transactions-to-real-estate-sales/</a>
100	Realogy Holdings Corp	4	U.S.	15000	11800	0.845	<a href="https://www.agentmile.com/">https://www.agentmile.com/</a>
							<a href="https://www.cbcworldwide.com/professionals/find">https://www.cbcworldwide.com/professionals/find</a>
							<a href="https://www.macrotrends.net/stocks/charts/RLGY/realogy-holdings/market-cap">https://www.macrotrends.net/stocks/charts/RLGY/realogy-holdings/market-cap</a>
							<a href="https://www.century21.ca/ron.oneil/blog/How_Blockchain_Technology_will_Change_Real_Estate">https://www.century21.ca/ron.oneil/blog/How_Blockchain_Technology_will_Change_Real_Estate</a>
							<a href="https://www.century21global.com/nl/makelaardijen">https://www.century21global.com/nl/makelaardijen</a>

*Note: See chapter methodology for explanation of search method. Websites can be found in different languages which are translated personally or through Google Translator. This list is comprised with 100 of the largest listed real estate companies through: <https://www.value.today/world-top-companies/world-top-real-estate-companies-list>. Only companies of which all information (employees, branches and market capitalization) are used in this list, some companies have been deleted because their main focus did not appear to be real estate. All market capitalization values are made actual therefore order of the list might be different from the source given. The source used might not contain all companies, or contain errors regarding the 'largest' real estate companies.*

*Index number explanation:*

*0 = no findable public mention from company on blockchain on company website, blogs or other official company sources.*

*1 = mention of blockchain on official website from company.*

*2 = mention of creating blockchain programs to implement on news websites.*

*3 = mention of creating blockchain programs to implement on company website.*

*4 = mention of using blockchain on news websites.*

*5 = mention of using blockchain on company website.*

*Multiple sources per company have been consulted to find location, number of employees, number of branches and market capitalization, sources can give contradictory results; if and when applicable the newest version is used. The market capitalization factor has been gathered between May 20<sup>th</sup> and May 29<sup>th</sup> 2019, due to stock markets these market capitalization factors change daily. Data has been retrieved between April till June 2019.*

## Appendix G: Stata Do File

*Note: This Do File for Stata uses the data from appendix F and appendix G, additional rows that only contain references are removed, so that company data is imported to Stata in one line only. Names are changed slightly from appendix F and G. “Cap\_us\_billion” is the name for “Market cap. in U.S. Billion”. “MarketCap” is “Cap\_us\_billion” times one billion. “Branches” is equal to “Number of locations”. “Employees” is equal to “Number of employees”. Variable “Type” is added, which is 0 with Real Estate Companies and 1 with Banks. On request the exact Excel file used for this research can be e-mailed, see contact details in colophon, but contains the information from appendix F and G and is left out for clarity.*

\*Make variables that are currently in string, numerical.

```
destring Branches Employees Cap_us_billion MarketCap, replace force
```

\*Show Index information.

```
tabulate Index
```

\*transform Index to binary (0 = 0 to 3 Index which shows the companies that have not successfully implemented blockchain yet (publicly), 4 and 5 which shows the companies that have successfully implemented blockchain publicly.

```
egen Implemented = cut(Index), at(0,4,6)
```

```
replace Implemented = 1 if (Implemented == 4)
```

\*Verify requirements linear regression: Ratio/interval dependent variable, Linear relationship between variables, Multivariate normality, No or little multicollinearity, No auto-correlation, Homoscedasticity

```
tabulate Implemented
```

```
tabulate Index
```

\*Linear relationship is not possible because of the Ordinal dependent variable, data does not meet requirements for linear regression.

\*Verify requirement for logistic regression:

\*1: Binary logistic reg requires dependent variable to be binary.

```
tabulate Implemented
```

\*2: Observations should be independent of each other, the data shows that this is met

\*3: Independent variables should not be too highly correlated with each other.

```
corr Branches Employees MarketCap Type
```

\*Highest corr is 0.7385 which is Employees and Branches and 0.7308 which is Employees and MarketCap.

```
corr Branches MarketCap Type
```

\*Highest corr is 0.4408 between MarketCap and Type.

```
corr Branches MarketCap
```

\*corr Branches - MarketCap = 0.3858.

