



The Impact of Technological Developments in Virtual Real Estate on Transactions: Virtual Reality, Blockchain, Tokens

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Abstract. Real estate has experienced the development of virtual reality, blockchain and token technologies, and has undergone a transformation from physical space to semi-physical space and virtual space to. The explosion of the Meta space concept has brought virtual real estate into the public eye. This paper focuses on the transformation that virtual reality, blockchain and token technologies have brought to virtual real estate. Virtual reality technology enables remote viewing and can help reduce the time consumed by transactions. Blockchain technology improves the reliability of property registration and helps to reduce the lengthy process of real estate transactions. Token technology divides property rights and facilitates the entry of retail investors into real estate transactions. This paper composes information from several aspects and illustrates using examples to conclude the technological development of virtual real estate and suggest feasible research directions. Overall, these results shed light on further exploration to guide the development of virtual real estate technology.

Keywords: Virtual Real Estate, Virtual Reality, Blockchain, Tokens.

1 Introduction

While 2021 is recognized as the "Year of the Metaverse", the "Year of Virtual Reality" is 2016. The five-year period encompasses technological developments related to virtual real estate: virtual reality technology, blockchain technology and then token technology. It also implies the transformation of real estate from physical space to digital space, with virtual reality technology providing a virtual experience, blockchain technology creating a network that frees real estate from physical constraints, and finally tokenization allowing for the division of property ownership to accelerate real estate mobility.

Virtual real estate in the metaverse is an integration of all three. The metaverse marketplace combines the capabilities of virtual reality, blockchain, and NFT technologies to create a virtual space and sell it as NFT to buyers [1, 2]. For example, a virtual shopping mall built on a network of blockchain technologies allows users to purchase commercial spaces as virtual real estate and earn money by leasing, pledging, advertising,

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and developing them to provide visitors with immersive experiences through VR technology.

Traditionally, the real estate industry has relied heavily on printed two-dimensional or three-dimensional images on websites to help close home purchase transactions. However, studies have revealed the inability of potential homebuyers to be positively influenced by these marketing methods [3]. Therefore, there is an urgent need for the real estate industry to undergo a digital transformation. Virtual reality is a technology that can provide users with a mental experience surrounded by a virtual environment [4]. In the real estate sector, virtual reality can help visitors to visit a house remotely through a computer, as well as help property holders to renovate their properties. In recent years, non-immersive VR has been used to showcase products on real estate platforms. Leading platforms around the world, such as Zillow, Beike, and ImmobilienScout24, have been implementing this technology since 2017 [5]. There are many researchers who are concerned whether virtual reality technology can have a positive impact on transactions.

Real estate transactions lack transparency, inefficiency, and complexity, transactions are privately negotiated, and transaction costs are high due to the involvement of third parties [6]. Blockchain technology becomes a promising solution. Blockchain is a distributed database [7]. The blockchain can provide asset and transaction verification between the two parties of a transaction and increase the transparency of the transaction market [8]. In fact, real estate transfers are also experiencing the use of blockchain and smart contracts, a phenomenon known as "proptech" [9]. The registration of property rights through blockchain to improve the transparency of real estate transactions and the use of smart contracts are important research directions for blockchain in the real estate field.

Retail investors are typically excluded from real estate investing due to capital constraints or inaccessibility to projects, and prevent investors from allocating more capital to real estate. In 2019, institutional investors will allocate only 10% of their capital to real estate, although portfolio theory supports a more optimal 30-60% asset allocation [10]. Real estate tokenization refers to the digitization of real estate assets into tokens, enabling investors to enjoy the benefits and appreciation of real estate assets by purchasing tokens. The tokens represent permissions for certain operations in the software [11]. Real estate can move with the help of tokens, increasing the liquidity of its transactions. Tokens representing partial ownership of real estate can be purchased by investors and these tokens can also be listed on secondary exchanges [12]. On September 21, 2021, Thailand launched SiriHub Token, the first regulated real estate-backed public initial token offering (ICO), located on the Tezos blockchain network [13]. The current use for tokenization technology in real estate is focused in the direction of property rights division.

This study will discuss the development direction of VR technology, blockchain technology and tokenization, as well as the limitations that have not been discussed yet, together with specific examples. In order to find solutions to the limitations that exist in the development of virtual real estate and to propose possible future research directions.

2 VR Technology

VR technology is used in real estate transactions as an aid to motivate buyers and may not increase the price of the transaction. As shown in Fig. 1, the acceptance of virtual tours by homebuyers is increasing year by year. This section compiles three studies related to this topic, analyzing them in terms of buyer experience and transaction price.

