



# Advancements and Applications of Blockchain Technology: A Comprehensive Analysis

Monika L R<sup>1</sup>, Priya D B<sup>2</sup>, Punya N<sup>3</sup>, Mohammed Adnan Akram<sup>4</sup>, Dr. Manjunath Kotari<sup>5</sup>

<sup>1</sup> Alva's Institute of Engineering and Technology, VTU, Moodbidri, India, monikahosmane14@gmail.com

<sup>2</sup> Alva's Institute of Engineering and Technology, VTU, Moodbidri, India, 4a120cs098@gmail.com

<sup>3</sup> Alva's Institute of Engineering and Technology, VTU, Moodbidri, India, punyagowda.n29@gmail.com

<sup>4</sup> Alva's Institute of Engineering and Technology, VTU, Moodbidri, India, mohammedadkram7786@gmail.com

<sup>5</sup> Alva's Institute of Engineering and Technology, VTU, Moodbidri, India, mkotari@gmail.com

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## ABSTRACT

The digital code of blockchain technology has revolutionized every aspect of business, commerce and industry. This new system eliminates the need to store and manage codes by providing timely and immutable data. Unlike the traditional systems, these blocks are not specific to a particular organization but are monitored by a network of nodes or computers. Strong encryption protection and connect all blocks together. Blockchain's immutability and security have revolutionized fundamental concepts such as trust, ownership, identity, and financial transactions[6]. This technology enables secure, fast, transparent and pseudonymous transactions. A source of in-formation about blockchain, this article provides an in-depth study of blockchain's history, principles and popularity. Additionally, various consensus algorithms used in the blockchain technology are also carefully examined. Originally conceived as a system for cryptocurrencies, blockchain has evolved into a transformative force across industries. The article discusses the concepts, methods and applications of blockchain technology.

Blockchain's decentralized structure, driven by decentralized ledgers and encrypted confirmation, ensures reliability, and security and transparency of information transactions. This research contributes to the growing body of knowledge about blockchain and is useful for researchers, practitioners, and policymakers who want to better understand the technology's impact and future directions. Additionally, this article will examine various applications and real-life examples of blockchain technology and addresses related issues and problems [2-8]. The presentation of non-current events expands the range of the potential applications. This study provides a better understanding of all aspects of blockchain by providing an overview of the products.

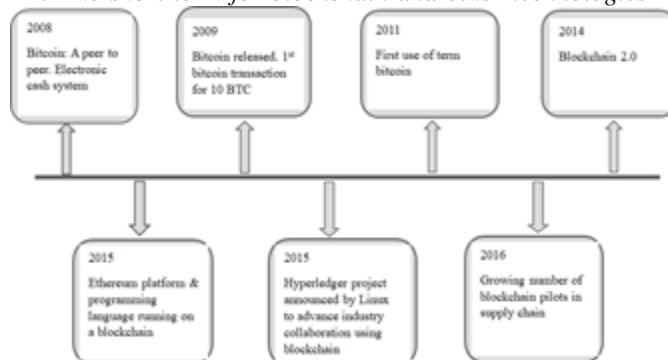
**Key words:** Cross-Chain Technology; Crypto economics; Initial Coin Offering (ICO); Toke- nomics; Supply Chain on Blockchain; Identity Management on Blockchain; RegTech

(Regulatory Technology); Compliance on Blockchain; Blockchain and Internet of Things (IoT); Blockchain and Artificial Intelligence (AI).

## 1. INTRODUCTION

It turns out that advances in blockchain technology are very different. The first period represented by Bitcoin focuses on digital currencies and financial transactions. The new era offers smart contracts that can complete the process with a simple transaction [4]. The third generation expands blockchain applications to areas such as healthcare, and government, and science. The revolutionary potential of blockchain lies in its ability to increase trust, transparency and security in the digital economy. [10] Blockchain speeds up the process and reduces debt by eliminating the need for intermediaries such as banks and lawyers. This machine has the power to change contracts, financial transactions and every aspect of daily life. As blockchain technology advances, discussions with four groups of artificial intelligence (AI) and digital intelligence show that it is creating an impact beyond initial use. However, for widespread adoption, issues such as scalability, management issues, and collaboration need to be addressed.[2] In this dynamic environment, the blockchain trajectory is emerging, heralding a future of distribution, security and transparency that will redefine the way we exchange and interact in the digital age.