\*4: Independent variables need to be linearly related to log odds. Due to using logit this research assumes that this requirement is met.

\*5: Logistic regression requires large sample size (minimum of 10 cases for least frequent outcome for each independent variable), this requirement is met and is shown through tabulation. Also tabulation per group (RE companies and banks are tabulated and condition is met for both groups) :

tabulate Implemented

tabulate Implemented if Type==0

tabulate Implemented if Type==1

\*Logistic regression.

logit Implemented Branches MarketCap Type

\*Likelihood test. Removed Type because the model is based on Type.

logit Implemented Branches MarketCap Type

estimates store All

logit Implemented Branches MarketCap if Type==0

estimates store A1

logit Implemented Branches MarketCap if Type==1

estimates store A2

lrtest (All) (A1 A2), df (2)

\*Because LR test is significant, model improves by creating two logistic regression for each group.

logit Implemented Branches MarketCap if Type==0

logit Implemented Branches MarketCap if Type==1

\*Export tables using asdoc

\*ssc install asdoc, replace

\*only run first line if asdoc is not installed yet.

asdoc summ Implemented Branches Employees Cap\_us\_billion Type

asdoc corr Branches Employees MarketCap Type

asdoc corr Branches MarketCap Type

asdoc logit Implemented Branches MarketCap if Type==0

asdoc logit Implemented Branches MarketCap if Type==1

asdoc logit Implemented Branches MarketCap Type

## Appendix H: Top 20 patent applicants and company type per sector

<i>Patent applicants per company for sector Real Estate from before 21-05-2019</i>				
ID:	Applicants:	Number of patents:	Type of company:	Source company type:
1	Strong Force Iot Portfolio Llc	84	ICT	<a href="http://www.buckhillgroup.com/portfolio/companies/strong-force/">http://www.buckhillgroup.com/portfolio/companies/strong-force/</a>
2	Ibm	55	ICT	<a href="https://www.ibm.com/ibm/nl/nl/organisatie.html">https://www.ibm.com/ibm/nl/nl/organisatie.html</a>
3	Altr Solutions Inc	28	ICT	<a href="https://www.altr.com/">https://www.altr.com/</a>
4	Visa Int Service Ass	23	Payments	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767</a>
5	Inmentis Llc	21	Business Services	<a href="https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd">https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd</a>
6	Monticello Entpr Llc	20	Business Services	<a href="http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444">http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444</a>
7	Nchain Holdings Ltd	20	ICT	<a href="https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063">https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063</a>
8	Microsoft Technology Licensing Llc	19	ICT	<a href="https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx">https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx</a>
9	Nasdaq Inc	19	Exchange	<a href="https://business.nasdaq.com/discover/index.html">https://business.nasdaq.com/discover/index.html</a>
10	Fmr Llc	16	Investment	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483</a>
11	Pure Storage Inc	16	ICT	<a href="https://www.purestorage.com/nl/">https://www.purestorage.com/nl/</a>
12	Walmart Apollo Llc	15	Advertising	<a href="https://www.adweek.com/brand-marketing/wal-mart-joins-project-apollo-86804/">https://www.adweek.com/brand-marketing/wal-mart-joins-project-apollo-86804/</a>
13	Guttman Moshe	13	Private person	<a href="http://www.cs.tau.ac.il/~wolf/projectwebpages/retargetpp.html">http://www.cs.tau.ac.il/~wolf/projectwebpages/retargetpp.html</a>
14	Tran Bao	13	Private person	<a href="https://www.managingrights.com/2018/07/bofa-and-bao-tran-blockchain-and-drm-patents.html">https://www.managingrights.com/2018/07/bofa-and-bao-tran-blockchain-and-drm-patents.html</a>
15	Civic Tech Inc	12	ICT	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=323634105">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=323634105</a>
16	Intel Corp	12	ICT	<a href="https://www.intel.com/content/www/us/en/homepage.html">https://www.intel.com/content/www/us/en/homepage.html</a>
17	Seematics Systems Ltd	12	ICT	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=422491348">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=422491348</a>
18	Bank Of America	11	Bank	<a href="https://www.bankofamerica.com/">https://www.bankofamerica.com/</a>
19	Affectomatics Ltd	9	Unknown	<a href="https://orbisdirectory.bvdinfo.com/directory-JJMJFIDINHCCIINHIAIJIDI.urk">https://orbisdirectory.bvdinfo.com/directory-JJMJFIDINHCCIINHIAIJIDI.urk</a>
20	Combobotronics Llc	8	ICT	<a href="https://www.f6s.com/kevinmauro">https://www.f6s.com/kevinmauro</a>
	Total:	426		

