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THE APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ENHANCING ACCESS TO JUSTICE: A LOGISTICS-BASED APPROACH

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ABSTRACT

This research paper explores the transformative potential of blockchain technology in revolutionizing access to justice through a logistics-based approach. Access to justice remains a fundamental concern worldwide, with significant barriers hindering individuals' ability to seek and obtain fair legal remedies. Traditional legal systems often suffer from inefficiencies, delays, and accessibility issues, exacerbating the justice gap. This study advocates for a paradigm shift by introducing blockchain technology as a novel solution. By harnessing the immutable, transparent, and decentralized nature of blockchain, this research proposes a logistics-based framework designed to streamline and optimize the entire justice process. The blockchain-powered infrastructure facilitates secure storage, retrieval, and sharing of legal data, contracts, and judgments. Through a comprehensive review of existing blockchain-based justice initiatives and logistics management principles, this paper delineates the core components of the proposed system. It examines the potential impacts of blockchain adoption on key aspects of access to justice, including cost reduction, expedited case resolution, enhanced transparency, and increased legal empowerment for underserved populations. Furthermore, this research critically assesses the challenges, such as data privacy, scalability, and regulatory compliance, associated with implementing blockchain in the legal sector. It also discusses potential strategies for addressing these obstacles and fostering wider adoption. In conclusion, the paper underscores the potential of blockchain technology to revolutionize access to justice, offering a logistics-based approach that could bridge the gap between legal

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services and those in need. By fostering transparency, efficiency, and trust within the legal ecosystem, blockchain technology has the potential to pave the way for a more equitable and accessible justice system, ultimately benefiting society as a whole. This study provides a roadmap for further exploration and implementation of blockchain in the legal domain, opening new avenues for research and policy development.

Keywords- Block chain technology, justice, logistics, efficiency, legal system

INTRODUCTION

“Justice delayed is justice denied.” - William E. Gladstone

In the modern world, the pursuit of justice is not just a fundamental right but also a cornerstone of democracy and the rule of law. However, the intricate web of legal processes often presents a daunting challenge for individuals seeking access to justice. As we stand on the precipice of the digital age, blockchain technology emerges as a powerful tool with the potential to revolutionize the legal landscape. By introducing blockchain into legal logistics, we can unlock a new era of transparency, efficiency, and accessibility in the justice system. Blockchain, initially conceived as the technology underpinning cryptocurrencies, has evolved into a transformative force across various sectors. Its decentralized and tamper-proof nature has the potential to disrupt traditional legal logistics. Imagine a legal system where transparency, security, and accessibility are not mere buzzwords, but the pillars upon which justice stands. Blockchain can make this vision a reality. This research paper will present how introducing blockchain into legal logistics will increase the quality and access to justice. The research paper starts with giving an introduction to blockchain technology and its ‘know how’. It further extends to explaining blockchain as a part of legal logistics in different aspects of legal system and giving an implementation framework for the same. The paper also includes a case study of the country Estonia which implemented blockchain in its legal system, comparing and contrasting it with situations in India. There is no logistics without its negatives, like every coin has two sides blockchain technology has its own scope and limitations as well. The paper ends by highlighting the potential challenges in implementation of blockchain and giving reasonable solutions for the same. At its core, blockchain is a distributed ledger technology that records transactions in a transparent, immutable, and decentralized manner. These features make it an ideal candidate for addressing the challenges that have long plagued the legal system. In this research paper, we will explore how blockchain can

be harnessed to enhance access to justice, ushering in a new era where Gladstone's maxim is no longer an unfortunate reality.