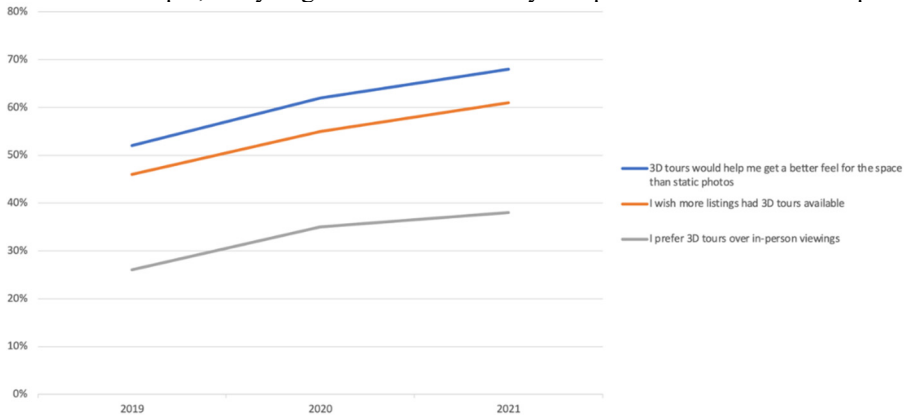


Fig. 1. Homebuyers' preference for virtual home viewing in 2019-2021. Data from Zillow.

In the study by Malaysian scholars, they used a questionnaire to collect data from an experiment with 60 potential home buyers. The data were then analyzed using paired samples t-test and partial least squares structural equation modeling (PLS-SEM). It was shown that there was no significant difference in the pleasure induced in real and virtual environments, but that pleasure stimulates purchase intentions in virtual environments [14]. Differently, it has been suggested that VR technology enhances the pleasure experience of buyers. A study from ScienceDirect used the SOR theory, where they verified the link between input (stimulus), process (organism) and output (response) for 232 participants. The results showed that the VR condition was associated with an enhanced positive experience and increased buyers' pleasure experience compared to the real environment [15].

Regarding the impact of VR technology on the transaction price aspect, some studies suggest that VR technology itself is unlikely to provide a price premium for sellers. The researcher collected data through real estate agency Web sites and processed the data using the Hedonic Pricing Model. The results showed that VR technology did not have a significant impact on the equilibrium sales price of real estate transactions [16]. It is implied that VR technology does not serve as a means for sellers to increase their prices.

However, the above study did not consider several variables that could affect the results. For example, as the distance between the property and the buyer increases, the pleasurable experience provided by VR technology may also increase, as the virtual experience saves more time and costs. In addition, VR technologies are non-immersive and non-immersive [17]. Immersive VR and non-immersive VR may not provide the same pleasurable experience. In terms of transaction price, the nature of the house may

become a new variable. This is because buyers' concerns will be different for properties used for residential or investment purposes. For properties used for investment purposes, buyers may be more concerned about the amenities near the property rather than what the property is furnished with, for example.

3 Blockchain

Due to the immutable and decentralized nature of blockchain data, there are important applications in the real estate sector to help record property rights in both directions. Fig. 2 describes the process of registering property rights and transactions through the blockchain. The property owner registers with the government department, which forms a smart contract through the blockchain. On the transaction side, the property rights are transferred through a three-way flow of smart contracts among buyers, sellers and the government. This section summarizes two studies that focus on title registration from urban America and rural India respectively.

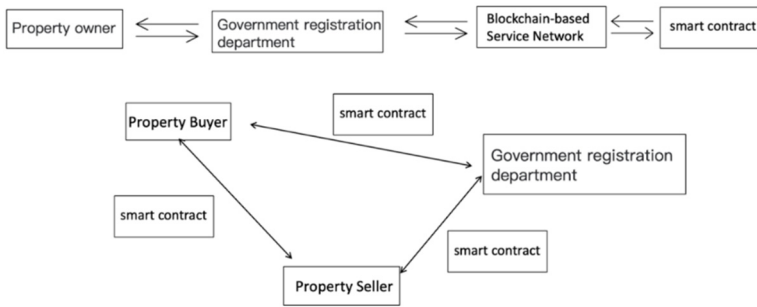


Fig. 2. Blockchain real estate registration process.