*Note: Patents have been searched on lens.org, with search query: Blockchain AND ( "Real Estate" OR "Housing Appraisal" OR "Dwelling" OR "Apartment" OR "Residential" OR "Property management" ) and search date all before May 21, 2019.*

<i>Patent applicants per company for sector Banks from before 21-05-2019</i>				
ID:	Applicants:	Number of patents:	Type of company:	Source company type:
1	Mastercard International Inc	95	Payments	<a href="https://www.mastercard.us/en-us.html">https://www.mastercard.us/en-us.html</a>
2	Bank Of America	87	Bank	<a href="https://www.bankofamerica.com/">https://www.bankofamerica.com/</a>
3	Strong Force Iot Portfolio Llc	84	ICT	<a href="http://www.buckhillgroup.com/portfolio/companies/strong-force/">http://www.buckhillgroup.com/portfolio/companies/strong-force/</a>
4	Nchain Holdings Ltd	60	ICT	<a href="https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063">https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063</a>
5	Alibaba Group Holding Ltd	54	ICT	<a href="https://www.alibabagroup.com/en/global/home">https://www.alibabagroup.com/en/global/home</a>
6	American Express Travel Related Services Co Inc	50	Payments	<a href="https://travel.americanexpress.com/travel/gcd/login">https://travel.americanexpress.com/travel/gcd/login</a>
7	Ibm	49	ICT	<a href="https://www.ibm.com/ibm/nl/nl/organisatie.html">https://www.ibm.com/ibm/nl/nl/organisatie.html</a>
8	Visa Int Service Ass	48	Payments	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767</a>
9	Accenture Global Solutions Ltd	44	Business Services	<a href="https://www.accenture.com/se-en/company">https://www.accenture.com/se-en/company</a>
10	Microsoft Technology Licensing Llc	43	ICT	<a href="https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx">https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx</a>
11	Altr Solutions Inc	28	ICT	<a href="https://www.altr.com/">https://www.altr.com/</a>
12	Royal Bank Of Canada	26	Bank	<a href="https://www.rbcroyalbank.com/personal.html">https://www.rbcroyalbank.com/personal.html</a>
13	Coinplug Inc	23	ICT	<a href="https://www.coinplug.com/">https://www.coinplug.com/</a>
14	Jpmorgan Chase Bank Na	23	Bank	<a href="https://www.jpmorganchase.com/corporate/investor-relations/pr/file-merger-application.htm">https://www.jpmorganchase.com/corporate/investor-relations/pr/file-merger-application.htm</a>
15	Cognitive Scale Inc	22	ICT	<a href="https://www.cognitivescale.com/">https://www.cognitivescale.com/</a>
16	Inmentis Llc	21	Business Services	<a href="https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd">https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd</a>
17	Monticello Entpr Llc	21	Business Services	<a href="http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444">http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444</a>
18	Tech S A	19	Business Services	<a href="https://www.sa-techinc.com/">https://www.sa-techinc.com/</a>
19	Fmr Llc	19	Investment	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483</a>
20	Gsc Secrypt Llc	19	Business Services	<a href="http://www.gsc-llc.com/">http://www.gsc-llc.com/</a>
	Total:	835		

