Blockchain Ecosystem for the Real Estate Industry

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Abstract—Blockchain is a fast-rising technology that has the potential to change how we pay for things, verify information, or buy or sell. Today, we see how blockchain has an impact on many industries, and real estate is one of them. Some of the issues that this industry is facing now are a lack of liquidity, complicated transactions, and many frauds in process. The purpose of this paper is to focus on the theoretical explanation of the blockchain ecosystem within the real estate industry. In other words, how blockchain, combined with smart contracts, can be used in the real estate sector and how this industry can benefit from using this technology We start with an explanation of the blockchain technology itself and then explain how this technology can be implemented in the real estate industry. The special focus of this paper is the theoretical example of a system for real estate transaction processing that uses blockchain technology.

Keywords - blockchain, real estate, smart contracts, tokenization

I. INTRODUCTION

Let's consider one of the biggest problems that everyone faces at least once in their life, and that is buying real estate. Namely, in this situation, we have a representative who sells the real estate and who, as a rule, should also be the last owner as well. However, in order to determine this, it is necessary to have recorded all previous transactions for the selected real estate, and this information is stored and verified by the institutions responsible for this. In this way, we could protect ourselves from fraud; however, what we can still notice today are cases of real estate being sold twice or by people who are not the owners. This is where blockchain technology could help: a distribution system where multiple parties keep information that they can guarantee has not been changed. Using smart contracts for transactions can exclude any intermediaries in the process, such as banks, for example. But smart contracts can also provide a more secure way to do transactions.

This paper should provide some theoretical knowledge of how blockchain can be used in the real estate industry. A new innovative business model for the application of blockchain in real estate is being developed. Furthermore, a blockchain ecosystem for the real estate industry is proposed.

II. BLOCKCHAIN

The first big appearance of the blockchain was around 2008, when an anonymous individual or group of individuals called Satoshi Nakamoto wrote a paper about a digital currency called Bitcoin that was based on blockchain technology[1]. The blockchain is "distributed storage of timestamped documents where no party can tamper with the content of the data or the timestamps without detection." [2]. It is based on a P2P network, which means that two or more nodes can communicate together without a third party involved. All transactions in this P2P network need to be validated. A blockchain consists of data sets that are composed of a chain of data packages (blocks), where a block comprises multiple transactions [3]. Blocks contain block headers with metadata such as block number, the hash value of the previous block header, timestamp, nonce value, size of the block, and block data, a list of transactions that were included in a block. This concept ensures the integrity of the entire blockchain.

Blockchain technology can be developed in three ways: as a private blockchain system, a public blockchain system, or a consortium blockchain system. The public blockchain system is organized as a decentralized open-source system within which democracy rules; that is, there is no authority that controls it. It can be used by anyone who wants to participate in basic activities within the blockchain network. Disadvantages of public blockchain systems include higher energy consumption for maintenance as well as the existence of malicious programs that aim to steal tokens. The implementation of a private blockchain allows only verified users to access the network. Unlike public blockchains, private ones are centralized and controlled by their users. In a consensus blockchain system, the consensus process is regulated in advance by a selected set of nodes.

Smart contracts can be defined as the computer protocols that digitally facilitate, verify, and enforce the contracts made between two or more parties on the blockchain [4]. Smart contracts refer to a series of computer codes and protocols that can automatically execute and enforce an agreement when the specified conditions between two parties are met. They enable the immutability and trustworthiness of blockchain transactions without intermediaries.

III. BLOCKCHAIN IN REAL ESTATE

Many people today, when they hear about blockchain, think about cryptocurrencies, but there are now many research papers that are all about how this technology can have an impact on other fields. The real estate sector is one of them. When we talk about real estate, the categories that blockchain technology can impact the most are land administration and real estate asset tokenization. The land administration category is about blockchain-based applications that are linked with land and title registration systems. The token is technologically connected with the cadastral data (geo-data) and property rights, including leases, mortgages, superficies, and other encumbrances and liens. The connection of title records with real estate and property rights is ensured by relevant blockchain records done by trusted third parties who have the authority to certify ownership, deeds, and other transactions with property rights. This is also called a hybrid approach, meaning that "it appears to offer a way to overcome blockchain adoption challenges by minimizing disruption while maximizing the benefits powered by smart contracts". [5] [6]. Tokenization refers to digitally representing real estate as a blockchain-based token. The token should represent property with all its obligations and rights.

In the previous part, we explained what smart contracts are, and here are some examples of how using smart contracts can be useful in the real estate industry. One of the advantages of using smart contracts is that they can have multiple signatures, which can be helpful because there could be more parties involved in the transaction process. For example, a smart contract can be designed to proceed with transactions with at least two signatures, so if the buyer and seller don't trust each other, they can then involve a third party. If conditions are met and both buyer and seller agree that everything is right, they can both sign and the transaction can proceed. On the other hand, when conditions are met but, for some reason, the buyer backs up, or vice versa, the seller can have a third-party sign the transaction, and the transaction will proceed. Another advantage of using smart contracts is that they are time-locked, which means they can delay transactions until the time that is set in the contract.

