Real Estate Tokenization in Germany: Market Analysis and Concept of a Regulatory and Technical Solution

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***Abstract*—Real estate is the largest asset class and is equally popular with professional and retail investors. However, this asset class has the disadvantage that it is very illiquid, and investments have a high entry barrier in terms of equity. The adoption of the Electronic Securities Act in 2021 by the German Bundestag has created the legal framework for tokenizing real estate assets and their management using digital ledger technology in Germany. In this paper we describe a business concept for managing ownership and business transactions for real estate in Germany using blockchain technology. Besides its possibilities, we present a market analysis that comprises existing approaches and discusses legal limitations specific to the country.**

***Index Terms*—Blockchain Technology, Distributed Ledger Technology, Tokenization, Smart Contracts, Real Estate Assets**

I. Introduction

The market for managing, financing, and trading property and asset rights in real estate has enormous global impact, as real estate accounts for 60% of global assets [1]. From 2016 to 2019, global real estate market turnover increased from $7.6 trillion to $9.6 trillion, and global commercial real estate investments reached a new high of $830 billion in 2019. Furthermore, the importance of real estate is not limited to its high market value but also to its critical role in every person's live as a foundation for living and working. Because of their fundamental importance, property and asset transactions have been formalized and regulated for centuries. For example, real estate and all related rights are fully recorded in land registers kept by land registries and any change to the land register requires a not inconsiderable bureaucratic act.

Due to legal requirements, processes, such as purchasing, financing, and marketing of real estate have been strongly characterized by manual and paper-based handling, which reduces the efficiency for involved companies, e.g., notaries, lawyers, and banks [2]. On the other hand, real estate has traditionally been one of the most illiquid asset classes, requiring a high level of capital commitment and entailing long, expensive transaction processes. The pressure on the real estate industry to change is increasing from the demand of new market participants and existing investors. Furthermore, there is a desire for more access to this market, such as the growing interest in real estate ownership. In Germany, real estate is the most sought-after asset class among private persons.

Since the adoption of the Electronic Securities Act in 2021 by the German Bundestag, the use of blockchain technology for managing ownership rights on real estate in Germany is possible in a legally secure framework [3], which has been a major limitation before [4]–[6]. Regarding real estate and property rights, the blockchain technology offers enormous potential for digitizing legal aspects and practical processing [7], e.g.,

- **Capitalization of hidden reserves**: The refinancing of illiquid assets, such as real estate, via banks is limited to lending limits to a portion of the lending value set by the bank. By issuing tokenized shares in the form of Mezzanine capital, additional liquidity can be obtained beyond the lending limit [8].
- **Higher liquidity**: Illiquid assets are challenging to sell, and the time and costs incurred in doing so are priced into the valuation of the same in the form of a discount by market participants on the fair value. With tokenization, shares theoretically become sellable at any time and thus achieve a higher trading value [9].
- **Fractalization**: Splitting into small units lowers the minimum cost of entry to a reasonable level and also offers small investors the opportunity to have direct ownership and control, which is one step towards the Democratization of the Financial Market [10], [11].

In this paper, we present a business concept, that relies on a software system in which tokenizations of property and asset rights to real estate are created and managed in the form of security tokens in Germany. For this purpose, regulated securities are mapped in digital twins that combine the advantages of regulated classical securities with those of digital currencies. With the cryptographic tokens, contractual services are regulated by smart contracts that enable legally secure and fully electronic and automated processing of the resulting business transactions. The basic idea of this approach