Scholars from MIT conducted a case study of the blockchain process in the American city of Nashville, Tennessee (Davidson County) by the comprehensive analysis obtained that blockchain can improve the reliability of registration as well as reduce the administrative costs and the time of registration [18]. A professor from the University of North Carolina, on the other hand, conducted a study of the Bhoomi program, a blockchain-based land registration project in a less developed region of India (Karnataka). A different point of view is presented: the digital divide can disadvantage the poor with different conclusions [19]. This is because for the poor, dealing with land related issues in a blockchain system becomes more time consuming and costly than before.

Although public blockchain systems do not require authorities to create infrastructure, most title registries remain licensing systems when used in practice, such as the two examples mentioned above. Because the public blockchain has no authority to manage and maintain the system, it is self-organizing and autonomous [20]. This is clearly not suitable for application to government systems. The government needs to be responsible for developing and maintaining the infrastructure, such as data centers,

nodes, network security, etc. This means that the government has the ability to control and change the ledger, but the burden comes with the infrastructure expenditure and its centralization.

4 Tokenization

Tokenized real estate investments have unique advantages over traditional securitization. The most prominent one is the division of property ownership, i.e., the economic benefit is divided into very small denominations for trading. This lowers the barrier to real estate investment and facilitates participation by retail investors. Fig. 3 illustrates the tokenized real estate market using NFT as an example. Real estate developers and token regulators create digital hair real estate place to convert real estate into tokens on which sellers and buyers trade. The two studies cited in this section are from the European and American perspective and the Asia-Pacific perspective, respectively.

Scholars from the Netherlands studied the financial and economic consequences of tokenizing 58 residential rental properties in the United States, which had an average of 254 owners. The data analysis verified that tokens allow for the fragmentation of ownership of properties, which leads to substantial risk sharing among households [21].

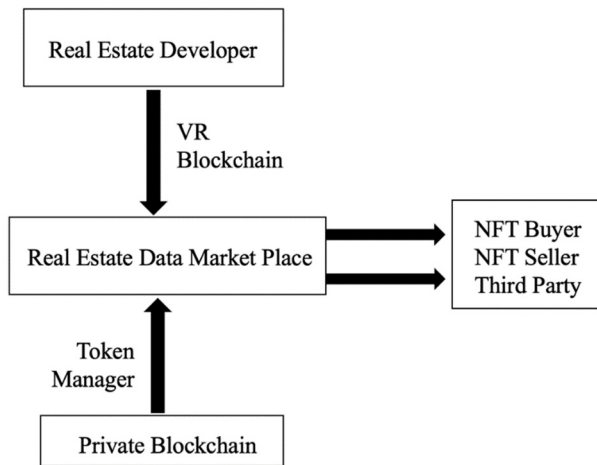


Fig. 3. NFT Real Estate Token Process.

Two scholars from Japan and Singapore, on the other hand, analyzed two real estate token investment platforms in the Asia-Pacific region, Kasa (South Korea) and SiriHub (Thailand). The data published by the data simulation platforms confirmed a significant increase in interest from retail investors compared to the period before tokenization [22].

Since tokens are built on blockchain technology, the token market is also a decentralized market. It is important to note that the lack of a centralized market may lead to

increased costs for investors. For example, the time spent to find a suitable exchange to trade properties and tokens may increase. In addition, the use of separate blockchain networks may raise isolated data and interoperability issues between different networks [23]. The resulting information about token prices and volatility would have to be collected separately from different platforms, and investors would spend extra time to understand or simply find third-party institutions. The second point is that real estate token prices may not reflect the economic value of a home. The current internet hype about tokenization may result in inflated token prices. In the long run, this may result in a loss of assets for investors.

5 Conclusion

In summary, this paper has sorted out the impact of technological developments on virtual real estate transactions from a temporal perspective and presented the limitations of current research. Virtual reality technology provides a tour of digital real estate that affects the buyer's pleasure experience but does not change the transaction price. It is worth noting that studies on these two aspects have not considered variables such as distance and property nature. Blockchain technology helps the digital transformation of real estate and has a prominent role in asset verification. It is also important to note the construction and maintenance costs of licensing systems for grassroots facilities. Tokenization is the current direction for new developments, and the ability to split property ownership is different from previous securities. There are limitations in research on whether third-party participation increases transaction costs and whether the current speculation on tokens will result in losses for investors in both areas. Overall, virtual reality technology, blockchain technology and tokens can help virtual real estate transactions remotely, improve transparency and reduce costs, significantly helping both sellers and buyers. However, there are limitations in the current research on these three technologies, and the paper look forward to the participation of later generations.

