Blockchain, a Feasible Technology for Land Administration?

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SUMMARY

Due to the fact that all transaction data are visible on all applications (clients) for everyone and traceable stored, the blockchain technology is considered secure and transparent. As a consequence, there are a number of activities and projects in the field of voluntary property registration as an alternative to the state-organized structures, where the surveying engineer has a central role. For this purpose, the blockchain technology for the real estate market is considered as a feasible technology and is already used in some cases.

This presentation is dealing with the possibilities for an implementation and the potential design of a blockchain-based land register in Germany. The idea of upgrading the current electronic land registry by a blockchain solution takes into account the emerging importance of the blockchain technology that has been developed in recent years. The introduction of a blockchain-based land registry has the following objectives:

- Faster implementation of pending ownership changes in the land register
- Automated notifications of ownership changes or changes in the land registry
- More transparency in transactions around the change of ownership in the land register
- Avoid physical archives for contracts and files
- More flexibility and resilience
- Greater security for land registry actors

Potential obstacles, legal, organizational and technical issues will be addressed as well. Finally, an evaluation of the concept with regard to feasibility is undertaken in order to create a blueprint for the implementation of a blockchain-based land register.

The DVW working group "Geoinformation" works closely with the FIG Commission 3 and 7 in order to discuss new approaches in information technology and land management.

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[1] German Association of Surveying (DVW), www.dvw.de

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1. INTRODUCTION

With the use of blockchain, it is possible to run a continuously expandable list of bookings decentralized and the respective proper state must be documented because many participants are involved in the bookkeeping. This concept is referred to as Distributed Ledger technology (decentralized booking technology). What should be booked and documented with it, is irrelevant. Crucially, later transactions build on previous transactions and confirm them as correct by demonstrating knowledge of past transactions. Bookings do not necessarily have to be property transfers, but it can also be a formal confirmation of the existence of all necessary documents by the notary so that a notarized land purchase agreement can be made. Thus, individual processing steps of the process of transfer of ownership could be speeded up and made more transparent, so that the parties involved can at any time have an overview of the status of proceedings.

A blockchain is a continuously expandable list (chain) of records (blocks) that are connected via encrypted data exchange. Each block typically contains a reference to the previous block, a timestamp, and transaction data. One of the most popular blockchain applications is the cryptocurrency Bitcoin. Due to the fact that the transaction data on all applications (clients) are visible for everyone and traceable stored, this system is considered tamper-proof and transparent.

On international level, a number of voluntary property registration activities and projects currently exist as an alternative to the 'classical' state-organized structures, in which the surveying engineer is playing a central role. For this purpose, the blockchain technology for the real estate traffic is considered as an appropriate approach and is already partly used.

In some developing countries, this approach may even work, where there is no or only a poor law-abiding and independent jurisdiction-controlled administrative action. The aim is often to development of a cadastre especially in areas without previous ownership (eg. informal settlements) in a very short time. For Germany, blockchain based land registry and cadaster seem to be not relevant, since with the German cadastre and land register a reliable property protection is already guaranteed. Nevertheless, the use of this technology is also being discussed in Europe (eg Ireland) as part of effective eGovernment. Target is e.g. to speed up the real estate traffic. In Germany, such considerations are currently not recognizable. However, in some parts of a long-lasting transfer process of a property, the application of blockchain technology might be able to accelerate the process in Germany as well. This paper deals with potential benefits of using blockchain technology, which will be presented in the following chapters.

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2. OBJECTIVES

The idea of introducing a land register with a blockchain-based solution, or replacing or at least extending an existing one, is due to the manifold application possibilities of blockchain technology.

The introduction of a blockchain-based land registry would have the following main objectives:

- Faster implementation of a pending ownership transaction in the land register
- Automated notifications of ownership changes or changes in the land register and cadaster
- Greater transparency of transactions for customers around the change of ownership in the land register and cadaster
- Allowing digital archives for contracts and files among stakeholders
- More flexibility and robustness
- Greater security for land registry actors through more transparency.

3. CASE STUDY

One of the main objectives in FIG is to exchange professional experience and learn from each other. Therefore, a case study has been conducted to figure out what has been done so far in the field of blockchain application in land registry and cadastre. The interesting result is that a lot of activities are recognizable in the world related to blockchain in land registry. This clause summarizes some significant examples from this internet study.

Countries with pilot projects on blockchain-based cadastre and land registry solutions:

Brazil
The Brazilian real estate register "Cartorio de Registro de Imoveis" has started a pilot project with the blockchain startup company "Ubiquity" to save land registrations on the blockchain. The system contains addresses, cadastral zoning, and owner information that is hashed and then mapped to a blockchain based on the Colored Coins protocol. Brazil's pilot program included the municipalities of Pelotas and Morro Redondo.

Dubai
The Dubai Land Department (DLD) uses blockchain technology to store real estate transactions. The system combines real estate with the Dubai Electricity & Water Authority (DEWA) and also includes tenant information and visa status. This blockchain solution is part of the Dubai Blockchain Strategy, which was launched in October 2016 and aims to ensure by 2020 that all transactions are processed on a blockchain.