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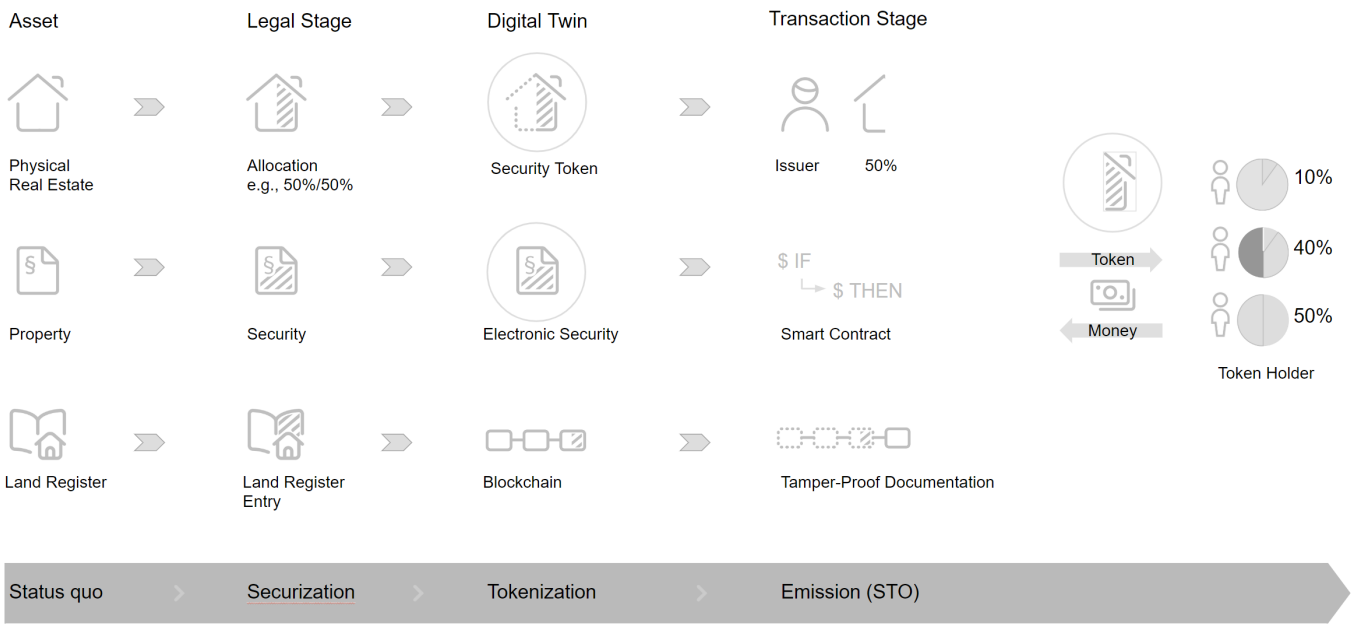

Fig. 1. Idea of tokenizing real estate assets. Digital twins of physical real estate assets are modelled as security tokens and the information on the ownership are stored in a blockchain. Using smart contracts, basic transactions, e.g., rents, are managed in an automatic way. The technology allows investors to buy and sell tokens and obtain ownership rights.

is shown in Figure 1, which has also been discussed in earlier works [2], [9], [12].

II. Concept

Our concept describes a white-label SaaS solution for managing ownership rights of real esate using blockchain technology. In order to demonstrate the functions and potential of such a software system practically, we start with a description of an use case which is shown in Figure 2. We then detail the technical architecture of the system.

A. Business Case

Real estate companies and project developers often need more equity as collateral to borrow from banks for new construction projects, renovations, and conversions. Since the financial crisis and the subsequent regulation, the requirements for equity ratios and liquidity reserves have risen sharply, and, at the same time, lending limits on existing properties have fallen; these conditions will become even more stringent in the wake of additional regulations such as Basel 3 from 2023 [13]. For banks, this means fewer loans granted and, thus, lower sales and profits.

Banks and other intermediaries can integrate the planned solution as white-label software into their inventory systems and Internet portals, thus setting up their own refinancing platform. If insufficient equity is available for a loan request from a property developer or project developer, the bank can refer him to the portal. The real estate company can then present its project to the bank's customers and raise the missing equity capital from customers as participation. Subject to compliance with certain conditions, the capital raised counts as Mezzanine capital and increases the balance sheet equity. This allows the real estate company to take out a loan, and the bank gains additional lending business and can monetize the use of the platform to customers and real estate companies with a fee.

Currently, no integrated SaaS solution for tokenization with individual parameterization and integration into existing systems and portals is available in Germany. While the individual technical components are available in various expansion stages for use by technically experienced personnel, there needs to be an integrated and user-friendly solution that can be operated and hosted in Germany in a legally secure manner.

B. Architecture

Our system architecture consists of several components corresponding to the processing pipeline's individual stages. The central system components are presented below as examples of essential functionalities.

The token issuer system represents the backend in the planned solution. The core component is the tokenization engine, which is used to tokenize real estate investments or securities backed by real estate. Electronic securities or security tokens are created, mapped, and managed in this process on the underlying distributed ledger and blockchain technology. In addition to the requirements of the underlying "real" securities, a number of other technical functionalities are taken into account in the development of the underlying backend infrastructure, examples of which are explained below:

- **Freedom of choice of on/off-chain functionalities**: Both the issuer (in the case of using the token holder portal) and the platform operator (in the case of white-label SaaS use) should have the freedom in customizing to have as many