### A. The short term for blockchain and other technologies



**Figure 1:** Crucial milestones in the development of blockchain technology. [6–10].

In Figure 1 each milestone is represented by a visual marker, and the image provides a comprehensive overview of the key events that shaped the development of blockchain technology. It serves as a reference for understanding major achievements and innovations in the field over time. Blockchain serves as a digital ledger employing encryption technology to safeguard and interlink digital data, known as "blocks." While the term "blockchain" was coined in 2008 during the launch of the Bitcoin cryptocurrency [1], its concepts trace back to 1980. In 1983, David Chaum introduced the concept of the blind signature [3], a novel encryption method enabling automated payments while preserving the payer's identity, payment amount, and third party's payment terms—essentially, a two-party authentication. Post-1991, researchers incorporated the concept of time, associating specific dates to enhance the security of digital data [4].

In 2004, Hal Finney II introduced Proof of Work (RPoW) [5]. The public unveiling of blockchain occurred in 2008 with the release of the document "Bitcoin: Peer-to-Peer Electronic Cash System," outlining the creation of efficient and transparent currencies without reliance on banks or centralized entities [1].

## 2. BLOCKCHAIN APPLICATION AREAS

The few applicable areas of blockchain technology are as follows:

### A. Governance

Governments have historically adjusted their governance models to societal and technological changes, evolving from early capitalist models to democratic bureaucratic structures [11]. Today, facing shifting societal needs and technological progress, governments are turning to new technologies to modernize their operations, especially in managing digitized records and improving data protection in financial transactions to combat fraudulent activities [8].

A blockchain-powered digital governance model presents a decentralized platform, aiming to ensure equitable access to government services and rebuild trust by overcoming the limitations seen in centralized systems. Governments worldwide are exploring blockchain's potential to enhance accountability and trust [4-8]. For example, Canada's National Research Council uses an Ethereum-based blockchain to ensure transparency in government funding. Cook County, Illinois, employs blockchain to fortify land record security, while Mexico's government utilizes it for transparency in public contracts through HACKMX. Additionally, in the USA, DARPA adopts blockchain to heighten cybersecurity measures.

### B. Insurance

Insurance's expansion to cover unconventional assets brings fraud and trust concerns [6]. The sector now includes body parts, pets, and more, broadening consumer needs. However, complex processes relying on many parties create

vulnerability, facing challenges like fraud, inefficient data exchange, and breaches, exemplified by Anthem Insurance's 2015 data theft, causing a \$375 million loss [9].

Blockchain offers promise by using smart contracts, in cryptography, and automation to overhaul insurance processes. Smart contracts ensure trust and transparency. The American Association of Insurance Services' openIDL network on the "IBM Blockchain" platform streamlines workflows, boosting accuracy. This highlights blockchain's potential to transform insurance by addressing vulnerabilities and fortifying security.

### C. The coordination and management of logistics and supply chain operations.

In logistics and supply chain management, incorporating blockchain technology offers a promising solution. Its unique features, like an immutable audit trail and record security, address sector challenges effectively.

Traditional supply chains relied on trust, but technological advances made this vulnerable [11-12]. Blockchain provides a decentralized platform ensuring record authenticity, transparency, and traceability, benefiting manufacturers, suppliers, customers, and partners, streamlining interactions. Globally, organizations adopt blockchain to enhance supply chain efficiency. IBM combats counterfeit drugs in Africa using blockchain, empowering informed purchases, demonstrating its real impact on ensuring product authenticity and consumer trust.