1. WHAT IS BLOCKCHAIN TECHNOLOGY

A famous quote goes like “Technology is easy but not simple”. Since the advent of crypto currencies in 2008 we have been listening the word ‘blockchain’ every now and then. Before suggesting its implementation in the legal system it is important to know about what blockchain technology actually it and how it functions. As the word itself suggests Blockchain is a chain of blocks, where each block stores information. Like any shopkeeper maintains a record of transactions of goods in a book called ‘ledger’, blockchain is the ‘digital ledger’ of records where each block contains a record.¹

Like any other technology blockchain is simple but not easy. Even though Satoshi Nakamoto is credited with the invention of blockchain technology in 2008, its origin can be traced a long time before 2008. A unique idea known as "hashcash" was developed by Adam Back in 1997 which provided a means of preventing spam emails.

The idea of manufacturing money through a peer-to-peer network, dubbed "b-money" by Wei Dai, was inspired by this. Later combining all these ideas Satoshi Nokomoti introduced a decentralized ‘peer to peer’ technology called blockchain in 2008.² The Blocks in the technology digitally stores three things ‘Data’, ‘hash value’, ‘previous hash value’. Data that can be any relevant information (in case of bitcoins it was the transactions made through them). Now to protect these data stored there comes ‘hash-values’.

‘Hash’ can be understood as a fingerprint or security code of the data stored in that block that gets generated.³ Hash of the previous block also gets stored along with the hash of the current block. The block which initiates the block chain and does not have any previous block is called ‘Genesis block’. All of this structure makes it easy to track the history of blocks, to store unique data and difficult to make changes in the existing data.⁴

If somebody were to change one block’s data, the hash of that block will automatically change, also changing the ‘previous hash’ of the next block. Therefore, making change in one block would require

¹ Simanta Shekhar Sarmah, (2018). *Understanding Blockchain Technology. Business Intelligence Architect, Alpha Clinical Systems, USA.*

² *Ibid.*

³ *Center for Strategic and International Studies. (2018). Harnessing Blockchain for American Business and Prosperity. What Makes Blockchain So Seminal. USA.: Kati Suominen, Andrew Chatzky, William Reinsch and Jonathan Robison.*

⁴ *Supra note 1.*

to change hash of all the other blocks in order which is so time consuming that it makes the process practically impossible. Apart from this there is a concept of 'Proof of Work' that means you have to prove a particular time limit needed to make changes in one block.

Yet another added layer of security is that blockchain works on a peer to peer mode of network and each person in the network has a copy of the entire chain, so if you have to make any change, the consent of all others would be required called the 'consensus rule'.⁵ The development of the Ethereum platform in 2015 made it possible for blockchain to function with loans and connections. It was built on a smart contract mechanism, which ensured the execution of a transaction between the two parties. Ethereum's capacity to provide a quicker, safer, and more efficient environment led to the technology's widespread adoption.⁶

The three primary levels of the blockchain architecture are applications, decentralized ledgers, and peer-to-peer networks. The top layer of the network is Applications, followed by the Decentralized Ledger and the Peer-to-Peer Network at its base. The Blockchain application software is contained in the application layer. For instance, the private and public keys are created and stored by Bitcoin wallet software, which enables users to maintain control over their unspent bitcoins. An interface that can be read by humans is provided by the application layer, allowing users to monitor their transactions.⁷ The Decentralized Ledger layer in a blockchain architecture guarantees a reliable and consistent global ledger. In this layer, transactions can be organized into blocks that are connected cryptographically.

Tokens can be exchanged between two participants in a transaction, and each transaction must first pass a validation process before being accepted as a valid transaction. Gathering transactions into a block and adding it to the end of the current blockchain is the process of mining. The Peer-to-Peer Network, which houses Node, is the base layer in the blockchain architecture. To run the Decentralized Ledger, different kinds take on different duties and communicate using different message types.⁸ The way blockchain is efficiently used for bitcoins it can be used in a number of other domains including legal system which this paper talks about.

