Journal of Information System, Technology and Engineering
Volume 2, No. 3, pp. 269-279
E-ISSN: 2987-6117
http://gemapublisher.com/index.php/jiste
Received: July 2024
Accepted: August 2024
Published: September 2024

Blockchain and AI Technology Convergence: Applications in E-Commerce

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Abstract

The discovery of blockchain technology is considered capable of increasing data and transaction security. Everything recorded cannot be altered or changed retrospectively, making blockchain secure. Blockchain technology and artificial intelligence can be applied to various aspects, but this research review focuses on blockchain technology and artificial intelligence for e-commerce. E-commerce is buying or selling goods or services via a computer network. Currently, e-commerce has developed so rapidly that it has diverse business models and a variety of goods and services offered. E-commerce makes it easy to carry out transactions, but apart from all this, there are security problems in e-commerce transactions. This research aims to help future research by reviewing, organizing, analyzing, and synthesizing the application of blockchain technology and artificial intelligence to e-commerce. The method used in this research adopted the Kitchenham literature review method, which consists of three stages: planning, implementing, and reporting the review. The collection of articles is distilled into relevant articles about developments in blockchain technology and artificial intelligence for e-commerce. The results of this research are in the form of a summary of predictions that the use of blockchain in e-commerce will increase secure data related to transactions and feedback in e-commerce.

Keywords: blockchain technology, artificial intelligence, e-commerce.

INTRODUCTION

Blockchain is a database record that can securely record all transaction information. The data structure of a linked list built by hash pointers to the data store, location, and hash value of the data is called blockchain. The area about data storage and manipulation can be determined. The header of each block in the blockchain contains a pointer to the location of the previous block, which is the hash value of the data in the last block. It consists of a discrete set of client nodes running over a TCP network (Nakamoto, 2008). Transaction history is stored on the blockchain to form a decentralized and distributed database. Blockchain, with the name Distributed Ledger Technology, is the blockchain database that is appended only, can only be added to, and cannot be updated. Blockchain technology has several important functions: decentralization, invariance, openness and transparency, machine autonomy, and anonymity. Blockchain is the leading technology of Bitcoin and other cryptocurrencies (Dang

DOI: https://doi.org/10.61487/jiste.v2i3.71

et al., 2019); it addresses the trust and security of users, users with the system, and transactions between systems operating on it.

The use of e-commerce to conduct business-related transactions is growing and has become a priority for many companies (International Trade Centre, 2009). At reasonable prices, consumers can buy products and services faster, anywhere and anytime, from online shopping sites. Sellers must understand the needs and desires of consumers beforehand to provide them with the best online experience (Waheed et al., 2017) (Babalola, Lateef, and Zekeri, 2020). E-commerce has largely changed how people live, and it has become indispensable for everyone. However, while E-commerce brings convenience to us, it also uncovers many problems that must be solved. First of all, we need to worry about security, which includes a lot of content, such as information security. Security is a crucial issue which concerns public trust in e-commerce. Existing solutions utilize blockchain protocols to prove the credibility of transactions with a trusted framework (ETTF) (Xie et al., 2018). Within the blockchain, in addition to personal information about the parties involved in the transaction, blockchain data is open to all. Decentralization allows each node to participate in a system (Swan, 2015).