Georgia
The Republic of Georgia was the first national government to use blockchain technology to store records of official transactions. The National Agency of the Republic of Georgia has

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teamed up with the start-up company "Bitfury" to set up land registrations on the Bitcoin blockchain. Georgia has begun to include state land in the registry and has extended it with private land in the second step. Georgia also plans to transfer trusteeship and emergency services to the Blockchain.

Honduras
In May 2015, Honduras announced that it would work with the start-up company "Factom" to store all private land on a blockchain. The focus of the project was the fight against corruption. In December 2015, the project was discontinued.

India
The Indian state of Andhra Pradesh has teamed up with start-up company "ChromaWay" to develop a blockchain-based land registry. The blockchain backend was combined with a web app as a frontend to provide citizens with more data transparency.

Japan
Japan plans to collect its state-owned real estate databases on a blockchain containing proprietary and sales data. The first test run was planned for 2018. While all of Japan's local government agencies have separate property registers and real estate companies maintain their own databases, Japan hopes to consolidate all data into a blockchain database.

Russia
Russia hopes to test a Blockchain-based land register later this year. The project involves the Ministry of Economic Development and the State Cadastral and Cartographic Organizations. The Russian government has determined that the costs can be significantly reduced by a Blockchain-based Land Registry system. The project operators plan to evaluate the current pilot project later this year in order to make a decision on the continuation of the project.

Sweden
Sweden's land registry authority "Lantmäteriet" has carried out a two-stage project to relocate real estate transactions to blockchain. Real estate is sold in this project via smart contracts, the implementation of which is monitored by banks and intermediaries. A legal feature in Sweden, which stipulates that signatures on a physical paper must be provided in real estate transactions, has proven to be problematic. However, the Swedish government and start-up company "ChromaWay"' are working to continue the project.

United Kingdom
The British Land Registry wants to test the blockchain technology shortly. Registration on the blockchain should lead to a state-guaranteed property guarantee.

United States of America
The Chicago Cook County Recorders of Deeds (CCRD) conducted a pilot project on the use of blockchain registries for real estate. The pilot project focused on around 2,000 vacant

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properties in Chicago and tested combining physical properties with a digital asset. The International Blockchain Real Estate Association (IBREA) and the startup company "velox.RE" worked together with the CCRD.

4. PROCESS OF OWNERSHIP TRANSFER WITHOUT BLOCKCHAIN

In Germany, the current process for transferring ownership has the following shortcomings:

1. The process of transferring ownership of land is a process of many, small steps. A lot of individual conditions must be fulfilled in the process, so that the next step can be initiated. In Germany, the process of land purchase, starting with the agreement between buyer and seller and ending with the entry in the land register, usually takes between 5 - 6 months. Due to a general lack of transparency of the process, buyers and sellers usually know only roughly in what step the land purchase process is currently in. This feeling of a "black box", especially in relation to the actions of the Land Registry, is considered as a major obstacle in the current process.

2. With a total duration of 5-6 months, the process of buying land with subsequent transfer of ownership takes significantly longer than an ordinary legal transaction. Alone, the time span between the formal intention to change the land register and the actual change usually takes 6 - 8 weeks. This often leads to delays in the economic transition (ownership, use) of a plot and hinder investments.

3. The many small, very bureaucratic processes between the actors lead to issuing and transmission of many additional documents that are often sent by post if electronic commerce cannot be used. The documents and the identity of the person signing must be checked by hand. This is a time consuming and error-prone process.

4. Another weakness is the late involvement of the land registry in the land purchase process. There, an evaluation of submitted documents and decisions are made rather late in the process. Earlier involvement of the Land Registry as the most credible actor could increase confidence in the process and transparency.

5. Legal archiving periods lead to large space or storage requirements and to increased security requirements with regard to the storage of documents by the actors. In addition, searching for old non-digital documents is often very time-consuming.
The obstacles described above have the potential to be eliminated by a combination of modern IT architecture and blockchain-based land registry processes.

5. PROCESS OF OWNERSHIP TRANSFER WITH BLOCKCHAIN

The process of transferring ownership of a property with a blockchain-based land register described in this chapter is to be understood the same legal process as analogue process

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without blockchain support. However, some additional ICT applications can also be integrated in the process to accelerate the process again. The digital process of transferring ownership can be conducted considering the following assumptions:

- Private and permissioned blockchain
- Interaction via application layer (dApp)
- Affiliated actors are buyers, sellers, notaries and land registries
- Tasks of notaries attesting to signatures can be assumed by Blockchain, but not the tasks of checking documents for registrability and contract execution
- Actors receive digital file with agreement to transfer ownership and to transaction history
- Authenticity of the procedure, signatures and property confirmation file are stored in the blockchain
- Land Registry stores blockchain with proof of sales
- Bearer papers are not stored in the blockchain
- All actions are signed and passed to the blockchain
- Actors see the same information and evidence of all performed actions by the other actors
- Illegal transactions are only possible by starting a new transaction with stolen or counterfeit identification
- Formal complaint procedures may be initiated if the process is deviated from the standard process
- Identification of the actors participating in the process takes place via certificate and Qualified Electronic Signature (QES) in accordance with the EU eIDAS Regulation. QES meets the highest technical and organizational safety standards. It can be used to fulfill formal requirements in substantive law. The notary can set up credentials electronically. Notaries use signature cards of the federal notary association (Bundesnotarkammer), which are provided with a notary identification number.
- DocuSign is connected as a partner for QES via the eSignature API
- Secupay will be connected as a trustee service partner via the Payment API.

