International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 01 | January - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

An Overview on Blockchain-Based E-Commerce Platform and NFT Marketplaces

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ABSTRACT

Blockchain technology promises to reshape the landscape of e-commerce and Non-Fungible Token (NFT) marketplaces. This survey paper explores the evolving integration of blockchain in e-commerce, focusing on its transformative potential. It envisions a future where secure, transparent, and decentralized exchanges of NFTs, and physical goods are the norm. With user-friendly interfaces making participation accessible for creators and consumers, this innovative approach redefines the dynamics of goods exchange on the blockchain. The paper highlights the empowerment of individual artists, creators, and entrepreneurs to establish independent platforms for NFTs, physical goods, or a combination of both, fostering a vibrant ecosystem of innovation and commerce in the blockchain space. This survey anticipates the profound impact of blockchain technology on e-commerce and the possibilities it holds for the future.

Keywords: *Blockchain Technology, Decentralized Platform, E-commerce, Non-Fungible Tokens (NFT) Marketplace, Ethereum, Security and Privacy, Transparent Exchanges.*

I. INTRODUCTION

The landscape of blockchain technology, continually evolving and improving, promises to reshape the way we engage with e-commerce and Non-Fungible Tokens (NFTs) in the future. As blockchain technology advances, it continues to hold its core features of decentralization and transparency, offering a solid foundation for innovative solutions. In this paper, we explore the transformative potential of blockchain technology in the context of e-commerce and NFT marketplaces. With an eye toward the future, we envision a dynamic ecosystem poised to empower a diverse array of stakeholders, from artists and entrepreneurs to tech-savvy users. The promise of this technology lies in providing a transparent and user-friendly environment, bridging the traditional gap that separates conventional e-commerce from the ever-evolving blockchain universe.

This novel approach to blockchain integration aspires to offer a digital marketplace where individual creators and businesses can thrive, expanding their online presence and realizing their full business potential. It signifies a fusion of the familiar with the novel, blending the well-established practices of traditional e-commerce with the emerging possibilities of blockchain technology. As we

delve into this survey paper, we embark on a journey to understand the potential and significance of this transformative landscape, exploring the ways in which blockchain technology and NFT marketplaces will redefine commerce in the future.

II. BACKGROUND AND SIGNIFICANCE

Blockchain technology plays a pivotal role in the ongoing transformation of e-commerce, offering a decentralized and transparent framework that challenges traditional models. With its inherent qualities, blockchain redefines trust and security in the digital marketplace by providing secure, immutable transaction records and ownership authentication. These characteristics enhance the security and reliability of e-commerce, creating a profound shift in how businesses and consumers interact online. By decentralizing authority and introducing smart contracts, blockchain mitigates the need for intermediaries, thus reducing transaction costs and increasing efficiency. The technology has the potential to revolutionize payment systems, supply chains, and data security in e-commerce, presenting opportunities for enhanced user trust and engagement. Table-1 represents distinction between Traditional Systems and Blockchain-Based Systems, highlighting various aspects in which they differ from each other.

Aspect	**Traditional Systems**	**Blockchain-Based Systems**
Data Structure	Centralized database	Distributed ledger
Trust	Central authority, single point of trust	Consensus mechanism, decentralized trust
Security	Vulnerable, single point of failure	High security via cryptography
Transparency	Limited visibility	Full transaction transparency
Control	Centralized control	Decentralized control
Speed	Potentially slow due to intermediaries	Fast, direct peer-to-peer transactions
Intermediaries	Often require intermediaries	Direct peer-to-peer transactions
Cost	Higher operational costs	Lower operational costs
Immutability	Alterable or deletable data	Immutable transaction history
Consensus	Not applicable	Consensus algorithms (e.g., PoW, PoS)
Verification	Central authority verification	Network nodes validate transactions
Permission	Open or permissioned	Public, private, or consortium blockchains
Use Cases	Traditional industries, government	Finance, supply chain, decentralized apps
Trustless Trans.	Not applicable	Trustless transactions
Cryptocurrency	Not integrated	Often uses cryptocurrencies (e.g., Bitcoin)
Data Storage	Centralized data storage	Distributed network storage
Smart Contracts	Not supported	Supports self-executing smart contracts
Scalability	Scalability challenges	Various mechanisms to address

		scalability
Anonymity	Limited anonymity	Pseudonymous and private transactions
Governance	Central entity control	Token holder-driven governance

