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Revolutionizing Insurance Sector in India: A Case of Blockchain Adoption Challenges

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Abstract

Insurance concept was found numerous centuries before Christ (BC). Correspondingly, Chinese and Babylonian traders practised moving or dispensing risks in 2nd and 3rd millennia B.C. Nowadays, insurance is the backbone of the economy, but developing economies face challenges in increasing its penetration. The recent introduction of Big Data, Blockchain, IoT and InsurTech led to the fourth industrial revolution in insurance in the developed world. This study explores the challenges and solutions in adopting blockchain technology to increase insurance penetration in India. This study applied a systematic literature review (SLR) to extract the themes/variables relating to challenges and solutions in adopting big data analytics in India's insurance sector. The several keywords used to search relevant literature from Google Scholar and Emerald. Based on inclusion and exclusion criteria, the filtered studies were explored. This study listed several challenges and their solutions in the adoption of blockchain technology in the Indian insurance industry. Policymakers could adapt to the suggestions to improve the service delivery insurance sector.

Keywords: InsurTech, Blockchain Technology, Cloud Computing, Insurance Industry**,** Digital Technologies.

JEL Classification: G22

1. Introduction

Blockchain technology is catching the attention of different sectors in India, especially banks and insurance. To reap benefit of this technology, these sectors are making associations to improve the processing operations of industries or businesses. 56% of Indian enterprises are shifting to blockchain technology to make it a core of their businesses. The Government of Andhra Pradesh cooperated with various Blockchain start-ups like Snapper Technologies and SimpleFy to discover

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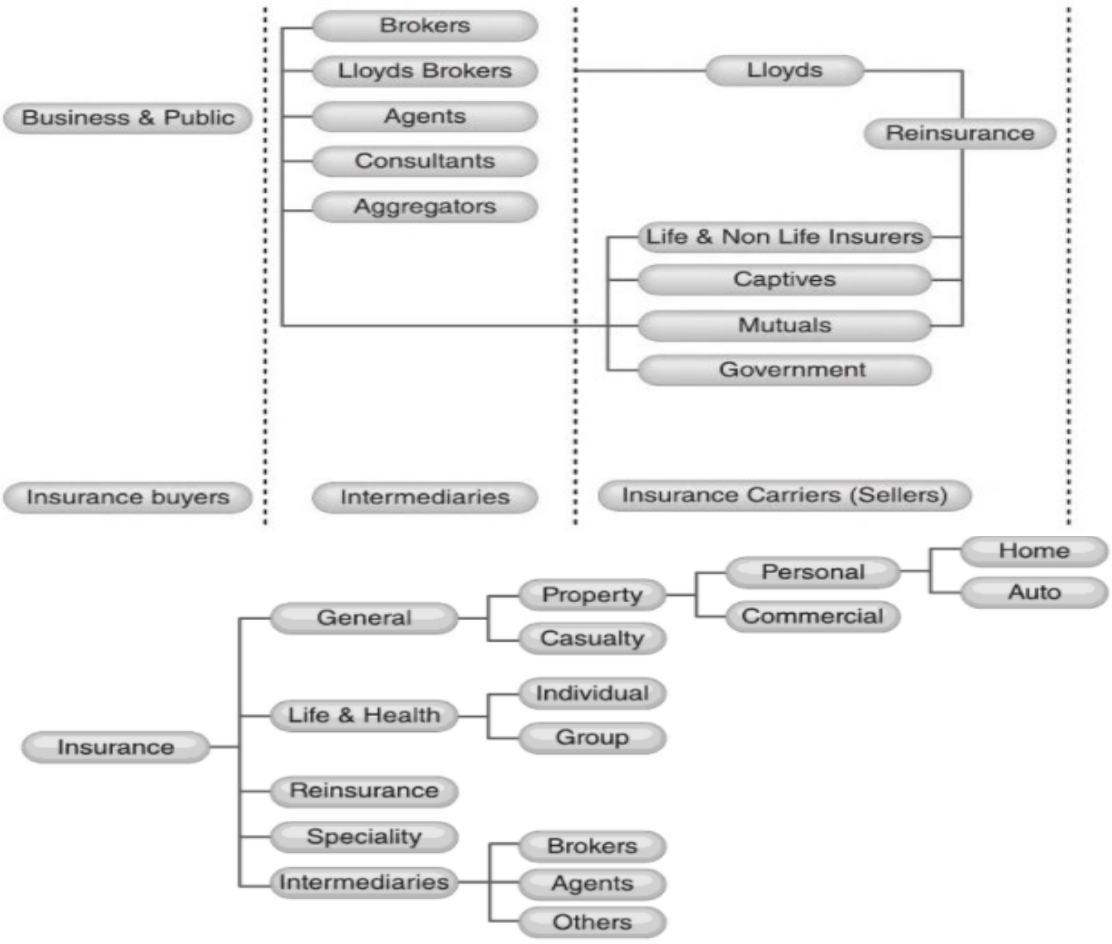
the administrative processes. Government of Andhra Pradesh are one of the leading states in terms of blockchain adoption in India. India is working on regulations to govern this type of technology in the industry. Figure 1 shows the insurance industry business model.