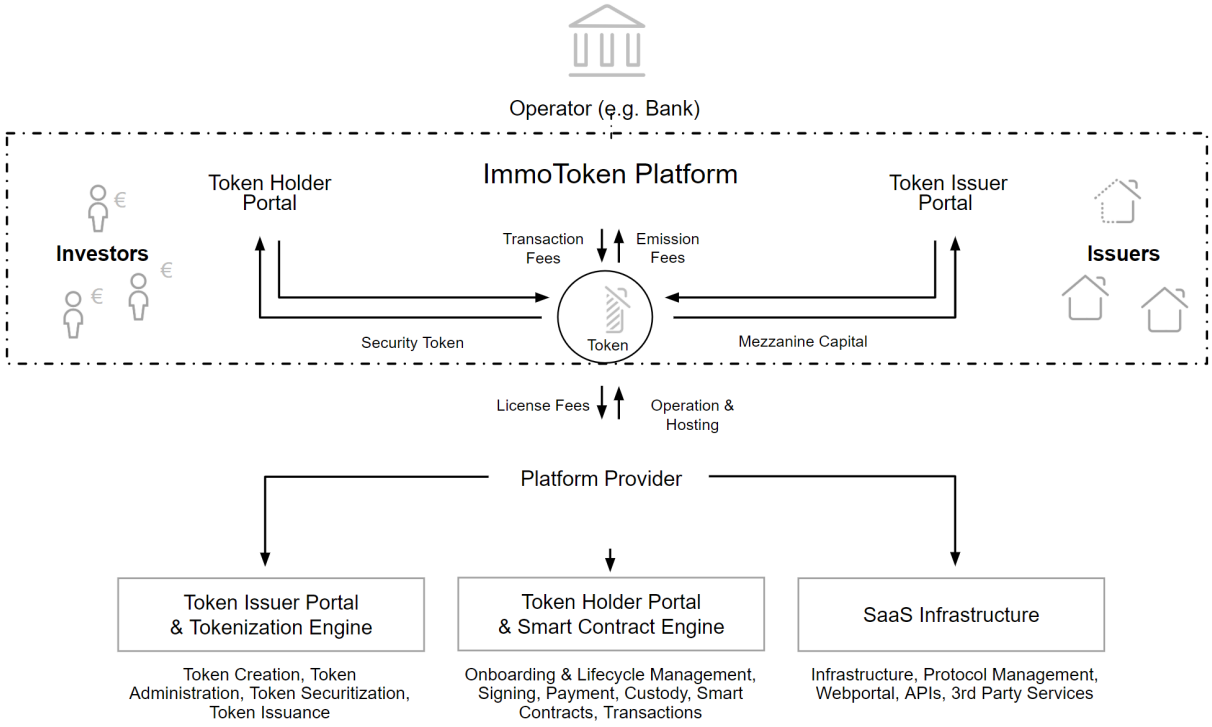

Fig. 2. White-label platform use case. The platform provider receives license fees for operation and hosting the platform. The operator receives transaction and emmision fees by allowing investors and issuers to interact.

functionalities as desired and permitted in the security by contract or regulatory law, initially also executed off-chain, i.e., outside the blockchain or smart contracts.

- **Upgradeability**: Within the smart contract engine, smart contracts should be individually upgraded for each token by the platform operator to correct critical errors or security problems.

The Token Holder Portal enables stakeholders to participate in token-based issuances via a fully digitized and paperless subscription route. As a frontend, it provides interactive user interfaces.

III. Market Analysis

Two main aspects must be considered before making a market entry decision: the current competitive situation, i.e., existing providers, and legal restrictions. Both aspects are considered below for Germany.

A. Existing Providers in Germany

The use of blockchain technologies in the real estate industry is still at a very early stage of development, not only in Germany but also worldwide [9]. The few existing providers of productive solutions are initially concentrating on selected, specific use cases. In addition, there are still significant geographical differences, and Germany needs to catch up to the USA, for example. A survey of existing approaches is presented in [14]. Existing work focuses on geographical regions, e.g. Europe [11], APAC [15], or on individual countries, e.g. Japan [12]. In our considerations, we close the gap by looking separately at the German market and presenting a concept similar to Kasprzak's Oracle Bank [16]. We further present our software architecture, similar to the considerations in [17].

Bitbond Finance GmbH conducted the first security token offering in Germany with the permission of the German Federal Financial Supervisory Authority (BaFin). The fundraising target of €3.5 million was not reached, with €2.1 million. However, this was not a real estate Security Token Offering (STO) but a corporate bond [18]. Bitbond has since changed its business model and is looking to move away from lending and borrowing (peer-2-peer lending) to become a technology service provider for tokenization. The company provides the technology for startup *Klickown*, which began offering real estate investments via STOs in 2020 [19]. All other projects supported by Bitbond, such as the placement of a token-based bond for real estate company *Vonovia*, are traditional financings for the companies themselves [20].While the clear technological standard for tokenizations worldwide is based on an Ethereum protocol, Bitbond uses the Stellar protocol. This has the advantage of supporting investments and transactions in micro amounts. However, Stellar for STOs has hardly established itself globally so far and tends to be more vulnerable to disruptions and attacks due to the smaller developer base and activity compared to Ethereum.