(Table-1 Traditional Systems vs Blockchain-Based Systems)

Concurrently, the rise of Non-Fungible Tokens (NFTs) represents a watershed moment in digital ownership. These unique and indivisible tokens enable creators to monetize digital assets while offering collectors a novel way to acquire exclusive items. This innovative concept challenges established notions of copyright and intellectual property, ushering in a new era for content creators, artists, and collectors. NFTs have found application in various domains, from art and entertainment to gaming and collectibles, reshaping how value is assigned to digital assets and intellectual property rights. The convergence of blockchain technology and NFTs ushers in a profound shift in the digital realm's dynamics, bridging the gap between digital and physical ownership and presenting an array of novel opportunities.

The impact of these developments transcends individual sectors, extending to societal and economic spheres. Blockchain and NFTs redefine not only commerce but also the democratization of trade and entrepreneurship. They empower individuals to create, trade, and own digital assets, thus challenging established business norms and unlocking fresh economic opportunities. These technologies signify a move towards an equitable and transparent global economy, shaping the future of how value is transferred, stored, and appreciated, making it vital to comprehend their significance and potential.

III. LITERATURE SURVEY

Sr. No.	Paper Title	Author/s	Publication	Year	Summary
1	NFTs for Open-Source and Commercial Software Licensing and Royalties [1]	M. Madine, K. Salah, R. Jayaraman, and J. Zemerly	IEEE Open Access	2023	Proposes a decentralized software licensing system using NFTs and blockchain for both open-source and commercial software, enabling developers to register, license, and monetize their code while earning royalties from other projects.
2	Web 3.0 based NFT Marketplace [2]	S. Puranik, S. Kamble, S. Meshram, M. Chaudhary, V. Manekar, and H. Taiwade	IJERT	2023	Discusses the concept of a Web 3.0-based NFT marketplace, exploring the fusion of blockchain technology and NFTs for new online marketplaces.
3	A Blockchain Based Decentralized NFT Marketplace [3]	S. Sarumathi, A. Raja, A. Kumar, A. Yadav, and F. Khan	IJARSCT	2023	Introduces a blockchain-based decentralized NFT marketplace, leveraging the security and encryption capabilities of blockchain technology to facilitate the transfer and licensing of digital assets in various industries, including art, music,