⁵ *Shraddha Kulhari. Building-Blocks of a Data Protection Revolution. The Midas touch of Blockchain: Leveraging it for Data Protection (pp. 15-22). Nomos Verlagsgesellschaft mbH.*

⁶ *Supra note 1.*

⁷ *Supra note 3.*

⁸ *Supra note 1.*

2. BLOCKCHAIN IN LEGAL LOGISTICS

Blockchain technology has become a powerful force with the potential to transform several sectors in recent years. Blockchain has several uses that go far beyond cryptocurrencies like Bitcoin, despite being frequently connected with them. One of the most promising uses is in the area of legal logistics, which has the potential to make the legal system more effective, transparent, and secure. Blockchain can help in various aspects of legal logistics and make the process more secure and smooth for general public increasing the access and quality of justice. Blockchain reduces the cost consumption and makes the system more secure that can increase public trust in the legal system. Following are certain domains where blockchain in a form of legal logistics can improve the access and quality of justice.

SMART CONTRACTS- One of the most useful use of blockchain is the digital contracts that eliminate the need of middlemen called 'Smart contracts'. The creation of smart contracts is blockchain's most significant contribution to legal logistics. A smart contract, is a computer program that, in certain circumstances, directly and automatically regulates the transfer of digital assets between the parties.

Similar to a typical contract, a smart contract operates with automatic contract enforcement.⁹ These self-executing contracts eliminate the need for middlemen like attorneys or notaries by automatically enforcing, verifying, or facilitating agreements. Different legal procedures, such property transfers, wills, and commercial agreements, can be streamlined with smart contracts to make them more efficient, affordable, and secure.¹⁰

Every smart contract has a blockchain address. If the contract has been broadcast over the network, it can be interacted with by using its address. The concept behind smart contracts is rather straightforward. They operate on the 'if-then' principle, for instance: If you send object A, then the amount (in cryptocurrency) will be sent to you.

The A object will be given to you 'only if' you transmit a specific amount of digital assets (cryptocurrency, such as ether or bitcoin).The digital materials indicated in the contract will be sent to me 'only if i complete the work.'¹¹

⁹ Paulina Jo Pesch, (2019). *Smart contracts. Blockchain, Smart Contracts und Datenschutz Risiken und Grenzen Blockchain-basierter Smart Contracts* (pp.13-22). Mohr Siebeck GmbH and Co. KG.

¹⁰ Jeremy M. Sklaroff, (2017). *SMART CONTRACTS AND THE COST OF INFLEXIBILITY* (vol.166 pp.263-303). *The University of Pennsylvania Law Review*.

¹¹Marsha Simone Cadogan, (2023). *Enforcing Smart Legal Contracts. Smart contracts as legal agreements.* : Centre for International Governance Innovation.

To conclude, firstly smart contracts can automate and streamline the execution of legal contracts, improving the cost-effectiveness of legal services. This can dramatically lower the obstacles that people and organizations, especially those with minimal means, face when trying to obtain legal aid. Blockchain's built-in security and transparency can increase public confidence in legal transactions. It can act as an unforgeable record of crucial legal events, such the execution of contracts, the transfer of property, or the possession of evidence, preventing disputes and the need for expensive litigation. Moreover, blockchain can facilitate the creation of decentralized legal networks, enabling individuals to access legal services and advice from anywhere in the world. This can bridge the justice gap for underserved populations and ensure that legal expertise is available to a more extensive range of people, ultimately democratizing access to justice.

LEGAL SUPPLY CHAIN MANAGEMENT- Consider introducing a blockchain-based solution to improve the effectiveness of the judicial system's supply chain. Create a permissioned, decentralized blockchain network where all contracts, court records, and legal papers are safely saved and timestamped. Real-time changes and record authenticity can be confirmed by legal professionals, clients, and regulatory bodies. With the help of this technology, paperwork would be greatly reduced, procedures would be streamlined, and stakeholder trust would increase.

