

Blockchain and Smart Contracts in the Metaverse: Challenges, Potentials, and Current Status

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The research
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Introduction

The advent of blockchain technology has laid the foundation for decentralized, transparent, and secure transactions. In the virtual realm of the metaverse, the application of smart contracts promises significantly higher automation and trustworthiness in the exchange of values and services. Blockchain technology already serves as the backbone of some virtual worlds, enabling the digital representation of assets, secure organization of transactions, and the establishment of trust without a central authority. Within these blockchain environments, smart contracts are programmable agreements that autonomously and transparently execute arrangements between participants. However, behind these theoretical promises and academic discussions, the practical application of the metaverse reveals significant challenges and untapped potential.

The Entry Barrier

The metaverse offers a fascinating digital world

where smart contracts and blockchain technology play a central role. Yet, potential users often face significant entry barriers, primarily due to the complexity and cost of getting started. The need to create digital wallets, handle cryptocurrencies, and convert traditional currencies into digital ones requires a certain level of technical understanding and poses a major obstacle for less tech-savvy individuals.

The complexity of these processes deters many people who feel more comfortable in traditional, less technical environments. This creates a noticeable gap between tech-savvy users, who can fully exploit the benefits of the metaverse, and those who are excluded due to the complicated initial steps.

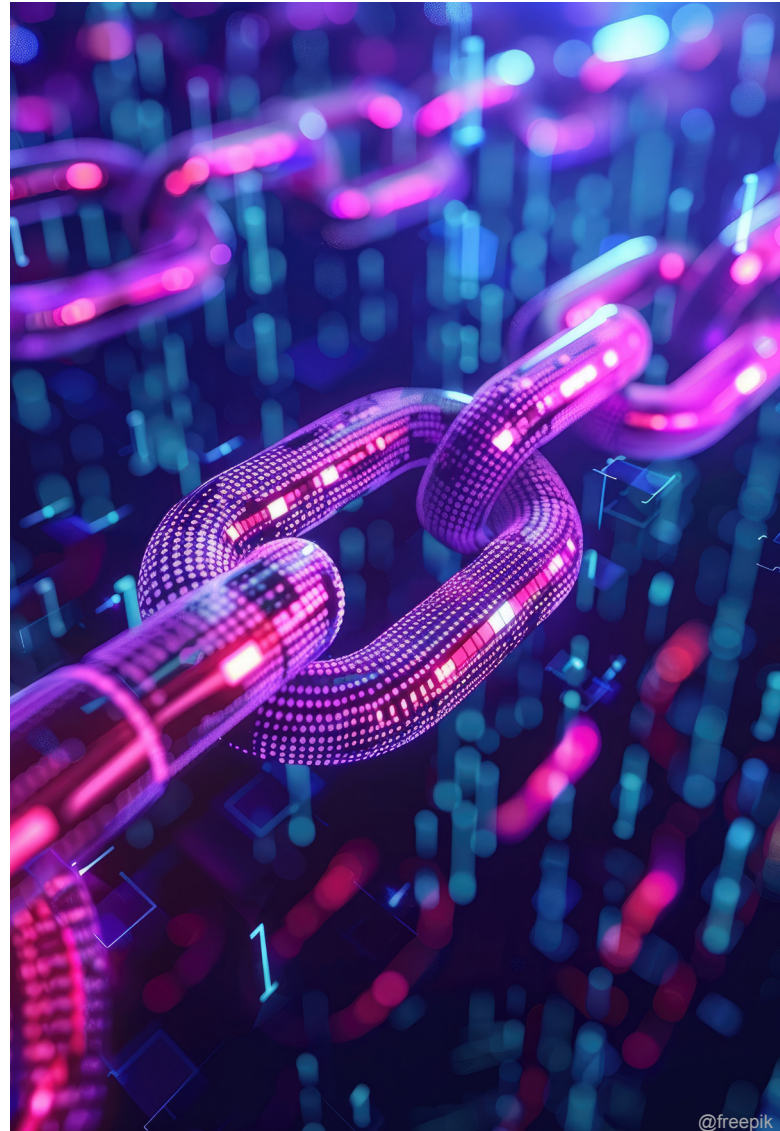
In contrast, centralized platforms in non-blockchain-based virtual worlds offer easier entry without requiring specific crypto knowledge. However, this raises the fundamental question of whether the benefits of decentralized blockchain platforms outweigh the higher barriers and costs for entry.