6. BENEFITS OF A BLOCKCHAIN-BASED LAND REGISTRY

The process described in the use case has the following advantages over the process according to today's version of the land register:

1. Reduction of the duration of the entire process from 5 - 6 months to 1 - 2 weeks possible
2. Much of the data for carrying out the process is already included in the blockchain-based land registry
3. Digital signatures provide a higher level of security than manual document filling (risk of errors and fraud decreases)
4. All actors can digitally store their documents, data and documents cannot be lost due to decentralized data management
5. Increased transparency, no "black box feeling"

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6. Completely digital experience, no media break
7. Lower costs for buyers and sellers with higher efficiency
8. Real-time ownership tracking via land registry dApp possible.

In conclusion, the design of the blockchain-based land registry process has led to improvements in the following criteria:
- efficiency
- effectiveness
- transparency
- service
- speed
- quality
- cost

7. PROPOSED TECHNICAL SOLUTION

A potential solution of a blockchain-based land registry comprises of the following components, the functions of which are described in the blockchain-based land register:

- Private and Permissioned Blockchain:
  Only participating actors verify transactions, transactions including hashes are recorded and stored
- dApp:
  dApp is one of the most important components, which does not run directly on the blockchain and includes user interfaces for buyers, sellers, notaries and land registries
- Smart Contract Engine:
  Smart Contract defines order of transactions, Smart Contracts are only confirmed in the blockchain
- External storage:
  External storage for smart contracts and documents (so that data volume in the blockchain does not get too big)
- Electronic land register:
  Access to metadata in the electronic land registry via API, automated retrieval process remains for the time being
- Registration:
  Actors register
- eSignature API:
  Actors identify themselves
- Payment API:
  Automated payment of the purchase price via trust service.

8. USE OF BLOCKCHAIN TECHNOLOGY ALSO IN CADASTRE?

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The introduction of a new technology should only take place if deficits identified with it could not be eliminated without this technology. Deficits, for example, would be a lack of transparent administrative action that could lead to a breach of trust between the parties involved. However, such a danger is currently not apparent. Another deficit might be the process of ownership transactions is considered too long.

The process of ownership transfer of a property is standardized and comprehensible. Cadastral administration plays an important but subordinate role in this process, as it provides the basis for a contract, but is not involved in the actual transfer of ownership (at least in Germany). So if the process of "ownership transfer" should be supported in some way with blockchain technology and thus made faster, the task of the leading institutions (notary, land registry) would not be that of the "technical supplier" which the cadastral administration basically is.

For the public administration, the blockchain technology promises an infrastructure that for the first time enables forgery-proof automation of basic administrative processes, including in the cadastre. However, this potential also faces challenges that need to be defined within the framework of blockchain governance. Before implementing a blockchain-based land registry, public administration will need to establish regulatory mechanisms that guarantee constant control of the blockchain. To mitigate and minimize damage, it will be necessary to adopt internal rules governing the handling of blockchain technology. And processes for continuous quality assurance of the software components used will have to be implemented in public administration.

In addition, the following challenges emerged from discussions with public administration officials:

- complexity of blockchain technology
- immutability
- Power consumption
- Re-design of process chains within the administration
- Unclear liability issue
- Limited applicability of legal norms

These challenges need to be addressed in the possible design of a blockchain-based land register through appropriate governance measures so that blockchain technology can be promoted and introduced beyond the land registry. An active or even leading role of the official surveying and mapping authorities cannot be recognized currently.

9. Conclusions

The blockchain technology undoubtedly has the potential to support the digitization of any administrative processes. Disruptive developments are currently not to be recognized or feared. The centralized approach for the land registries in Germany has proved successful,

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that there is no need for a decentralization which would be introduced by using blockchain. The use of that technology will certainly optimize the government's administrative actions, but will not replace them completely.

However, for the German cadastre neither a loss of trust nor a breach of trust (between institutions) can be detected, which would require the use of a tamper-proof system. Shortening the administrative operations (e.g., when changing ownership) appears to be required, but is not the core task of the cadastral administration. One potential role could be the technology provider since cadastral administration usually used modern technology.

As shown there are lots of benefits using blockchain technology in the land register, even there is already a sophisticated electronical register. Combined with other state-of-the-art technology the process of ownership transactions can be significantly optimized. This could significantly support the process of digitalization of governmental services.

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