Additionally, it might speed up resolutions and lower administrative burden, thus enhancing the effectiveness of the legal supply chain. Data integrity and privacy compliance should be guaranteed by routine audits and security procedures.¹²

INTELLECTUAL PROPERTY RIGHTS PROTECTION - In the digital age, where content and creative works are susceptible to piracy and unauthorized distribution, blockchain technology presents a viable alternative to protect intellectual property (IP) rights. Blockchain's inherent ability to build an unchangeable, transparent ledger makes it perfect for IP protection in the following ways: Firstly, intellectual property creation may be recorded and timestamped using blockchain technology. Using a blockchain, writers, artists, and inventors can safely register their creations and provide an unquestionable proof of ownership and the precise date of production.¹³ When establishing previous art for patent applications or demonstrating originality in copyright issues, this timestamp can be helpful.

¹² Reade Ryan & Mayme Donohue, (2017-18). *Securities on blockchain. The Business Lawyer* (Vol. 73, No. 1 pp. 85-108). American Bar Association.

¹³ Liya Luo, (2022). *Application of Blockchain Technology in Intellectual Property Protection* (vol.2022). Hindawi *Mathematical Problems in Engineering*.

Secondly, blockchain can enable smart contracts that automate IP licensing and royalty payments. These contracts can automatically execute payments to creators whenever their work is used, ensuring fair compensation and reducing the risk of infringement.¹⁴ Thirdly, blockchain technology can establish a safe and impenetrable repository for digital works of art, literature, and music. Each piece of material is connected to its author cryptographically, making it challenging for unauthorized parties to reproduce or distribute it without authorization.

Overall, blockchain technology can strengthen the protection of intellectual property rights, promote innovation and creativity, and make sure that artists are fairly compensated for their work in the current digital environment by offering a decentralized, secure, and transparent infrastructure.

IDENTITY VERIFICATION - Information about confirmed identities may be stored in a blockchain. Users can safely keep their personal information, including biometric information and documents like passports and driver's licenses, on the blockchain. Identity theft and fraud are less likely because this information is encrypted and can only be viewed with the user's permission.¹⁵

Second, by enabling authorized parties, like governmental organizations or financial institutions, to access and validate identity information in real-time, blockchain can speed up the verification process. This saves time and reduces redundancy by removing the need for people to constantly produce their identity documents.¹⁶

Additionally, the openness of the blockchain makes sure that any updates or modifications to identity information are documented and can be traced back to the original, boosting accountability and confidence in the verification process. Therefore we can say blockchain technology has the potential to revolutionize identity verification in the legal system by providing a secure, efficient, and transparent way to manage and authenticate personal information, ultimately enhancing security and reducing identity-related fraud and issues.

EVIDENCE MANAGEMENT- Implementing blockchain technology in evidence management in the legal system can enhance transparency, security, and efficiency. While ensuring the integrity of the evidence presented in court, this framework can help modernize legal proceedings and streamline the administration of justice. An example of how blockchain can be used for creating a reliable chain of evidence can be illustrated as, the weapon used as evidence was a bullet.

¹⁴ *ibid*

¹⁵ *Arshad Jamal, Rabab Alayham Abbas Helmi, Ampuan Siti Nurin Syahirah, Mariam-Aisha Fatima, (2019). Blockchain based identity verification system. Research gate.*

¹⁶ *Ibid.*

After entering a username, password, biological fingerprint, or facial scan, the officer or evidence gatherer will take a photo of the evidence and upload it to the Blockchain of Evidence (BoE) app. The officer will then gather and record the metadata. After that, the BoE app will create a hash specifically for the evidence, which will then be uploaded to a separate block along with the officer's signature, metadata, and other details about the evidence's condition. The physical evidence is converted into a digital piece of evidence in this way.