					and gaming.
4	Toward Achieving Anonymous NFT Trading [4]	Z. Chen and K. Omote	IEEE Open Access	2022	Addresses privacy issues in NFT trading by proposing a new exchange scheme that hides the owner's address and uses a proof of commitment scheme, enhancing security and privacy during NFT transactions on platforms like OpenSea.
5	NFT Marketplace Based on Ethereum Blockchain [5]	Y. Gutte, A. Vora, Y. Sharma, and B. Bhardwaj	IJARSCT	2022	Explores the development and implications of an NFT marketplace using the Ethereum blockchain, discussing the integration of blockchain technology into NFT trading and sales.
6	An NFT Marketplace's Development and Scope in the Future of E-Commerce [6]	A. Singh, and V. Sharma	IJCRT	2022	Provides a guide for creating NFT marketplaces, featuring the example of RareBuy, while discussing blockchain selection, contract creation, legal concerns, and the potential advantages of NFT markets in the context of future e-commerce.
7	DigitalStack: A NFT Marketplace [7]	S. Khan and N. Agnihotri	IJCRT	2022	Explores the sudden surge in interest in NFTs and their impact on the concepts of "value" and "scarcity" in the context of blockchain technology, offering insights into the potential future of blockchain development and exchange.
8	Challenges of Implementing an NFT Marketplace [8]	Y. Mahatre, D. Dixit, R. Salunkhe, and Dr. S. Sharma	IRJET	2022	Examines the difficulties and obstacles in establishing an NFT marketplace, addressing issues related to technology, design, and potential legal concerns in the NFT Marketplaces.
9	NFT: Applications and Challenges [9]	W. Rehman, H. e Zainab, J. Imran, and N. Z. Bawany.	IEEE Explore	2021	Offers an overview of NFTs, exploring their core technologies, applications in various sectors, and the challenges they present in terms of security, privacy, environmental impact, ownership, governance, and property rights.
10	Blockchain Technology in E-Commerce Platform [10]	T. Xuan, M. Alrashdan, Q. Al-Maatouk and M. Alrashdan	IJM	2020	Explores the use of blockchain technology to enhance data security in e-commerce platforms, addressing the growing concern of cyberattacks and data breaches that can undermine trust and profitability in the industry.

(Table-2 Literature Survey)

The paper titled, *NFTs for Open-Source and Commercial Software Licensing and Royalties* [1] proposes a decentralized software licensing system using NFTs and blockchain for both open-source and commercial software. It allows developers to register, license, monetize their code, and earn royalties from other projects, addressing funding and royalty payment issues in the software development industry.

In *Web 3.0 based NFT Marketplace* [2] explores the concept of Web 3.0, a decentralized internet that empowers users and artists. The paper discusses how NFTs offer a new way to support creators by eliminating intermediaries and highlights the development of a decentralized NFT marketplace for secure, user-driven transactions.

A Blockchain Based Decentralized NFT Marketplace [3], is a paper which discusses the application of blockchain and NFTs across various industries. It highlights the growing interest in NFTs, their security through blockchain encryption, and proposes a system for transferring encrypted content to NFTs. The paper emphasizes the potential for NFTs to securely store and transfer digital assets while exploring their market growth.

The IEEE Open Access paper titled, *Toward Achieving Anonymous NFT Trading*, addresses privacy concerns in the NFT market by proposing a new exchange scheme that hides NFT owners' addresses during trading. It employs a proof of commitment scheme to protect identity and an anonymous payment method to prevent Ether tracking. The paper demonstrates the scheme's security and suitability for practical application, enhancing privacy and security in NFT transactions, particularly on platforms like OpenSea.

The paper titled, *NFT Marketplace Based on Ethereum Blockchain* [5], focuses on the growth of NFT markets and the rise of centralized NFT marketplaces. The paper proposes a secure platform for trading digital assets as NFTs, integrating Ethereum-based cryptocurrency. It explores the technical feasibility of a decentralized file system (IPFS) for secure digital asset storage, emphasizing the importance of blockchain technology in this context.

In the paper, *An NFT Marketplace's Development and Scope in the Future of E-Commerce* [6], introduces the concept of non-fungible tokens (NFTs) and their growing prominence. The paper provides a guide for creating NFT marketplaces using RareBuy as an example, outlining the development process, blockchain selection, contract creation, legal concerns, and advantages of NFT markets in the context of future e-commerce. It highlights the role of blockchain technology in enhancing security and transparency in NFT markets and sets the stage for future research on NFT-related topics.

DigitalStack: A NFT Marketplace [7] is a paper published to IJCRT, explores the sudden interest in NFTs and their impact on the concepts of "value" and "scarcity" in the context of blockchain technology. The paper aims to raise awareness of these questions and their potential implications for the future of blockchain development and exchange, particularly in the context of non-fungible virtual assets.