### D. Internet of things

Since its inception, the Internet of Things (IoT) has expanded across various industries [1-4], with Gartner projecting an installation of 27.4 billion IoT devices by 2025. This integration has seamlessly united the physical and digital realms, driving substantial progress in multiple sectors. However, the extensive network of connected devices generating vast data emphasizes the critical importance of data security and integrity [4]. The complex connections heighten the risks of both internal and external threats, potentially compromising data through loss or manipulation. Notable instances like the Mirai Botnet DDoS attack, disrupting East Coast internet services [5], and the FDA recall of 500,000 IoT-based pacemakers in 2017 due to vulnerabilities, underpin the significant challenges posed by IoT security.

### E. Travel and hospitality

Blockchain's impact on travel and hospitality is akin to a monumental transformation, reshaping the industry's core. Its diverse uses in the transaction handling mark an era of pioneering innovation, securing data, eradicating intermediaries, and enabling global access. TUI and others pioneer this shift: BedSwap revolutionizes inventory management, Lock Chain enables commission-free rentals, loyalty programs adopt tokens, and platforms like Beenest foster direct connections [3-7]. Airlines like Lufthansa utilize

blockchain for efficient bookings and baggage tracking, promising reliability. In this ongoing saga of innovation, blockchain leads the charge, crafting a realm defined by transparency, efficiency, and direct connections in travel and hospitality.

#### *F. Food and agriculture*

China's report highlights a staggering global loss of \$30-40 billion annually from food and agriculture fraud, sounding an urgent alarm in an industry reliant on third-party oversight. Blockchain technology emerges as a beacon of change, set to transform supply chains, payments, and tracking systems in agriculture [8]. It provides an immutable journey map from seed to consumption, addressing consumer demands for transparency and quality assurance. By eliminating intermediaries, reducing delays, and ensuring traceability, blockchain promises enhanced profits. Its potential spans efficient subsidy distribution, empowering fair compensation for farmers, and revolutionizing logistics, supply chains, and marketing strategies by creating a unified platform for producers and consumers.

#### *G. Identity management*

When it comes to self-regulation on a large scale, blockchain has become a pioneer of change. When problems occur in traditional systems, the blockchain remains set in stone to prevent data leakage [8-11]. The cryptography guru pioneered decentralized identity using zero-knowledge proof to provide anonymity and transparency. This is a place where privacy is preserved but authentication remains unchanged. This isn't just a thank you; it is beautiful architecture that creates a sanctuary where safety, anonymity and identity are compromised; a space where the individual is in control rather than in control. They are powered by the incredible impact of blockchain innovation.

The transformative potential of blockchain in identity of the management extends to providing substantial value for identity owners, issuers, and verifiers [10]. As exemplified by LifeID, which leverages blockchain principles to establish a universal account linked to an individual's identity, blockchain has the capacity to revolutionize the existing identity management processes.

#### *H. Intellectual Property (IP)*

Blockchain's impact in protecting intellectual property (IP) goes beyond a list; It is the foundation that hides the essence of creativity [6]. Immutable intellectual property: Blockchain records the content of intellectual property in an immutable ledger, creating an immutable method of ownership, limiting fraud and piracy.

Automated Royalty Transactions: Smart contracts can automatically manage royalties, ensuring fast and fair revenue for producers, bypassing intermediaries and improving the performance of the business

International impact: Based on intellectual property such as entertainment and software businesses receive sales, licensing and regulatory security to encourage innovation and trust[12]. Anti-Fraud: Blockchain transparency is a shield against fraud, providing undeniable realistic of ow and ensuring creators only get paid. Blockchain is not just a revolution; It is a revolutionary change in management skills. It's about creating an environment where creators are protected, innovation thrives, and fair pay is a reality, not just an idea.

#### *I. Real estate*

Traditionally, the real estate sector has depended on the middlemen like brokers to link sellers and potential buyers, overseeing transactions. This method often involved fees and numerous offline interactions, increasing the chances of fraud and inefficiency. However, with technological advancements like blockchain, there's an opportunity to transform real estate by digitizing transactions, promising increased security and advantages.