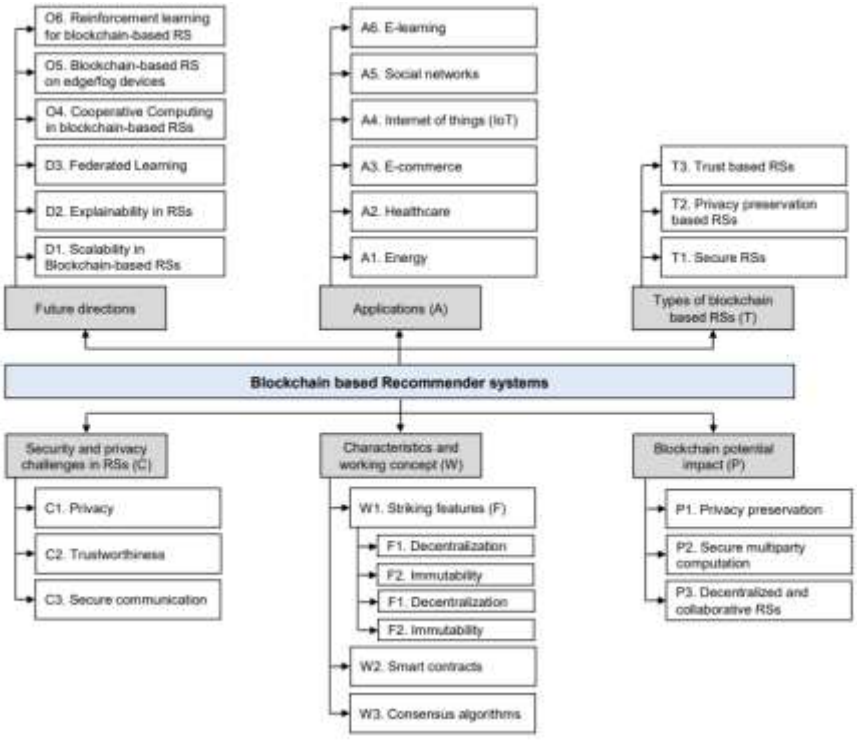

Figure 1. Taxonomy of Blockchain-Based Recommender Systems (Himeur et al., 2022)

This article reviews the identification of where blockchain technology has been used in e-commerce. The analysis considered the keywords used, the journal that published the article, the disciplines covering the research and technologies that have been adopted or are in the process of being adopted, and to what extent blockchain technology is utilized in e-commerce. The second part covers the search methods used; the third discusses blockchain technology. The fourth part provides analysis and is followed by implications; the fifth part concludes the discussion.

DOI: https://doi.org/10.61487/jiste.v2i3.71

METHOD

The article search strategy was carried out through Google Scholar, ScienceDirect, Scopus, Web of Science, IEEE Xplore, Springer Link, Emerald Insight, and ACM Library databases for the 2010-2022 period with the help of publish or perish 8 software, using the keyword "blockchain in e-commerce", after the data obtained based on the most citations were taken 200 article titles, then selected from 62 titles to 28 articles to identify the use of blockchain technology in e-commerce.

This study uses systematic review, which identifies, assesses, and interprets all existing studies related to a particular subject or research question (Kitchenham and Charters, 2007). Adopted for the survey then reviewed should consist of three stages: planning, implementation, and reporting, to build a roadmap reducing the risk of bias (Kitchenham, 2004). Defining the problem with a condition limitation approach (Brewerton and Millward, 2001) with stages: determining the source, period, and method used, material collection, descriptive analysis, choosing structural dimensions and analytical categories, and finally, material evaluation.

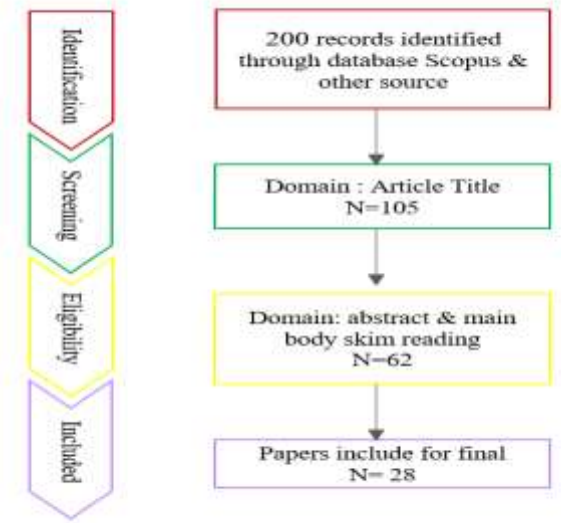

Figure 2. The Fow Diagram for Searching (Page, McKenzie, et al., 2021) (Page, Moher, et al., 2021)

RESULT AND DISCUSSION

Blockchain is the immutable and most challenging to tamper with distributed ledger technology (DLT), which is used in a shared, synchronized environment where users and traceable validate all transactions. It enables a decentralized environment where all network members can interact securely without needing a trusted authority. It, therefore, eliminates the need for a central entity by validating and storing all transactions through distributed consensus. The workflow of using blockchain for transactions is seen in the following figure (Fu and Zhu, 2019), (Dutta et al., 2020a).