The IRJET Open Access paper titled, *Challenges of Implementing an NFT Marketplace* [8], examines the revolutionary potential of blockchain technology and NFTs in various creative industries. It discusses how NFTs represent digital forms of real-world objects, emphasizing their unique value and the opportunity for artists to gain financial remuneration. The paper also highlights the challenges of building a complex NFT marketplace due to the relatively new nature of blockchain technology, scarce resources, and the importance of NFT marketplaces at the core of various use cases.

In the paper titled, *NFT: Applications and Challenges* [9], provides a comprehensive overview of NFTs and their core technologies, blockchain and Ethereum. It explores various platforms for buying and selling NFTs and their applications in education, fashion, sports, and digital art. The paper also addresses the challenges of NFT technology in terms of security, privacy, environmental impact, ownership, governance, and property rights, highlighting the growing interest in NFTs and their diverse use cases.

Blockchain Technology in E-Commerce Platform [10] is a paper published to IJM, discusses the importance of secure data management in e-commerce due to the increasing cyberattacks. It proposes a

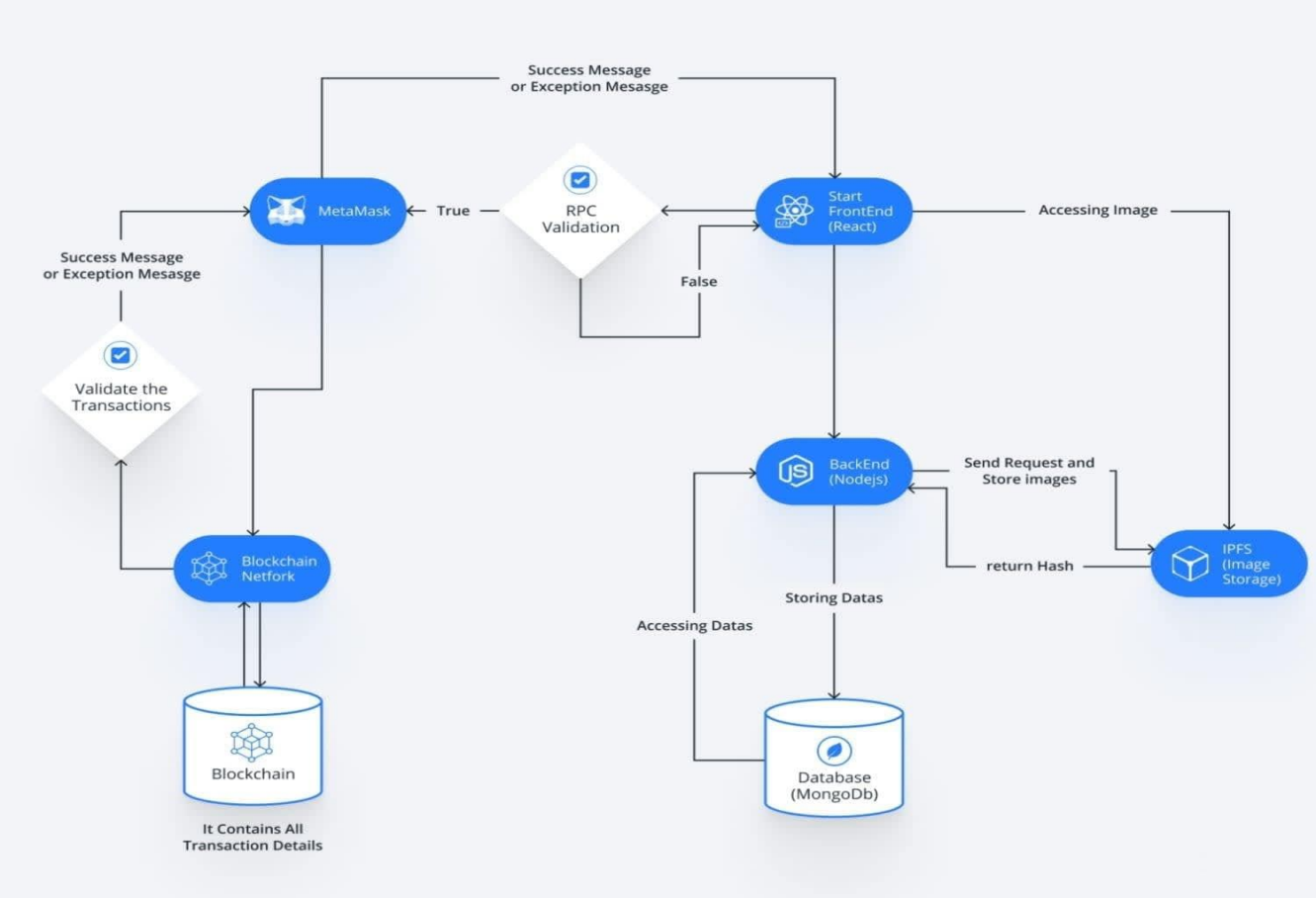
blockchain database management system to enhance data security and protect sensitive customer and transaction data. By introducing blockchain nodes, the system aims to secure the database and improve trust in the e-commerce platform, addressing concerns related to data breaches and the potential loss of customer trust.