Smart contracts, essentially self-operating contracts integrated into blockchain, offer a way to automate seller-buyer transactions, removing intermediaries and their associated charges [11-13]. Moreover, real estate assets can be tokenized, representing physical properties digitally and enabling their trade on secure online platforms. This setup allows direct interactions between buyers and sellers, eliminating the necessity for brokers. Additionally, tokenization allows partial ownership of properties, making it feasible for individuals to invest in smaller portions of high-value assets that were previously out of reach due to cost barriers. Once tokenized, these assets become easily tradable, boosting market liquidity and accessibility.

Integrating blockchain into real estate holds the tremendous potential for streamlining processes, cutting costs, and enhancing transparency [5]. By eradicating intermediaries, automating transactions, and enabling partial ownership, blockchain has the capability to revolutionize the entire real estate buying, selling, and management landscape.

#### *J. Transportation*

Blockchain technology has the capacity to transform the industry, in increasing the efficiency, transparency, and security [5]. Application of blockchain in transportation includes:

Supply chain management: With the help of blockchain we can track the goods and materials in supply chain, increasing the efficiency, limiting to paperwork and reduction of delays.

Freight tracking: Employing blockchain to real-time track the location and status of freight shipments, improving customer service by providing accurate information and reducing the risk of theft and damage.

Dispute resolution: Leveraging blockchain's transparent and immutable nature for indisputable records of transactions,

facilitating swift and fair resolution of disputes by identifying the root cause through the entire transaction history.

**Trade finance:** Using blockchain to automate and secure trade finance transactions, reducing costs and risks associated with international trade.

**Vehicle data management:** Employing blockchain to store and manage vehicle data, such as mileage, maintenance records, and accident history, to enhance vehicle safety, efficiency, and provide valuable insights for stakeholders like insurance companies.

**Autonomous vehicles:** Using blockchain for well secure communication and coordination among autonomous vehicles, improving safety and efficiency by enabling the sharing of information about location, speed, and intentions.

**Decentralized transportation networks:** Implementing blockchain to create decentralized transportation networks, enhancing efficiency and resilience by facilitating easier sharing of transportation services like ride-hailing and carpooling [5-12]. As blockchain technology continues to evolve, more innovative applications for addressing specific transportation challenges are expected to emerge. Here's a breakdown of how blockchain technology can address specific transportation challenges:

- **Administrative Efficiency:** Blockchain is about more than efficiency; it does administrative work, design work, eliminates middlemen and processes information. Smart contracts are the jewels of the blockchain space, redefining everyday tasks like payments, data analysis, and settlements with automation perfection [9]. Besides efficiency, it also tells the story of freedom from the limited book of this document; The power of blockchain not only reduces costs, but also creates new music, making the management of projects more efficient, cost-effective and efficient. Glide is not supported by the manufacturer.

- **Shipment Tracking:** The magic of blockchain lies in its instantaneous prism of being able to tell the location and status of the shipment, making delivery more efficient and increasing customer satisfaction [1]. Traceability capability allows transportation providers to create a consistent supply chain, ensuring shipments are always safe and preventing delays, losses and damages. But it's not about the view; It is a definition of authentication, a journey where blockchain looks into the realm of timeliness and security, a journey where on-time delivery becomes a must rather than a necessity. Blockchain emerges as a business alchemist that will solve deep problems in transportation [3-6]. It not only encourages the collaboration and transparency; It orchestrates the music of efficiency, protection and trust. What makes it special is not just solving problems; It aims to create a new narrative for the

future of the movement, to reconcile the poor and precarious work, to reform the nature of business.

#### *K. Entertainment*

The nature of blockchain is immutable, trustworthy and transparent, and it has the power to change the lifecycle of entertainment content. It works to fight crime, enforce the law, and ensure the fair distribution of property rights. But this is more than a renovation; It is a catalyst that redefines how content is selected, shared and measured, disrupting the way equity and equity compensation intersect in economics in a changing landscape.

#### *L. Blockchain-based password less authentication*

Blockchain-based password less authentication is a novel approach to user authentication that leverages blockchain technology to enhance security, improve user experience, and strengthen compliance with data privacy regulations. It will eliminate the reliance on traditional passwords, which are vulnerable to various attacks, and instead employs cryptographic keys and decentralized protocols to authenticate users. This approach offers several compelling advantages, including: **Eliminating Password Vulnerabilities:** By eschewing passwords, it eliminates the risk of phishing, hacking, and brute-force attacks that often target password-based systems.