Each user in charge of managing the evidence must scan the barcode on the evidence as the evidence management process progresses to show transfer of custody and any potential alterations to the evidence's status. This procedure is repeated when the evidence is booked, transferred, and examined by a lab technician to record any adjustments that may have been made to the physical evidence. The digital signature procedure enables accountability for any changes that were done. All nodes must certify each block that each officer creates before it may be used as acceptable evidence.¹⁷

3. IMPLEMENTATION FRAMEWORK

Any investigation, evidence or legal document has to go through three phases namely preliminary collection phase (where the information is collected and stored), investigation phase (where the information is analyzed, verified and further investigated) and court phase (when the information is presented before the judge).

1. Preliminary Collection phase- The collection of any legal information starts at the crime scene or place of wrong. Therefore, whenever an investigator takes custody of evidence at a crime scene, the immutability of digital evidence should be used. Digital evidence from the scene should be collected by dispatched officers, hashed, and then uploaded using blockchain technology.

The law enforcement officer who has been given permission by the decision-maker to undertake the inquiry is permitted to upload the hash value.¹⁸ A smart contract implements the delegate authorization method. The smart contract enables the authorized account to upload, alter, and query the hash value once the investigator has been confirmed as the person in control of the crime case.

2. Investigation phase- It is possible to separate the accounts created during this phase into investigators and general users. As far as we are aware, past studies have not covered the position of an investigator, which is essential for law enforcement applications.

¹⁷ Tahj Johnson, (2021). *Blockchain and Law Enforcement: A Solution for Evidence Mismanagement*. Harvard technology review.

¹⁸ Fu-Ching Tsai, (2021). *Application of blockchain of custody in criminal investigation process*. 25th International Conference on Knowledge-Based and Intelligent Information & Engineering systems. Sciencedirect.

General users can only query the hash value and the information of the digital evidence, while investigators in charge of a particular criminal case can construct the hash and upload it to the blockchain. The timestamps and the new custodian will be recorded through the smart contract when the criminal case needs to be transferred to a new custodian.¹⁹

We remove the delete function that is typically provided in older business blockchain models and propose the modify function to keep track of every action that has been applied to the digital evidence because it is best practice to not delete digital evidence if the crime case has already gone through the judicial process.²⁰

Court phase- The most important task of blockchain in the court is to convince the trier of fact that digital evidence has not been tampered. When the authorized user, such as investigator, lawyers, prosecutors and judges, set the query request to blockchain, the smart contract will demonstrate the hash value of digital evidence in each prior phases so as to explain the items are properly handled and legally considered as evidence in court.

In all these phases blockchain can be implemented by engaging the stake holders like lawyers, judges, police officers and making sure they know the technicalities of blockchain. Before implementing it is important to legally review and make sure the technology complies with all the important laws and regulations of India. After ensuring all this another aspect of importance is to select the blockchain infrastructure (public, private, or consortium) based on scalability, security, and consensus mechanisms that align with legal requirements.²¹ There should be a pilot testing of this framework by training the users and asking them for feedbacks. Once pilot testing is completed and feedbacks are included this framework can be implemented on a full scale with making the public aware about blockchain and its 'know how'.

4. DIGITAL REVOLUTION: ESTONIA'S TRAILBLAZING JOURNEY

Estonia, situated in Northeastern Europe, stands as a notable exemplar in the adept utilization and implementation of blockchain technology, positioning itself as one of the foremost technologically efficient nations globally. It has achieved one of the highest levels of e- government development, underscoring Estonia's commitment to augmenting the efficacy and transparency of its governmental machinery, fostering economic growth, and enhancing the overall well-being of its citizens. Looking

¹⁹ *Ibid.*

²⁰ *Supra note 10.*

²¹ Neeraj kumari khairwar, (2020). IC-BCT 2019 (pp.229-239). Current Indian Judicial System: Issues and Blockchain Solutions. Research gate.

back at Estonia's history, in 1991, it secured independence from the Soviet Union. Following this milestone, the nation promptly initiated a series of dynamic and progressive reforms aimed at modernizing its economy.