References

1. Kemec, A.: From reality to virtuality: Re-discussing cities with the concept of the metaverse. *International Journal of Management and Accounting*, 4(1), 12-20 (2022).
2. Gadekallu, T. R., Huynh-The, T., Wang, W., et al.: Blockchain for the metaverse: A review. *arXiv preprint arXiv:2203.09738* (2022).
3. Bolton, A., Butler, L., Dabson, L., Enzer, M., et al.: *Gemini principles* (2018).
4. Loomis, J. M., Blascovich, J. J., Beall, A. C.: Immersive virtual environment technology as a basic research tool in psychology. *Behavior research methods, instruments, & computers*, 31(4), 557-564 (1999).
5. Yan, Z., Meng, Z., Tan, Y.: How does virtual reality matter? Evidence from an online real estate platform. *Evidence from an Online Real Estate Platform* (2021).
6. Wouda, H. P., Opendakker, R.: Blockchain technology in commercial real estate transactions. *Journal of property investment & Finance*, 37(6), 570-579 (2019).
7. Muzammal, M., Qu, Q., Nasrulin, B.: Renovating blockchain with distributed databases: An open source system. *Future generation computer systems*, 90, 105-117 (2019).

8. Hoxha, V., Sadiku, S.: Study of factors influencing the decision to adopt the blockchain technology in real estate transactions in Kosovo. *Property Management*, 37(5), 684-700 (2019).
9. Nasarre, A. S.: Collaborative housing and blockchain. *Administration*, 66(2), 59-82 (2018).
10. Baum, A.: Tokenization—The Future of Real Estate Investment?. *The Journal of Portfolio Management*, 47(10), 41-61 (2021).
11. Li, X., Wu, X., Pei, X., Yao, Z.: Tokenization: Open asset protocol on blockchain. In 2019 IEEE 2nd International Conference on Information and Computer Technologies (ICICT) Kahului, HI, USA (2019, March).
12. Gupta, A., Rathod, J., Patel, D., Bothra, J., Shanbhag, S., Bhalerao, T.: Tokenization of Real Estate Using Blockchain Technology. In *Applied Cryptography and Network Security Workshops*. Springer, Cham (2020).
13. Pleyers, G., Poncin, I.: Non-immersive virtual reality technologies in real estate: How customer experience drives attitudes toward properties and the service provider. *Journal of Retailing and Consumer Services*, 57, 102175 (2020).
14. Azmi, A., Ibrahim, R., Abdul Ghafar, M., Rashidi, A.: Smarter real estate marketing using virtual reality to influence potential homebuyers' emotions and purchase intention. *Smart and Sustainable Built Environment*, 11(4), 870-890 (2022).
15. Pleyers, G., Poncin, I.: Non-immersive virtual reality technologies in real estate: How customer experience drives attitudes toward properties and the service provider. *Journal of Retailing and Consumer Services*, 57, 102175 (2020).
16. Yan, Z., Meng, Z., Tan, Y.: How does virtual reality matter? Evidence from an online real estate platform. *Evidence from an Online Real Estate Platform* (March 11, 2021).
17. Ventura, S., Brivio, E., Riva, G., Baños, R. M.: Immersive versus non-immersive experience: Exploring the feasibility of memory assessment through 360 technology. *Frontiers in psychology*, 10, 2509 (2019).
18. Spielman, A.: Blockchain: digitally rebuilding the real estate industry (Doctoral dissertation, Massachusetts Institute of Technology) (2016).
19. Kshetri, N.: Blockchain as a tool to facilitate property rights protection in the Global South: lessons from India's Andhra Pradesh state. *Third World Quarterly*, 43(2), 371-392 (2022).
20. Garcia-Teruel, R. M.: Legal challenges and opportunities of blockchain technology in the real estate sector. *Journal of Property, Planning and Environmental Law*, 12(2), 129-145 (2020).
21. Swinkels, L.: Empirical evidence on the ownership and liquidity of real estate tokens. *Financial Innovation*, 9(1), 1-29 (2023).
22. Chow, Y. L., Tan, K. K.: Real Estate Insights Is tokenization of real estate ready for lift off in APAC?. *Journal of Property Investment & Finance*, 40(3), 284-290 (2022).
23. Ghaemi, S., Rouhani, S., Belchior, R., Cruz, R. S., Khazaei, H., Musilek, P.: A pub-sub architecture to promote blockchain interoperability. *arXiv preprint arXiv:2101.12331* (2021).

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