#### *M. Antiques and weapon trading.*

The integration of blockchain with fundraising and the philanthropy has led to a sea change enlightened by transparency, trust and efficiency. The ability to store immutable data, enable direct peer-to-peer transactions, and use smart contracts for maintenance is the foundation of people's trust. In this fight for adoption and compliance, blockchain serves as a beacon, improving the donation tracking landscape [3]. It acts as a guarantor, carefully collects and distributes all donations, and creates an ecosystem where the donor's faith flourishes. With a careful eye, blockchain enables financial institutions to be accountable, demonstrate accountability and trust, and paint a picture of the impact and efficiency of each donation.

#### *N. Auctions and crowdfunding*

Blockchain technology brings a wave of transparency, accountability, and security to the realm of crowdfunding. It also enhances transaction speed and cost-effectiveness. In the context of auctions, where bidding plays a crucial role, technologies of blockchain contributes a tamper proof and mechanism of immutable that safe guards bidding prices from manipulation, fostering a fair and transparent auction process. Blockchain's inherent characteristics empower it to revolutionize crowdfunding and auctions in the following ways:

- **Enhanced Transparency:** In the decentralized finance market, blockchain is taking center stage as a master of

conducting an audit trail and recording all movements of funds and execution of projects [8-11]. This transparency is more than a portal; This is a beacon of confidence and appreciation for investors, project managers and every- one involved in this beautiful spectacle of success. Its extraordinary content lies in the creation of harmonious music, crystal clear sound that creates unity of trust among stakeholders. This choreography is much more than a show; This is a sonnet of unshakable security and transparency, reflecting their rhythm in every deal and at every step of the project's development, creating an indelible resonance of trust.

- **Improved Accountability:** In the complex system of the accountability, blockchain plays the role of an indelible historian, recording every action and decision in a clear ledger [4-5]. This is more than just watching; It is a system of fraud and mismanagement that protects all investors [7]. Its extraordinary ability lies in creating immutable, digital evidence that protects the truth from tampering. Here blockchain is more than just a cool technology; It embodies fairness and weaves a shield of transparency that protects stakeholders from fraud and financial abuses.

- **Enhanced Security:** Blockchain is like an impenetrable fortress with strong and solid walls that protect transactions from unauthorized access and manipulation [12]. In this impermeable fortress, money finds refuge in compromise, preserving the sanctity of crowdfunding campaigns. This security is not just a lock, but a maze-like tapestry intricately woven to enhance every business. With its cryptographic power and decentralized flexibility, blockchain becomes the guardian of trust, ensuring the stability of money and the integrity of the masses. He stands there solidly, a messenger who provides the trust and security that are so important for victory in these situations.

- **Reduced Transaction Time and Costs:** In the symphony of transactions, blockchain appears as a master conductor, orchestrating fluid performances by removing the middle notes [6]. But the benefits go beyond business speed and cost reduction; creates music that delivers consistent returns to investors and planners [10-12]. This performance is not only spectacular; It's a revolutionary way of working that creates narratives that progress and integrate, empowering everyone involved in a fast-paced, cost-effective environment - a canvas where innovation thrives and opportunity abounds.

- **Tamper-proof Bidding Mechanism:** In the auction world, think of blockchain as an unshakable sentinel protecting the integrity of bids from an indelible ledger. Its de- termination ensures that competitions remain unchanged and unregulated, ensuring the integrity of participants and preserving the sanctity of the competition [3]. As a step backwards, blockchain has emerged as an avantgarde approach to crowd sourcing and competition that confronts transparency,

accountability, security, efficiency and fairness. As this amazing technology develops, it is poised to transform these industries, laying the ground- work for change and preparing for broader integration, with plans to increase violence in these areas.

#### *O. Plagiarism and copyright*

In the field of education, blockchain becomes an undeniable guardian that not only detects but also prevents crime, ensuring the originality and uniqueness of educational design [5]. It empowers people to claim ownership by creating an immutable bond for property, thus becoming a deterrent against copyright infringement and academic dishonesty.