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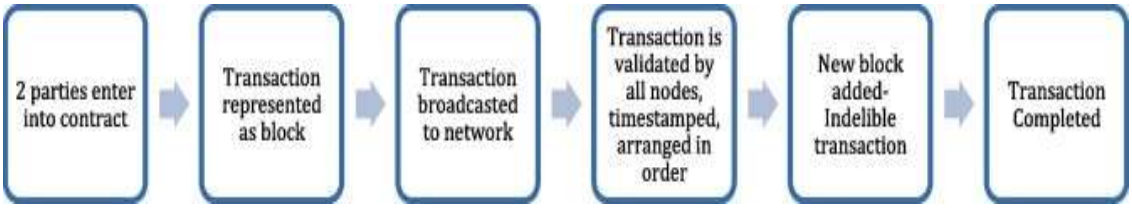

Figure 3. Blockchain Workflow

Blockchain is formed through a series of connected blocks, where transaction history can be easily traced through previous blocks, thus making the technology transparent and trustworthy. Each block contains its unique ID and has a hash of the last block, therefore ensuring the security of the transaction. All transactions are validated and recorded by users on the network. They are also timestamped, arranged in chronological order, connected to previous blocks, and cannot be changed once added to the network. One of the most essential functions that make a blockchain trusted, secure, and transparent is the so-called "consensus mechanism"; this entire blockchain structure makes it a trusted technology (Queiroz and Fosso Wamba, 2019).

Blockchain is the leading technology of Bitcoin and other cryptocurrencies and is one of the most secure technologies; and presents a new market structure in the form of existing blockchain-based transaction rules transaction platforms to cover popular market types, illustrating how demand burdens are managed under this blockchain-based market. The case study found that there was a cost savings of 18.9% of the total cost (Dang et al., 2019). The concept of peer-to-peer (P2P) trading, or transactive energy (TE), is gaining momentum as future networks restructure. with blockchain and Internet of things (IoT)) to promote the technical and economic efficiency of the system as a whole with the Vickrey-Clarke-Groves (VCG) multiple auction mechanism platform. Alashery conducted case studies to analyze and evaluate the proposed commerce framework and demonstrate the effectiveness of the solution in addressing possible market shortages (Alashery et al., 2021)

A version of a purely peer-to-peer electronic payment system that allows online payments to occur directly from one party to another without going through a financial institution. Digital signatures are one part of the solution, but the main benefits will be lost if you involve a third party to avoid double-spending. The solution to this double-spending problem is to use a peer-to-peer network. This network will create a timestamp of transactions by hashing, which will be included in the current proof-of-work hash-based chain (Nakamoto, 2008). Here's a comparison of blockchain usage (Verma, 2023).

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Table 1. Comparison of Blockchain

Comparison of Blockchain	Blockchain 1.0	Blockchain 2.0	Blockchain 3.0	Blockchain 4.0
Focus	The first generation of blockchain technology primarily focused on digital currencies and payments.	The second generation expanded the use of blockchain beyond digital currencies to include programmable intelligent contracts and decentralized applications (DApps).	The third generation is characterized by efforts to address scalability, interoperability, sustainability, and privacy issues.	The fourth generation is advancing blockchain network scalability, interoperability, and sustainability.
Key Innovation	The key innovation was the creation of cryptocurrencies, with Bitcoin as the pioneering example.	With its smart contract capabilities, Ethereum was the essential innovation in this phase.	Various innovations drive this phase, including sharding, Layer 2 solutions, interoperability protocols, and advanced consensus mechanisms.	The integration of artificial intelligence, IoT, and other emerging technologies enhances blockchain network capabilities.
Use Cases	Bitcoin was primarily a digital alternative to traditional currencies, allowing peer-to-peer transactions without intermediaries.	Smart contracts allow for a wide range of applications, including decentralized finance (DeFi), non-fungible tokens (NFTs), supply chain management, and more.	Aims to enable a wide range of applications, from high-performance DeFi platforms to enterprise-grade supply chain solutions, while supporting cross-chain interactions.	Applied in various industries such as supply chain management, healthcare, finance, and decentralized finance (DeFi).
Consensus Mechanism	Bitcoin and many other early cryptocurrencies used Proof of Work (PoW) as their consensus mechanism.	Ethereum initially used PoW but was transitioning to Proof of Stake (PoS) to address scalability and energy efficiency.	Some projects implement advanced consensus mechanisms like Delegated Proof of Stake (DPoS), Tendermint,	Use novel consensus mechanisms like Proof of Stake (PoS), Delegated Proof of Stake (DPoS), or other consensus

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			and Practical Byzantine Fault Tolerance (PBFT) to improve scalability and energy efficiency.	algorithms to improve network efficiency and security.
Scalability	Scalability was a significant challenge, leading to slow transaction processing times and high fees.	Scalability remained a challenge, leading to network congestion and high gas fees during periods of high demand.	Scalability solutions, such as sharding and Layer 2 scaling solutions (e.g., Lightning Network, Optimistic Rollups), are being developed and implemented to enhance transaction throughput and reduce fees.	Improving scalability is a significant goal of blockchain 4.0 to enable faster transaction processing and support a more significant number of users on the network.