*Note: Patents have been searched on lens.org, with search query: Blockchain AND ( "Banking" OR "Financial institution" OR "Financial organization" OR "Trust company" OR "central bank" ) and search date before May 21, 2019.*

<i>Patent applicants per company for sector Banks from before 21-05-2019</i>				
ID:	Applicants:	Number of patents:	Type of company:	Source company type:
1	Strong Force Iot Portfolio Llc	84	ICT	<a href="http://www.buckhillgroup.com/portfolio/companies/strong-force/">http://www.buckhillgroup.com/portfolio/companies/strong-force/</a>
2	Ibm	50	ICT	<a href="https://www.ibm.com/ibm/nl/nl/organisatie.html">https://www.ibm.com/ibm/nl/nl/organisatie.html</a>
3	Microsoft Technology Licensing Llc	45	ICT	<a href="https://www.microsoft.com/en-us/legal/intellectualproperty/ml/default.aspx">https://www.microsoft.com/en-us/legal/intellectualproperty/ml/default.aspx</a>
4	Intel Corp	31	ICT	<a href="https://www.intel.com/content/www/us/en/homepage.html">https://www.intel.com/content/www/us/en/homepage.html</a>
5	Northstar Battery Company Llc	29	Energy	<a href="https://www.northstarbattery.com/">https://www.northstarbattery.com/</a>
6	Altr Solutions Inc	28	ICT	<a href="https://www.altr.com/">https://www.altr.com/</a>
7	Accenture Global Solutions Ltd	27	Business Services	<a href="https://www.accenture.com/se-en/company">https://www.accenture.com/se-en/company</a>
8	Cognitive Scale Inc	25	ICT	<a href="https://www.cognitivescale.com/">https://www.cognitivescale.com/</a>
9	Inmentis Llc	21	Business Services	<a href="https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd">https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd</a>
10	Pure Storage Inc	20	ICT	<a href="https://www.purestorage.com/nl/">https://www.purestorage.com/nl/</a>
11	Nant Holdings Ip Llc	16	Energy	<a href="https://nantenergy.com/news/">https://nantenergy.com/news/</a>
12	Tran Bao	15	Private person	<a href="https://www.managingrights.com/2018/07/bofa-and-bao-tran-blockchain-and-drm-patents.html">https://www.managingrights.com/2018/07/bofa-and-bao-tran-blockchain-and-drm-patents.html</a>
13	Visa Int Service Ass	14	Payments	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767</a>
14	Monticello Entpr Llc	13	Business Services	<a href="http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444">http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444</a>
15	Royal Bank Of Canada	13	Bank	<a href="https://www.rbcroyalbank.com/personal.html">https://www.rbcroyalbank.com/personal.html</a>
16	Civic Tech Inc	12	ICT	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=323634105">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=323634105</a>
17	Drishti Tech Inc	12	ICT	<a href="https://drishtitech.odoo.com/">https://drishtitech.odoo.com/</a>
18	Tyco Integrated Security Llc	12	Security	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=248742853">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=248742853</a>
19	Netspective Communications Llc	11	ICT	<a href="https://www.netspective.com/">https://www.netspective.com/</a>
20	Nokia Technologies Oy	11	ICT	<a href="https://www.nokia.com/nl_int/">https://www.nokia.com/nl_int/</a>
	Total:	489		

*Note: Patents have been searched on lens.org, with search query: Blockchain AND Blockchain AND ( "Healthcare" OR "Health" OR "Hospital" OR "Medicine" OR "Physician" ) and search date before May 21, 2019.*