Another German company that appears on the German market as a provider of STO and "tokenization-as-a-service" is *Black Manta Capital Partners GmbH (BMCP)*. BMCP claims to have tokenized a property with a total volume of almost 12

million euros in 2020, together with the real estate developer *Tigris Immobilien GmbH* [21]. Upon closer examination, it becomes apparent from the securities prospectus that BMCP does not own the technology but advised Tigris by using the technology provider Tokeny *sàrl*, based in Luxembourg, for the tokenization.

One of the few German STO providers with its own technology is *Upvest*. Upvest originally started as a crypto custody provider and offers software or hardware for securing the private keys of security and other tokens. However, the responsibility for custody does not lie with Upvest, but with the company that integrates the service. The company makes its technology available to various companies that provide consulting and project services in the STO area. These include, for example, *Cashlink GmbH* and *Micobo GmbH*, but also so-called crowd-investing platforms for real estate such as *Exporo* and *Klickown*. However, Upvest changed its business model and no longer supports tokenization directly. Instead, it intends to develop a B2B solution as a securities trading bank, which in the future should enable banks and financial service providers to integrate their products with themselves [22].

B. Legal Requirements

The issue of regulation represents a significant market entry barrier for the proposed white-label solution. Despite initial regulatory frameworks, a comprehensive legislative classification of blockchain technology in the context of electronic securities and tokens has yet to take place in Germany.

First, the relevant laws and regulations for traditional financial service providers or financial instruments in Germany must be considered, e.g., *Kreditwesengesetz*, *Investmentgesetz*, and the *Zahlungsdiensteaufsichtsgesetz*. In particular, general licensing regulations, supervisory law, and administrative implementation regulations, e.g., accounting/tax regulations on the auditability of the journal or immutability of transactions on the blockchain, are relevant here. On the European level, *Directive 2004/39/EC on Markets in Financial Instruments* [23], as implemented in the *Zweites Gesetz zur Novellierung von Finanzmarktvorschriften* in Germany [24], should be highlighted as an example.

Regulation varies greatly globally and within Europe for security tokens as a digital or electronic representation of securities. In Germany, the financial supervisory authority *BaFin* initially published circulars on the subject, which generally define cryptocurrencies as virtual currencies and place them in the context of existing regulation. The regulation of the crypto custody business is relevant to the project, which came into force in 2020 [25]. In this respect, the custody solution incorporated externally into the solution must have this approval for an offer in Germany permissible under supervisory law. Adopting the law on introducing electronic securities, which took place in 2021, is also relevant [26]. This law stipulates, for example, that electronic securities, like traditional securities, are required to publish a securities information sheet or a securities prospectus.

IV. Discussion

The complexity of implementing the individual processes is high, resulting in a considerable realization risk for the intended overall system. One risk is the selection of a specific blockchain. No long-established blockchain manufacturers are comparable to the market-shaping database manufacturers. In this respect, selecting a blockchain technology that is still young represents a risky decision since it is still being determined whether and how the respective blockchain technology will be further developed and how any vulnerabilities that arise or are discovered will be dealt with. In addition, it is still being determined whether sufficiently low transaction costs can be guaranteed. Theoretically, tokenization allows for an arbitrarily high number of tokens for a specific real estate object's specific value and, thus, an arbitrarily small division into economic units. The actual transaction costs in a network regularly make these transaction volumes uneconomical. In extreme cases, the transaction costs can exceed the transaction value and thus make, e.g., the pro rata rent payment impossible.

Personal data, e.g., wallet addresses, is already protected by reference keys, e.g., hash keys that can only be interpreted backward when the data is imported. Even if a public blockchain is used as the underlying infrastructure, the solution is still not a generally accessible information system in the sense of data protection.

V. Conclusions

Although tokenization is still a young topic, regulators and regulatory frameworks are adapting quickly. Most countries, including Germany, treat tokenized securities defacto analogous to traditional securities in terms of regulatory and tax law [27]. Germany has also taken a pioneering role in this field by being one of the first countries to include cryptocurrencies in the German Banking Act and regulate the custody of tokens as early as the beginning of 2020. Increasing regulation increases costs but also leads to the professionalization of the entire market. One can expect that the resulting greater security for investors and planning certainty for providers will mean that, for the first time, even long-standing, experienced, medium-sized market participants can be convinced of the technology as customers. This will result in clearly defined target markets, which will continue to develop initiatives over the next few years due to the legal situation that has now come into effect. The planned software technology aims at various real estate stakeholders who create, market and manage the tokenizations. The leading target group for marketing the platform are issuing companies, such as real estate developers, housing cooperatives, and real estate funds. Banks that want to include real estate in their portfolios as part of asset management represent a particular target group. The platform is marketed at the same time for the notaries involved in the processes.

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