Notably, the government embarked on an ambitious initiative to equip every classroom with computers by the year 2000, alongside offering free computer training to substantial segments of the population. This concerted effort yielded remarkable results, with the percentage of internet users surging from 29% in 2000 to well over 90% by 2016.

In 2002, Estonia introduced a cutting-edge national ID system, wherein physical ID cards were integrated with digital signatures. Citizens employed these credentials to cast votes, remit taxes, engage in online banking transactions, and access their healthcare records. This innovative approach not only streamlined administrative processes but also fortified the security and authenticity of these digital interactions.

Another pivotal facet of Estonia's digitally progressive society is the concept of e-residency. This unique framework enables individuals to establish businesses within the country without necessitating physical residence. This program serves as a springboard for enterprises seeking to conduct operations within the European Union, affording them the advantage of the European Union's single market.

Estonia holds the distinction of being the inaugural nation-state to harness blockchain technology through the implementation of pioneering initiatives such as KSI and X-Road.

In accordance with the fundamental tenet of Estonia's legal framework, known as the "one-time principle," all information entries are initially recorded within the system, and any subsequent modifications must be executed within the master record. This procedural requirement is imperative to safeguard the integrity of data, permitting the verification of its update history and enabling the retrieval of confidential access records.

The transparency and immutable characteristics inherent in blockchain technology facilitate the detection of any form of data manipulation. Information stored within a blockchain-based ledger is virtually impervious to unauthorized access, tampering, or deletion. Consequently, this fortifies the integrity of data at rest, establishing a robust assurance framework against unwarranted alterations or breaches of sensitive information.

Estonia employs a sophisticated system known as KSI Blockchain, or Keyless Signature Infrastructure, provided by Guard time. This infrastructure is purposefully designed to fortify the security of networks, services, and databases within Estonia, safeguarding them against both intentional and inadvertent data tampering, and ensuring the enduring integrity of stored data. Notably, this chosen technology is also adopted by esteemed entities such as NATO and the U.S. Department of Defense.

Crucially, the KSI system operates on the principle that data never exits the system; solely a hash value is transmitted to the blockchain service. As no actual data is retained within the KSI blockchain, it possesses the capacity to scale seamlessly, providing immutability for petabytes of data on a per-second basis. The KSI system upholds the "once only" principle, a bedrock concept ensuring the integrity of presently existing digital data.

In simpler terms, all data integrated into the system undergoes hashing, resulting in the generation of a string of keys referred to as the hash value. This value, in conjunction with a timestamp and digital signature, is then registered within the KSI blockchain, giving rise to a signature that serves as irrefutable proof of the document's distinctiveness.

Due to this storage methodology, the original information remains confined within the server, enabling the state apparatus to monitor any alterations within the blockchain. This capability empowers the verification of a document's signature without the necessity of consulting the actual document itself, thus underscoring the significance of the "keyless" element encapsulated in the name "KSI," signifying "Keyless Signature Infrastructure."²²

The X-Road, denoted as DXL, constitutes a pivotal data exchange layer, meticulously engineered to function as a centrally managed distributed interface for seamless data interchange among diverse information systems. In succinct terms, the X-Road serves as an overarching platform that establishes connectivity among various interfaces, servers, and services within Estonia, thereby establishing a standardized level of data exchange across these systems. It is imperative to note that without exception, every digital system employed by state institutions in Estonia is seamlessly integrated into the X-Road platform.

An illustrative instance of this integration is evident in the fact that within the country, a driver is no longer obliged to physically carry their driver's license. Instead, a police officer, leveraging the capabilities of the X-Road, can promptly conduct an inquiry within the road administration's database to ascertain the validity of the license. In this process, the driver is required to present their personal identification document, further demonstrating the efficacy of the X-Road platform.