The characteristics of blockchain that make it unique and promising for future industrial applications (Dutta et al., 2020a) include decentralized, transparent, immutability, autonomy, open source, anonymity, ownership and uniqueness, provenance, automation of intelligent contracts. Blockchain architecture consists of five modules that govern each operation and create protocols for blockchain applications (Dutta et al., 2020b) (Choi et al., 2020): data source module, transaction module, block creation module, consensus module, connection module, and interface.

Blockchain in E-Commerce

The use of e-commerce in Indonesia has grown and has many benefits and advantages to expand the market and remain competitive. However, in this case, it faces many challenges, such as fraud, commission fees, limited contact between buyers and sellers, and misuse of personal data. Blockchain implementation has the potential to address these issues with increased security and transparency through the application of cryptocurrencies and smart contracts to e-commerce for secure and efficient transactions in Indonesia (Ismanto et al., 2019). Aspects of electronic commerce researched by Jain include importance, facilitators, benefits, challenges, and scope within the Indian market (Jain, Malviya, and Arya, 2021), the use of blockchain on the Ethereum platform (Ranganthan et al., 2018), and the application of e-commerce in supply chain management (Liu and Li, 2020). This use is for protection of transaction processes, protection of customer data, and feedback when using e-commerce. Helping transform the e-commerce sector by improving payment systems, e-procurement, SC risk management, last mile logistics, and data security (Dutta et al., 2020a). For the end of the day, consumers expect that blochain technology can really guarantee that the feedback they

DOI: https://doi.org/10.61487/jiste.v2i3.71

create is displayed publicly without engineering.

Fabric architecture is a blockchain system developed to run distributed applications. Fabric embodies the permitted model using the portable membership concept, which can be integrated with industry-standard identity management (Androulaki et al., 2018). Blockchain applications include finance, security and privacy, IoT, reputation systems and public &; social services (Merkx, 2019), with the typical consensus algorithms used in blockchain. Blockchain is also very important for its use in the era of integrated industry (Xu, Xu and Li, 2018).

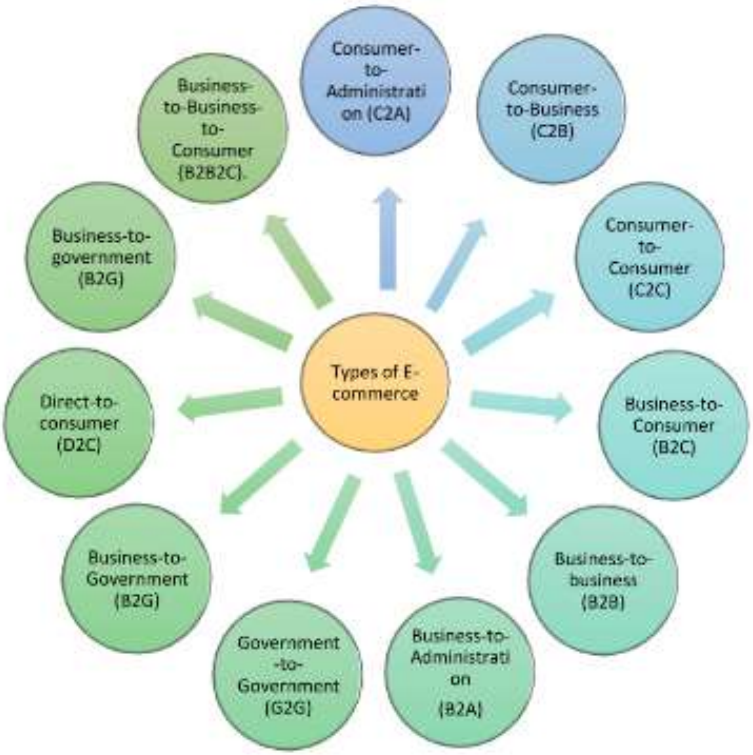

Figure 4. Illustration of Schematics of Types of E-commerce Based on Their Characteristics (Romindo, 2024)

The emergence of smart homes, smart cities, and other smart things, which will have an impact on the Internet of Things (IoT). When it comes to security, blockchain is one of the technologies that can be used for security requirements for IoT along with its attacks, threats, and advanced solutions (Khan and Salah, 2018). Blockchain technology, proven to alleviate some global supply chain management issues as distributed digital ledger technology related to transparency, traceability, and security (Saberi et al., 2019), as far as the energy industry, related to the security of its solution with blockchain (Andoni et al., 2019).