Let's begin to explore in detail the various ways to demonstrate the power of blockchain to support equitable education:

- **Immutable Record of Intellectual Property:** Think of blockchain as a weak defense against legacy technology, a ledger containing timestamps, entries, and revisions to a nonexistent database [9]. This certification elevates teachers and schools to the level of a key decision maker, making them more accountable for capitalizing on students' efforts. Beyond the list, the source of truth is a light that emerges with the opposite of crime - in the area where moral education takes shelter in the castle that does not actually exist, a light that preserves the integrity of the search for innocence.

- **Plagiarism Detection:** Imagine a plagiarism in the investigation powered by the power of blockchain, the vigilant guardian of the sanctity of academic integrity. They dive into the blockchain reservoir, analyze the students' submissions for similarities, and thus keep it real [7]. But this tool goes beyond traditional analysis; They use cutting- edge techniques that carefully analyze the nuances and patterns of writing to increase the accuracy of detecting academic errors. [7-10] The integration of blockchain and advanced analytics is more than a matching game; It is the foundation where innovation flourishes and the center of justice where learning is protected with absolute certainty.

- **Copyright Protection:** In intellectual property ownership, blockchain plays the role of a stable custodian and extends its custodian role to learning assets protected by law [7]. Thanks to its cryptographic safe haven, blockchain empowers developers to place learning content in digital fortresses, thus preventing illegal use or distribution of their intellectual property [11]. This new concept not only provides support to members, but also creates a safe environment where the content of academic skills can be developed and protected from illegal use and violence.

- **Limpidity and Visibility:** In education, imagine a canvas with a transparent notebook on it; This is a blockchain masterpiece [2-5]. Its transparent foundation provides a non-descriptive narrative that beautifully documents all the dances

of scientific content at the decentralized level. Transparency here is not a passive observation; It acts as a breath of fresh air, breathing life into plagiarism investigation and providing teachers with a broad perspective on research across multiple platforms. Education based on the focus of blockchain has embarked on an unprecedented adventure through analysis and practical experience – a space where the journey of knowledge fosters a haven never seen before, yet unseen, where truth and duty rise to virtue.

- **Decentralized storage and Access:** In the storage of information, the distribution of storage of the blockchain plays the role of a guardian, affecting countless numbers of information [12]. This feedback can eliminate data loss or downtime, acting as an antidote to the dangers inherent in centralized storage. In this decentralized framework, students and teachers gain unrestricted access to academic credentials, supporting an easy-access ecosystem and facilitating cross-border collaboration. This shift not only increases the productivity of scientists, but also heralds an era in which knowledge moves beyond borders, disrupting the connection between people, students, and teachers around the world in the search for understanding.

- **Smart contracts:** They are placed at the core of the blockchain and become the leaders of the value revolution. These personal agreements have the power to alter the automatic effect by carefully guarding the creator's right to accept [2]. Their practical wisdom acts as a shield against unintentional acts of violence and paves the way for the honest recognition of wisdom. This intelligent automation not only improves integrity, but also supports integrity by honoring the essence of creativity with the respect it deserves.

Blockchain in education becomes a powerful guardian of justice, using its power to preserve academic authenticity. Its strength lies in creating an immutable agreement to protect intellectual property, investigate crime, uphold the law and promote culture [4-9]. As blockchain continues to evolve, its proliferation in education is also expected to strengthen the education system and support the community of gaining what is most important and true.

### 3. CONCLUSION

Blockchain is pioneering decentralization and transparency, revolutionizing business by weaving an intricate tapestry of secure transactions. With Bitcoin in 2008, it was born in an era driven by cryptography and decentralization, pushing it towards a time of change. Blockchain has begun planting the seeds of innovation, traveling beyond its origins into smart contracts, healthcare, governance, and more [10]. Its change lies in creating pillars of trust, transparency and security while reducing complexity and costs by avoiding intermediaries. Its transactions are continuous and continuous and are protected by a fortress of encryption that prevents tampering and fraud.