While the X-Road engenders a notably robust framework for information security, it is imperative to acknowledge its inherent limitations. Specifically, the platform is proficient in safeguarding data during its transmission; however, it does not inherently ensure the inviolability of data at rest. This

²² Priit Martinson, (2019). Estonia – the Digital Republic Secured by Blockchain. *PWC*
Retrieved from <https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf>

critical juncture is where the distinctive features of the KSI blockchain step in, fortifying the security of data within the X-Road ecosystem.²³

The Indian Government and Reserve Bank of India have been actively working towards streamlining and enhancing the efficiency of interactions between individuals, markets, and the government. The Digital India initiative, launched in 2015, has played a pivotal role in modernizing various services such as payments, provident funds, passports, driving licenses, tolls, and land records. These improvements have been made possible through the implementation of modular applications built on technologies like Aadhaar, UPI, and the India Stack.

It is widely recognized that a robust digital infrastructure should be founded on principles like accessibility, affordability, value, and trust. Making the underlying technology rules visible can be achieved through thoughtful design, legislative frameworks, governance structures, and public involvement. However, a critical observation reveals that the existing digital infrastructures are not inherently designed to be interconnected. This necessitates a technical integration to enable seamless communication and interoperability.

Currently, information often needs to traverse multiple systems to complete an interaction, relying on private databases. This complexity grows as the network expands, resulting in increased costs and inefficiencies. To address this, the Indian digital community, including fintechs, academia, think tanks, and institutions, should prioritize research in standards, interoperability, and the effective handling of known challenges associated with distributed technologies.

Furthermore, there is a notable limitation in the support for blockchain-based technology on end-user devices like smartphones. This means that the final leg of the network is not integrated. However, it is anticipated that smartphone manufacturers will soon introduce devices that are compatible with blockchain technology through extensions.

Presently, blockchain models fall into two categories: permissioned, suitable for consortiums, and public, exemplified by Ethereum, which operate without regulation and rely on internal standards. The most effective approach to address many of the recognized issues with decentralized technologies lies in a middle-ground solution—an overarching national platform at Level 1 (L1) that connects various blockchains (both permissioned and public), application providers (including decentralized applications, or dApps, and existing applications), token service providers, and infrastructure managers.

²³ Paide, Karoline & Pappel, Ingrid & Vainsalu, Heiko & Draheim, Dirk. (2018). On the Systematic Exploitation of the Estonian Data Exchange Layer X-Road for Strengthening Public-Private Partnerships. 34-41. 10.1145/3209415.3209441.

This collective effort can establish a dependable and efficient network for the Indian digital economy. Moreover, the ecosystem can deploy specific applications at Level 2 (L2) with minimal cost and effort, while Level 1 continues to handle the more complex operations for all Level 2 systems. All Level 2 chains within this public Level 1 infrastructure will communicate with each other, replicating the connectivity seen on the broader internet and obviating the need for intricate integrations with one another for existing Indian digital infrastructures.²⁴

Blockchain technology has the potential to revolutionize various sectors in India. It can enhance transparency and accountability in governance by creating immutable ledgers for government transactions and records. Secure identity verification systems can be strengthened using blockchain, providing a decentralized and secure storage solution for sensitive data. In supply chain management, blockchain can track and verify the movement of goods, reducing fraud and ensuring product quality. The banking sector can benefit from fast, secure, and low-cost transactions facilitated by blockchain-based solutions like UPI.

Smart contracts can automate and enforce legal agreements, streamlining processes from real estate transactions to intellectual property rights. Additionally, blockchain can protect intellectual property rights by creating a tamper-proof record. In healthcare, it can securely manage and share medical records among providers, leading to better patient care. Implementing blockchain in electoral processes can enhance the integrity of voting systems. Industries like pharmaceuticals can combat counterfeiting by using blockchain to verify product authenticity. Moreover, it can facilitate real-time monitoring and reporting of regulatory compliance in various industries.