<i>Patent applicants per company for sector Vehicles from before 21-05-2019</i>				
ID:	Applicants:	Number of patents:	Type of company:	Source:
1	Ibm	95	ICT	<a href="https://www.ibm.com/ibm/nl/nl/organisatie.html">https://www.ibm.com/ibm/nl/nl/organisatie.html</a>
2	Strong Force Iot Portfolio Llc	84	ICT	<a href="http://www.buckhillgroup.com/portfolio/companies/strong-force/">http://www.buckhillgroup.com/portfolio/companies/strong-force/</a>
3	Walmart Apollo Llc	55	Advertising	<a href="https://www.adweek.com/brand-marketing/wal-mart-joins-project-apollo-86804/">https://www.adweek.com/brand-marketing/wal-mart-joins-project-apollo-86804/</a>
4	Accenture Global Solutions Ltd	52	Business Services	<a href="https://www.accenture.com/se-en/company">https://www.accenture.com/se-en/company</a>
5	Intel Corp	46	ICT	<a href="https://www.intel.com/content/www/us/en/homepage.html">https://www.intel.com/content/www/us/en/homepage.html</a>
6	Altr Solutions Inc	35	ICT	<a href="https://www.altr.com/">https://www.altr.com/</a>
7	Visa Int Service Ass	33	Payments	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=3027767</a>
8	Wal Mart Stores Inc	31	Supermarket	<a href="https://www.walmart.com/">https://www.walmart.com/</a>
9	Northstar Battery Company Llc	29	Energy	<a href="https://www.northstarbattery.com/">https://www.northstarbattery.com/</a>
10	Cognitive Scale Inc	25	ICT	<a href="https://www.cognitivescale.com/">https://www.cognitivescale.com/</a>
11	American Express Travel Related Services Co Inc	23	Payments	<a href="https://travel.americanexpress.com/travel/gcd/login">https://travel.americanexpress.com/travel/gcd/login</a>
12	Bank Of America	22	Bank	<a href="https://www.bankofamerica.com/">https://www.bankofamerica.com/</a>
13	Microsoft Technology Licensing Llc	22	ICT	<a href="https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx">https://www.microsoft.com/en-us/legal/intellectualproperty/mtl/default.aspx</a>
14	Inmentis Llc	21	Business Services	<a href="https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd">https://www.manta.com/ic/mx9cr36/ca/inmentis-ltd</a>
15	Fmr Llc	20	Investment	<a href="https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483">https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=410077483</a>
16	Pure Storage Inc	20	ICT	<a href="https://www.purestorage.com/nl/">https://www.purestorage.com/nl/</a>
17	Gsc Secrypt Llc	19	Business Services	<a href="http://www.gsc-llc.com/">http://www.gsc-llc.com/</a>
18	Nchain Holdings Ltd	18	ICT	<a href="https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063">https://www.bloomberg.com/research//stocks/private/snapshot.asp?privcapId=427615063</a>
19	Monticello Entpr Llc	15	Business Services	<a href="http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444">http://www.buzzfile.com/business/Monticello-Enterprises,-LLC-904-940-3444</a>
20	Shocard Inc	15	ICT	<a href="https://shocard.com/">https://shocard.com/</a>
	Total:	680		

*Note: Patents have been searched on lens.org, with search query: Blockchain AND ( "Cars" OR "Car" OR "Vehicle" OR "Automobile" OR "self-driving" ) and search date before May 21, 2019.*

## **Appendix I: REMOVED Transcripts of interviews and signed consent forms.**

To ensure privacy of the interviewees, pages 88-130 have been removed in this published thesis which contains the transcripts of the interviewees. The following pages contained the transcripts:

- Pages 84 till 96 contained the interview with the two notaries.
- Pages 97 till 106 contained the interview with the real estate manager.
- Page 107 till 122 contained the interview with the bank official.
- Page 123 till 136 contained the interview with the blockchain expert.

The transcripts have all been transcribed using the “Times New Roman” font at size 12 using equal text size and layout as this thesis.

The audio files containing the interviews on which the transcripts are based will be deleted between six to twelve months after the master thesis has been fully approved. This period is chosen to allow for integrity checks.

The signed consent forms have not been added in the internal or published version of the thesis to safeguard the privacy of those interviewed. These signed consent forms contain the names of those interviewed and are on request only. The signed consent forms are only obtainable by integrity commissions of the University of Groningen. The signed consent forms will be deleted between six to twelve months after the master thesis has been fully approved. This period is chosen to allow for integrity checks.