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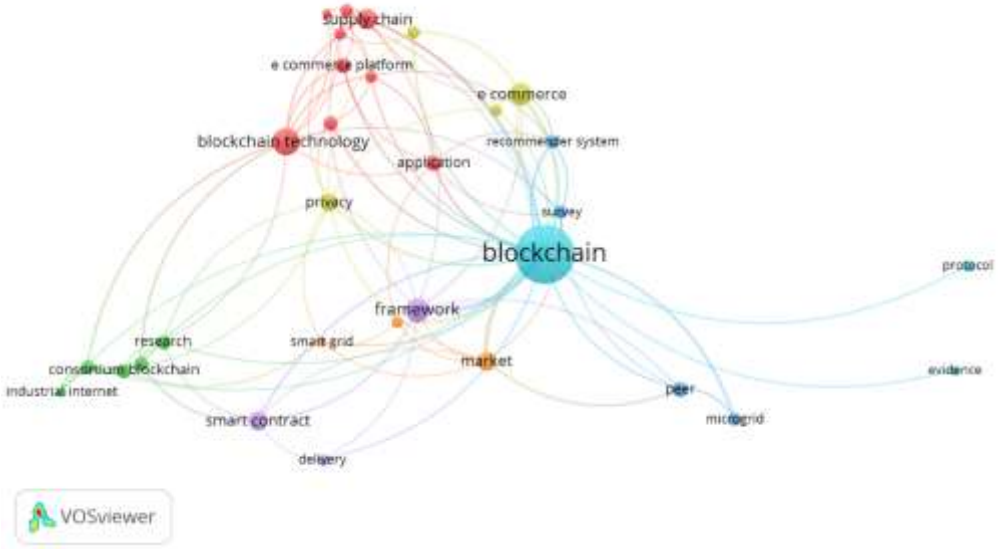

Figure 5. Mapping The Use of Blockchain in E-Commerce

In the mapping from the figure above, cluster 1 for the use of blockchain is e-commerce, in addition to cryptocurrency and supply chain management. This further strengthens that the use of blockchain in e-commerce in the future will increase to secure data related to transactions and feedback in ecommerce. Blockchain-powered applications have grown in various sectors such as supply chain, business, healthcare, IoT, privacy, and data management (Casino, Dasaklis and Patsakis, 2019) (Himeur et al., 2022).

Blockchain technology and artificial technology (AI) have been applied in transportation system applications (Singh et al., 2022). Blockchain enables authentication, confidentiality, privacy and access control, data sources, resources, and integrity assurance in the services it provides (Fu and Zhu, 2019), on IoT security (Queiroz and Fosso Wamba, 2019), intrusion detection systems (Meng et al., 2018) and RFID security. The protocol is compatible with decentralized databases and allows seamless communication with RFID devices (Sidorov et al., 2019).

CONCLUSION

Blockchain and artificial intelligence can improve the security of data and transactions and recommended due to its peer-to-peer nature and decentralized structure, Blockchain technology can be realized in many areas, including aspects of e-commerce. Blockchain-based technologies have major implications for e-commerce (Treiblmaier and Sillaber, 2021). For further privacy is recommended through the integration of artificial intelligence and blockchain (Bosri et al., 2021).

Blockchain technology and artificial intelligence for e-commerce, towards broader customer protection, about feedback, reviews and points as well as their shopping experience. This technology will be increasingly widespread and play an important role including in finance, logistics, health, education, automotive, transportation, energy resource management and more. With the ability to improve efficiency, transparency, and data security, blockchain can change the way we transact and interact as a whole. Meanwhile, artificial intelligence will

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continue to evolve and provide smart solutions. These two technologies will continue to open up new opportunities and expand the boundaries of possibilities in various sectors.

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