The list is not just a tracker; He is the architect of justice, shaping a new industrial paradigm were trust and transparency reign supreme.

### 4. FUTURE SCOPE

The future canvas of blockchain technology offers a rich, vibrant mosaic with the promise of seamless innovation woven into a beautiful fabric. In this constant change, the fire flies in the exciting conversation and the fourth sign of convergence are born, artificial intelligence (AI) and digital intelligence change paths a lot [4-7]. But with such hope comes great challenges: rising to the highest level of skill, taking control, following the path, and building bridges to each other. Overcoming these challenges becomes the key to unlocking the infinite potential hidden in blockchain Pandora's box.

The map goes beyond traditional borders; It paves the way for scalability solutions that redefine the nature of blockchain. Transaction speed and volume [11]. This partnership, this heartbeat, unites the diverse groups of the blockchain world in the music of growth and innovation. In this revolutionary process, the integration of artificial intelligence and blockchain has become a guide in revealing the unknown world of digital intelligence.

This sentence is not an uncertain horizon, but a real reality that changes business, people and the world. The model of our digital life. This is about making history that breaks barriers and realizes the promise of the connection between blockchain and infinitely scalable smart technology

### REFERENCES

1. Giuffrida R, Antonelli F, Spada P (2019) Promoting Sustainable Agricultural Practices Through Incentives. In: 2019 IEEE Int. Work. Metrol. Agric. For. MetroAgriFor 2019 - Proc., pp 242–246. 10.1109/MetroAgriFor.2019.8909281
2. Vangala A, Das AK, Kumar N, Alazab M. Smart secure sensing for IoT-based agriculture: blockchain perspective. IEEE Sens J. 2020 Doi: 10.1109/jsen.2020.3012294.
3. Basnayake BMAL, Rajapakse C (2019) A Blockchain-based decentralized system to ensure the transparency of organic food supply chain 103–107.
4. Kuo, T.T.; Kim, H.E.; Ohno-Machado, L. Blockchain distributed ledger technologies for biomedical and health care applications. *J. Am. Med. Inform. Assoc.* 2017, 24, 1211–1220.
5. Kilibarda, M.; Andrejić, M.; Popović, V. Research in logistics service quality: A systematic literature review. *Transport* 2020, 35, 224–235.
6. Jamil, F.; Hang, L.; Kim, K.; Kim, D. A novel medical blockchain model for drug supply chain integrity management in a smart hospital. *Electronics* 2019, 8, 505.

7. Petersen, M.; Hackius, N.; von See, B. Mapping the sea of opportunities: Blockchain in supply chain and logistics. *IT Inf. Technol.* 2018, 60, 263–271.
8. Savelyev, A. (2018), 'Copyright in the blockchain era: Promises and challenges', *Computer Law and Security Review*, Vol. 34, No. 3, pp. 550-561. · Doi: 10.1016/j.clsr.2017.11.008.
9. Scott, B. et al. (2017), 'Exploring the rise of blockchain technology: Towards distributed collaborative organizations', *Strategic Change*, Vol. 26, No. 5, pp. 423–428. Doi: 10.1002/jsc.2142.
10. Sharma, P. K.; Moon, S. Y.; Park, J. H. (2017), 'Block-VN: A distributed blockchain based vehicular network architecture in smart city', *Journal of Information Processing Systems*, Vol. 13, No. 1, pp. 184–195. doi: 10.3745/JIPS.03.0065.
11. Ouyang, X. et al. (2017), 'Preliminary Applications of Blockchain Technique in Large Consumers Direct Power Trading', *Zhongguo Dianji Gongcheng Xuebao/Proceedings of the Chinese Society of Electrical Engineering*, Vol. 37, No. 13, pp. 3737–3745. doi: 10.13334/j.0258-8013.pcsee.170370.
12. Li, G. et al. (2018), 'Energy management analysis and scheme design of microgrid based on blockchain', *Dianli Jianshe/Electric Power Construction*, Vol. 39, No. 2, pp. 43–49. doi: 10.3969/j.iisn.1000-7229.2018.02.006.