Using blockchain technology, it is possible to develop a system for monitoring the flow of documents for the transfer of real estate. It is possible to develop an online application in which users can attach all the complete documentation required for the transfer of real estate ownership. In this way, intermediaries such as real estate agencies or notaries could be excluded. [7]

When talking about the real estate sector, which includes renting out properties, blockchain with smart contracts can be used for automatic rent payments and thus enable secure collaboration between landlords and property owners.

IV. BLOCKCHAIN ECOSYSTEM IN REAL ESTATE

A. Business Model Canvas (BMC) for blockchain in the real estate industry

Customer segments. Customer segments can be defined as "the different groups of people or organizations that an enterprise aims to reach and serve" [8]. Customer segments that would benefit from using blockchain systems are people or companies that want to buy, sell, or rent real estate in a more transparent and secure way. Government institutions, especially the regulatory bodies that are responsible for land administrations, together with banks, would also benefit from using blockchain technology.

Key partners. Key partners are builders, investors, real estate agencies, banks, and government institutes. Also, technology companies develop application programming interfaces and software development kits [8].

Value proposition. Tokenizing real estate assets with the help of smart contracts is an alternative option to raising capital that simultaneously guarantees transparency, security, accessibility, and instant liquidity. Tokenization is a way to digitally represent ownership rights to real-world assets in the form of a token on a blockchain [9]. This way customers would have the possibility to trade tokens faster, in a secure and transparent way. It would also allow them to track transaction history and prevent fraud. Also, with smart contracts, customers would feel much safer because transactions would only proceed if all preconditions were met.

Revenue streams. Revenue is generated through transaction commissions, a platform fee, and cryptocurrency conversion.[9]

Key activities. Some of the key activities would be developing user interfaces, application programming interfaces (APIs), software development kits (SDKs), P2P networks, cloud data storage, and databases. Also programming smart contracts and wallet integrations with Know-Your-Customer (KYC) and Anti-Money Laundering (AML) protection [9].

Key resources. Key resources that we would need are a team of software and blockchain developers, and blockchain infrastructure. An adequate workspace with work equipment and storage is also needed.

Channels. Customers could be reached through advertising on various websites and mobile applications for selling or renting real estate assets. Social networks can also be used for communication between platforms and customers.

Customer relationship. Social media can be used to promote platforms but also to create a community of customer support for every question and help that customers need. Also included in developing loyalty programs would

be privacy, security, tokenized reward points, exchange or selling reward points, and discounts for token transactions [10].

Fig. 1. Business Model Canvas for blockchain in real estate

Cost Structure. The cost of developing a blockchain system. Platform maintaining cost. Salaries and workplace maintenance costs. Marketing cost for promoting platform. The price of the token is based on the value of the property itself, but what would make a difference is less cost of the expenses for intermediaries.

B. Blockchain ecosystem in the real estate industry

Blockchain can be enabled to improve the transparency of a system enabling regulators to catch and prevent fraudulent behavior. Some of the transaction costs for real estate can include title search fees, land transfer taxes, legal fees, agent fees, listing fees and notary fees [11]. Although blockchain cannot reduce all costs, some of these costs can be avoided by implementing this technology. In the previous part, when we talked about blockchain in real estate, we mentioned a hybrid approach to using blockchain technology, and based on that, we can propose a system that can be developed with automated transactions such as buying and selling a property. The whole process of buying and selling a property can be divided into a few phases. First, the buyer and seller make an agreement and initiate the property transaction. Then, with the approval of the notary, both parties sign the contract. After the contract is signed, the buyer transfers the payment to the seller's account, and here is where banks could be involved. When money is transferred, a transfer of ownership may be initiated as well. In this phase, the system will notify the local cadastral office to initiate the process of transfer of ownership and inform tax administration about the change of ownership. A taxpayer is obligated to pay the tax for the transfer of absolute rights. And after taxes are paid, the seller gets ownership of the property, and here is where we can say the whole process is complete. All documents and records about the transaction are added to the blockchain. The third parties that would have access to the system as well would be notaries and real estate agents. Real estate agents are needed to connect buyers and sellers, and the notary "conducts all the legal affairs related to the transfer of ownership, including administrative activities such as obtaining a real estate folio document from the cadaster as a proof of ownership, as well as initiating the procedure for registration." [12]

In this article, we propose a blockchain system for real estate that integrates various services for stakeholders in the real estate sector (Fig. 2.):

- **Builders and investors**- Builder or investor can be a person or a company that invests/build property for selling or renting purposes. There are many ways that globalization has impacted the real estate industry, and some of them are cross-border investments, but also off-shoring in certain parts of the supply chain [13] Blockchain can be used for tracking transactions through all supply chains, and this data would be available to all stakeholders in the blockchain system. Builders can also use blockchain technology with smart contracts to activate actions automatically, such as payment to a contractor, when an agreed-upon milestone has been reached. Evidence of this can also be automatically shared with authorized government institutions. [14] This way, all transactions would be more transparent, and this process would be more time and cost-efficient.