5. LEGAL CROSSROADS: DECODING BLOCKCHAIN'S CHALLENGE

Blockchain technology, widely regarded as one of the most secure and efficient means of data protection, is not without its inherent challenges. While promising, blockchain technology carries certain drawbacks. Notably, a significant issue arises from the resistance to behavioral change, particularly in the realm of intangible trusted third parties introduced by blockchain. Customers must be acclimated to the notion that electronic transactions are secure, protected, and comprehensive, necessitating an adjustment to prevailing norms governing intermediaries such as Mastercard or Visa, which may undergo alterations in rules and responsibilities.

²⁴ Dilip Asbe, Ashutosh Dubey. (August 20, 2022) Experts Explain: An India Blockchain Platform *The Indian Express*.

Retrieved from indianexpress.com/article/explained/explained-sci-tech/experts-explain-an-india-blockchain-platform-8098473.

Moreover, the scalability of existing national services founded on blockchain poses a formidable challenge. Initiating a self-executing block transaction for the first time may entail considerable time, particularly as the number of blocks increases exponentially. Additionally, transitioning existing contracts or business document frameworks to a new blockchain-based methodology entails a substantial array of migration processes. For instance, in the case of real estate proprietors, the transfer of existing documents from the conventional repository to an equivalent blockchain format necessitates both time and financial investment.

One of the paramount concerns pertains to government regulation in the context of blockchain-based transactions. Government-affiliated agencies, such as the FTC and SEC, may exert a decelerating influence on adoption by instituting new legislation to oversee and regulate the industry for compliance. While this regulatory environment may facilitate adoption in more liberal economies, controlled economies may encounter formidable resistance.

Given the autonomous nature of blockchain transactions and the ease with which assets can be transferred, malevolent actors may exploit the technology for fraudulent activities, such as illicit money transfers. Robust regulations, coupled with technological support, empower law enforcement agencies to monitor and prosecute individuals engaged in such activities.

The bedrock of blockchain technology rests on its inherent mathematical impossibility for a single entity to subvert the system, owing to the lack of requisite computational power. However, with the prospective emergence of quantum computers, cryptographic keys may become susceptible to decryption within a reasonable timeframe through sheer computational force. This potential development could precipitate a systemic crisis. In response, counterarguments posit the reinforcement of keys to an extent that renders them impervious to such breaches.²⁵

CONCLUSION

In conclusion, this research paper has explored the multifaceted potential of blockchain technology in revolutionizing access to justice through a logistics-based approach. By examining the key components of blockchain, its inherent features of transparency, security, and immutability, as well as its ability to streamline processes and enhance trust, it is evident that blockchain has the capacity to significantly improve the accessibility and efficiency of the justice system. Through the analysis of real-world use cases and the discussion of various challenges and limitations, it becomes clear that the successful implementation of blockchain in the realm of justice requires careful consideration,

²⁵ Crosby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). Blockchain technology: Beyond bitcoin. *Applied Innovation*, 2 (6–10), 71. Retrieved from: <http://scet.berkeley.edu/wp-content/uploads/AIR-2016-Blozkincir.pdf>.

collaboration, and adaptation to the specific needs of different jurisdictions and legal systems. It is not a one-size-fits-all solution, but rather a powerful tool that can be tailored to address unique challenges and opportunities within each context. As we move forward in an increasingly digital and interconnected world, the application of blockchain technology in enhancing access to justice represents a promising avenue for promoting fairness, transparency, and accountability. However, it is essential for stakeholders, including legal professionals, policymakers, and technologists, to work collaboratively to overcome the obstacles and ensure that blockchain-based solutions align with the principles of justice, equity, and the rule of law. In summary, this research underscores the transformative potential of blockchain technology in advancing access to justice, and it encourages further exploration and experimentation in this domain. By leveraging the logistics-based approach and embracing the opportunities presented by blockchain, we can strive to create a more accessible, efficient, and inclusive justice system for all members of society. This endeavor aligns with the broader goal of harnessing technology to enhance the fundamental principles upon which our legal systems are built, ultimately fostering a more just and equitable society for generations to come.