IV. DISCUSSION AND FINDINGS

In our survey of blockchain-based e-commerce platforms and NFT marketplaces, we have delved into the existing literature to unravel insights, trends, and challenges that shape the digital commerce landscape. A significant focus of our exploration has been the potential integration of a goods exchange platform into the emerging ecosystem. This endeavour promises to empower individual artists, creators, and entrepreneurs by facilitating their seamless entry into the blockchain world. As we reviewed the literature, it became evident that while the integration of goods exchange platforms is still a relatively novel concept, it presents a significant opportunity to bridge the existing divide between the digital and physical marketplaces. This integration is poised to expand business horizons for artists and entrepreneurs, enabling them to extend their presence and embrace the benefits of blockchain technology, including transparency, security, and decentralized control. Moreover, our analysis revealed certain gaps and challenges, which, while not insurmountable, suggest areas that require further exploration. These include refining the user experience, addressing potential legal concerns, and fostering trust within the decentralized landscape.

Some important concepts related to NFT Marketplace Architecture are:

a. Blockchain Platform: The foundation of an NFT marketplace, where you choose a blockchain network like Ethereum, Solana, Tron, etc., to create, issue, and deploy NFTs. You also select NFT token standards like ERC-721, ERC-998, or ERC-1155, depending on your requirements.
b. NFT Storage Platforms: Store NFTs using software wallets, IPFS for decentralized data storage, or specialized platforms like Filecoin for redundancy and availability.
c. Frontend & Backend Framework: The user interface of your NFT marketplace is built using frontend libraries like ReactJS and backend technologies like Python Flask or Node.js for web apps, and Kotlin or Swift for mobile apps.
d. Smart Contracts: Use technologies like Ethereum Virtual Machine or BSC Virtual Machine to create smart contracts for NFT transactions.
e. Other Components: Database, search engine features, analytics, devops, and cache systems are similar to traditional web applications.
f. Testing and Integration: Utilize standard testing and integration technologies Truffle, Hardhat or any similar tool to ensure the smooth operation of your NFT marketplace.
g. Programming Languages: Common programming languages for NFT marketplace development include C, Python, JavaScript, and Solidity.
h. Frameworks: Web 3.0 frameworks like Thirdweb Truffle, Hardhat, Brownie, OpenZeppelin SDK, and Chainlink SDK assist blockchain developers in building NFT marketplaces efficiently.



(Figure-1 General Architecture of NFT Marketplace [11])

The findings from this paper also illuminate the promising direction in which blockchain-based e-commerce and NFT marketplaces are headed. Notable case studies and examples underscore the dynamic evolution of this space, while tables and images offer valuable comparisons of various platforms. We anticipate that these trends will continue to shape the future of digital commerce, offering a wealth of opportunities for both developers and users. While challenges persist, such as privacy and scalability, the literature suggests that these issues will gradually be overcome as technology evolves and the community's collective expertise grows. In this sense, the gaps and challenges we have identified serve as stepping stones to future enhancements, and as we look ahead, the prospects for this burgeoning field remain promising.