- **Sellers/Real estate agencies.** Property can be sold or rented by the individual who owns it or by the real estate agency that represents the rights of the owners of the property. The sellers can use the blockchain to tokenize their assets. There are several ways in which a real estate asset can be fractionalized, including joint ownership, physical subdivision, timeshares, and others. [15] These tokens can then be transferred using smart contracts. When we talk about renting, real estate agencies can use blockchain to create smart contracts that could automate cash flow between buyer, agency, and owner [16].

- **Banks**. Banks in the real estate industry act as trusted third parties when it comes to financial transactions within this sector. Banks also play an important role in giving loans for purchasing properties. Today, this process requires a lot of paperwork and time for risk management to check and verify whether loans should be allowed. With blockchain, all this information about properties or information parties involved can be brought to one place. This way, banks could use blockchain, where structured and standardized data can form the input for internal workflows and analyses, to better understand the risks associated with real estate. [17] Banks could also participate as trusted third parties when smart contracts with multiple signatures are designed, this way, banks can monitor or check financing easier.

- **Government institutions.** Government institutions play a limited role in regulating the real estate market. Some of the methods and instruments that government institutions use are legislation, taxation, licensing of market participants, transaction costs and procedures, and similar. [18] Tracking and maintaining real estate records is difficult and time-consuming. This system can also be vulnerable to record tampering. Blockchain technology with smart contracts can be used to record the data of all buyers and sellers, with chronological details of transactions. In this case, the Ministry of Justice would have a

system for transferring real estate between citizens that is less prone to fraud. Even if an authorized person alters the data, the blockchain infrastructure will show its details to impose transparency. This could also prevent corruption within government institutions. On the other hand, these records will be available to all stakeholders in the blockchain system; for example, if the buyer is interested in buying a property, he will use the system to search the property and see all records of the owner for proper verification of the land. [19]

- **Real estate customers.** Real estate customers can be individuals or companies that want to buy or rent property. Customers can use blockchain applications to get all the real-time data necessary for the desired property. Using smart contracts can help when buying properties that are under construction. The buyer can deposit money into the account on the blockchain, and when he gets the property, the money for the developer will be automatically unlocked [20]. This way, the buyer is assured that his money will transfer only if he has the right to the property.
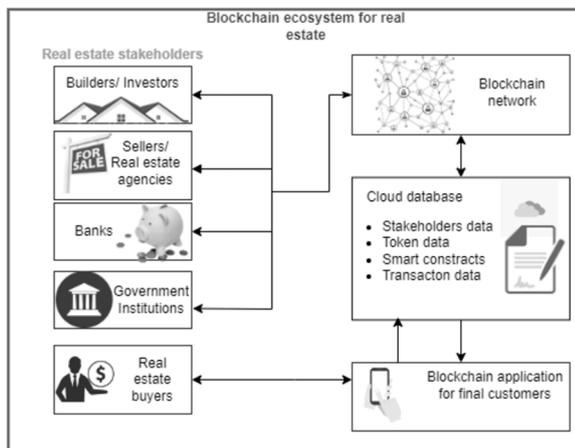

Fig. 2. Blockchain ecosystem for the real estate industry

V. CONCLUSION

Blockchain technology is a distributed ledger with growing lists of records (blocks) that are securely linked together via cryptographic hashes. Today, blockchain technology is considered to have several benefits for different sectors, such as real estate. The lack of transparency, high transaction costs, and the need for digitalization in commercial real estate companies give blockchain its game-changing potential.

The focus of this paper was on the benefits of including blockchain technology in the real estate sector, but there are also some challenges to this kind of system that need to be mentioned. One of them is the verification of the identities of the parties involved. If blockchain technology is implemented, it needs to address this issue, or it needs to check the real identities of the parties involved. Another issue that needs special attention while developing blockchain technology combined with smart contracts is the control of the legality and effectiveness of the contract. This means that a smart contract only checks the fulfillment of the pre-

conditions [21]. Based on this, we can say that before we can overcome all these challenges, the "hybrid approach" should make perfect sense, where blockchain technology together with traditional institutions could make the real estate system much more secure and valid. But if we think in the long term, some transactions in real estate, such as buying or selling properties, could be done without an intermediary.

The system could be designed just to notify all relevant institutions that need to be involved, such as a notary to conduct all the legal affairs related to the transfer of ownership, a bank about the payment, a cadaster to register the transfer of rights, and the tax administration to calculate taxes [12]. This way, all data would be available to all stakeholders in the blockchain system, and this would enable full transparency of the process. Since this system is based on smart contract features, work could include the implementation of this system using the Algorand blockchain platform for tracking transactions in the proposed ecosystem. Smart contracts will be coded using PyTeal programming language.

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