In this context, solutions that simplify entry, such as creating user-friendly interfaces and streamlining the use of smart contracts, are critical. The overarching goal should be to make participation in the metaverse more accessible and promote broader adoption.

Negotiations and Trade: Smart Contracts in the Background

In practice, the use of smart contracts is often limited to simple background processes, though they possess enormous potential for negotiations between users and the exchange of goods. However, the limited use of smart contracts in the metaverse is not due to a lack of knowledge about their functions but rather the scarcity of appropriate application points. The restricted application of smart contracts in negotiation situations may be due to the fact that current possibilities for individual transactions are not cost-efficient, and the relatively small, blockchain-based virtual worlds do not exhibit enough regular commercial activity. The focus here lies on the idea that smart contracts would be particularly useful in a comprehensive economic system, which has not yet been fully realized in these digital worlds. Therefore, the barriers to the broader application of smart contracts in the metaverse lie less in their technological complexity and more in the need to develop suitable use cases. Innovative approaches are required to fully harness the potential of these intelligent contracts and establish them as an integral part of a comprehensive economic ecosystem. The advancement of smart contracts in the metaverse should therefore focus not only on technological development but also on expanding their application fields to unleash their true transformative power.



Challenges in Transaction Time and Fees

In blockchain-based metaverses, critical aspects, particularly regarding transaction time and fees, significantly influence efficiency and attractiveness. Transaction time, the period from initiating a transaction to its final confirmation, proves to be a crucial parameter. An analysis of various virtual worlds reveals that blockchain-based metaverses exhibit longer transaction times compared to non-blockchain-based worlds. This results from the more complex process smart contracts must under-

go on the blockchain to fulfill their tasks. Another key factor in process execution is the platform fees of the blockchain. These costs are an integral part of transactions in blockchain-based worlds, unlike non-blockchain-based virtual worlds, which are free from such fees.

Longer transaction times and the fees associated with smart contracts present a challenge and raise the fundamental question of whether the benefits of blockchain technology, in terms of security and transparency, justify the potential drawbacks of higher costs and longer wait times. This trade-off becomes a central factor for the practical application of blockchain-based metaverses and requires innovative solutions to balance efficiency with the inherent cost burden.

Post-Contract: High Security, Low Flexibility

After a smart contract is concluded, key aspects come to the forefront, particularly the trade-off between security and flexibility. Blockchain technology undoubtedly ensures increased security in transaction processing due to the immutability of contract terms. This security aspect is based on the decentralized nature of the blockchain and the unchangeable nature of smart contracts. However, this security also brings a certain inflexibility. Smart contracts are immutable once they are created and uploaded to the blockchain. This means that even if errors are identified or changes are desired, no retroactive adjustments are possible. In traditional contract law, modifications could be made to adapt to changing circumstances. The immutability of smart contracts can therefore be perceived as a limitation in certain situations.

The compromise between security and flexibility thus becomes a central consideration in the application of smart contracts in blockchain-based virtual worlds. The security gains from immutability must be weighed against potential needs for flexibility to ensure that the technology meets the needs of users in an ever-evolving digital environment. Striking a careful balance between these two aspects will be crucial to fully harnessing the transformative power of smart contracts while also responding to the dynamic demands of the digital world.

Conclusion

The current development of smart contract applications in the metaverse shows that, despite theoretical promises and technological advances, significant challenges still exist. The pursuit of a decentralized, transparent, and automated economy in the virtual space aligns with the principles of blockchain technology. Nevertheless, obstacles such as technical complexity, financial barriers, and time delays in transactions are undeniable. It will likely take some time before this topic becomes truly relevant and applicable for businesses.

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