Figure-2 visually represents a comparison of few of the most popular NFT Marketplaces that are currently most used and provide insights on some of their important features.

Figure-3 provides visual representation for comparison of few of the most popular Blockchain and highlights their important features.

Platform	Main Login	Credit/ Debit Card	Lazy/ Gasless Minting*	Unlockable/ Hidden Content	Branded Token/Symbol Option**	Content Storage	Split Payments & Royalties	Verified Exchange Smart Contract	Verified NFT Smart Contract	Utility/Gov Token	Initial Sale Fee (platform)	Secondary Sale Fee (platform)	Networks	Link
OpenSea (Open)	Wallet	Yes	Yes	Yes	No	Centralized	No	Yes	No	No	2.50%	2.50%	Ethereum, Polygon	opensea.io
Rarible (Open)	Wallet	No	No	Yes	Yes	IPFS	No	Yes	Yes	Yes, (RARI)	2.50%	2.50%	Ethereum	rarible.com
Mintable (Open)	Email	No	Yes	Yes	Yes	Centralized	No	No	No	Yes, (MINT)	2.5%/ 5%(Gasless)	2.5%/ 5%(Gasless)	Ethereum, Zilliqa	mintable.app
Cargo (Open)	Email	No	Yes	Yes	Yes	Centralized	Yes	?	No	Yes, (GEM)	2.50%	2.50%	Ethereum, xDAI, Polygon	cargo.build
Mintbase (Open)	Wallet	Yes	No	Yes	Yes	Arweave	Yes(only Near)	?	Sometimes	No	2%	2%	Ethereum, Near	mintbase.io
Zora (Open)	Wallet	No	No	No	No	IPFS	No	Yes	Yes	No	0%	0%	Ethereum	zora.co
SuperRare (Curated)	Wallet	No	No	No	No	IPFS	No	Yes	Yes	No	15%	0% (+3% buyer fee)	Ethereum	superrare.co
MakersPlace (Curated)	Email	Yes	No	No	No	IPFS	No	No	Yes	No	15%	2.50%	Ethereum	makersplace.com
KnownOrigin (Curated)	Wallet	No	No	No	No	IPFS	Yes	Yes	Yes	No	15%	2.50%	Ethereum	knownorigin.io
Nifty Gateway (Curated)	Email	Yes	No	No	Yes	IPFS	No	Yes	Yes	No	15%	5%	Ethereum	niftygateway.com
Foundation (Curated)	Wallet	No	No	No	No	IPFS	No	No	No	No	15%	0% (via OpenSea)	Ethereum	foundation.app
Async (Curated)	Wallet	Yes	No	No	No	IPFS/Centralized	No	Yes	Yes	No	1%-30%	1%	Ethereum	async.art

Lazy/Gasless Minting: NFTs are platform specific until sold and don't require any gas fees or a one time fee and subsequent gasless NFT minting

Branded Token/Symbol: NFTs are often put under the token of a marketplace, a branded token(e.g "JohnArt" -> "JART") is your own dedicated custom token contract

(Figure-2 Comparison of Popular NFT Marketplaces)

	Reef	Ethereum	Ethereum 2.0	Bitcoin	Solana	Avalanche	Polkadot	BNB Smart Chain	Cardano	Cosmos	Fantom
Type	Layer 1	Layer 1	Sharding	Layer 1	Layer 1	Layer 1	Layer 0	BNB Layer 1 Chain	Layer 1	Layer 0	Layer 1
Consensus Algorithm	Nominated Proof Of Stake	Proof Of Waste	Proof Of Stake	Proof Of Waste	Proof Of Waste	Delegated Proof Of Stake	Nominated Proof Of Stake	Delegated Proof Of Stake	Proof Of Stake	Proof Of Stake	Delegated Proof Of Stake
Energy Consumption	000 GWh	112500 GWh	5.26 GWh	-	11.05 GWh	-	-	000 GWh	-	-	000 GWh
Finality	40 Seconds	600+ Seconds	-	3600+ Seconds	13 Seconds	1 Second	-	60 Seconds	600+ Seconds	1 Second	2 Seconds
Block Time	10sec	~17 Seconds	~12 Seconds	~600 Seconds	0.4 Seconds	1-5 Seconds	2-3 Seconds	3 Seconds	20 Seconds	1 Second	1-2 Seconds
Max Block Size	3.75 MB	-	-	<2 MB	10 MB	-	-	-	-	-	-
Throughput	465	14	30	7	20000	1000 (C-Chain)	1500	100	7	1000	10000
Smart Contracts	Yes, EVM & WASM	Yes	Yes	No	Yes	Yes, EVM	Yes	Yes, EVM	Yes	Yes	Yes, EVM
Validators	24	-	250,000	-	1634	1377	297	21	-	158	18
GitHub Stars	132	36201	2453	62702	7658	1476	5489	631	2595	3565	139
Applications	3	5000+	-	-	900+	100	485	350+	60	263	152
Founding Year	2020	2015	2021	2009	2018	2014	2016	2019	2015	2014	2018
On-Chain Upgradability	Yes	No	No	No	No	No	No	No	No	No	No
Working Product	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Transaction Fee	$0.02	$12.76	-	$26.89	$0.000025	$0.50	Varies By Parachain	$0.1	$0.21	$0.20	$0.10
Market Cap ($BN)	$0.17	$361.03	$361.03	$808.37	$29.76	$4.73	$19.77	$67.02	$32.65	$8.10	$1.29

(Figure-3 Comparison of Popular Blockchains [12])

V. SOCIAL IMPACT AND FUTURE DIRECTIONS

This paper examines the intersection of blockchain technology, e-commerce, and NFT marketplaces, it becomes evident that the socio-economic impact of this convergence is far-reaching. Blockchain-based e-commerce promises to reshape traditional business practices, fostering transparency and trust in digital transactions. This transformation extends to a multitude of industries, including art, entertainment, and gaming, offering new avenues for creators and businesses to monetize digital assets

and redefine concepts of ownership. Real-world applications abound, from art galleries accepting NFTs to musicians releasing albums as NFTs, revolutionizing how value is assigned to digital content. The empowerment of creators and entrepreneurs is a central theme, as individuals can establish their platforms, host NFT marketplaces, and engage in decentralized commerce.

In anticipation of the future, we pivot towards emerging trends and innovations within this dynamic landscape. The potential for blockchain-based e-commerce and NFT marketplaces is vast, with ongoing developments in blockchain scalability, privacy, and sustainability. New research directions beckon, spanning the realms of security, governance, and the legal frameworks needed to navigate this evolving terrain. The prospects for this field are brimming with promise, as blockchain technology continues to mature, creating opportunities for both researchers and entrepreneurs to redefine the boundaries of commerce in the digital age. The fusion of blockchain, e-commerce, and NFTs heralds a future where creativity knows no bounds, entrepreneurship finds new frontiers, and the exchange of digital assets is democratized and transparent.

VI. CONCLUSION

This survey of blockchain-based e-commerce platforms and NFT marketplaces reveals a landscape of innovation, potential, and transformation. The fusion of blockchain technology and NFTs is reshaping commerce, offering novel opportunities for creators and entrepreneurs. As this ecosystem evolves, we witness the promise of secure, transparent, and decentralized transactions, with far-reaching implications for various industries. While challenges persist, they are catalysts for progress. Looking ahead, the future of blockchain-based e-commerce and NFT marketplaces holds great promise, encouraging further exploration and innovation within this dynamic landscape.

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