Figure 1. Insurance Industry of India Source



Source: (Tony, 2016)

Figure 2. Relationship between parties in the insurance industry of India

Source: (Tony, 2016)

Figure 3. Insurance function

Source: (Tony, 2016)

Blockchain technology can potentially change the whole insurance value chain model and revolutionize the whole insurance sector. Public, especially the youth, understands the need for electronic money transfer and payment and adopts it rapidly. Presently, India is zealous to adopt blockchain technology to revolute e-transactions (Rathore et al., 2021). There are some challenges in adopting blockchain technology in India, which will be explored in this study along with solutions that will help the insurance companies increase the insurance penetration level in India.

2. Background

History of Insurance in India

In 1818, a British company called Oriental Life Insurance established the first insurance company in India. After that, Bombay Assurance Company in 1823 and the Madras Equitable Life Insurance Society in 1829 were established in India (Srivastava et al., 2012). Indian Life Assurance Companies Act, 1912 was the first statutory assessment to control life dealing. In 1928, Indian Insurance Companies Act was passed to enable the Government to gather statistical data regarding both life and non-life business managed in India by Indian and foreign insurers, including provident insurance societies. Insurance Act, 1938, with complete provisions for effective control over insurers' activities, was introduced in 1938 to protect the interest of the people (Venkatesh, 2013).

The first general insurance company, Triton Insurance Company Ltd., was encouraged in 1850 by British nationals in Calcutta. The first general insurance company established by an Indian was Indian Mercantile Insurance Company Ltd. in Bombay in 1907. Due to evolution in fire, accident and marine insurances, these were brought in the purview of the Act of 1912. The insurance business in India began without any rules in the 19th century. After the independence from British Empire, life insurance company and general insurance enterprises were taken by Government in 1956, and in 1972 subsequently. Monopoly of Life Insurance Company remained in 1990s due to the re-opening of the insurance sector for private sector. Government fashioned a specific board for boosting foreign direct investment in India. This board is called Foreign Investment Promotion Board chaired by the Secretary of Industry (Department of Industrial Policy & Promotion) within the office of the Prime Minister (Singh & Gautam, 2014).

Health sector in India falls under both centre and state Government. The Central Government Health Scheme (CGHS) and Employees State Insurance Scheme (ESIS) are the most significant schemes. Life Insurance Company introduced various speciality insurance programmes in 1993, which covered medical expenses for only four dreaded diseases (Ellis et al., 2000). The first health insurance named mediclaim was started by the government insurance company in 1986. Mediclaim is a compensation base insurance for hospitalization for the middle class and the rich. Various small NGOs have also developed health insurance (Mavalankar & Bhat, 2000).

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InsurTech History

Insurance concept is found in numerous centuries before Christ (BC). Approaches for moving or dispensing risks were practiced by Chinese and Babylonian traders in 3rd and 2nd millennia BC, correspondingly. Chinese merchants voyaged from very unsafe waterways, therefore, they disseminated their commodities across many containers to limit the loss of any vessel's capsizing. The Babylonians began a system recorded in the Code of Hammurabi, around 1750 BC, and practised by early Mediterranean sailing merchants which is known as first industrial revolution (Insurance 1.0). If a merchant received a loan to fund his/her shipment, she/he would pay the lender an additional sum in exchange for the lender's guarantee to cancel the loan if the shipment is stolen, or lost at sea. Circa 800 BC, the inhabitants of Rhodes formed the "general average." This mechanism allowed groups of merchants to pay to insure their goods shipped together. The collected premiums were essential to compensate any trader whose products were lost during transportation due to hurricanes or dropping (Trenerry, 2009).

In the era of second industrial revolution (Insurance 2.0), the expansion of electricity and telegraph were made, improving the transportation and communication systems. For manufacturing machines, materials like steel, copper, or aluminum were required, which expanded the industry concept, especially chemical industry (Schwab, 2017).

The application program presented to back the organization's operations. Actuarial and statistical applications and other applications were presented to manage and control insurance processes. From 1980s, most independent agents used desktop computer-based automation systems to grow efficiency and cut expenditures. Since 1970, Acord, an American not-for-profit standard setting association for the insurance industry, has been involved in automation. Companies, agents, vendors, solution providers, associations, and other interested parties are part of the association. They provide standard forms and Electronic Data Interchange (EDI) (Shaw & Qualls, 2005). This era is known as third industrial revolution (Insurance 3.0).

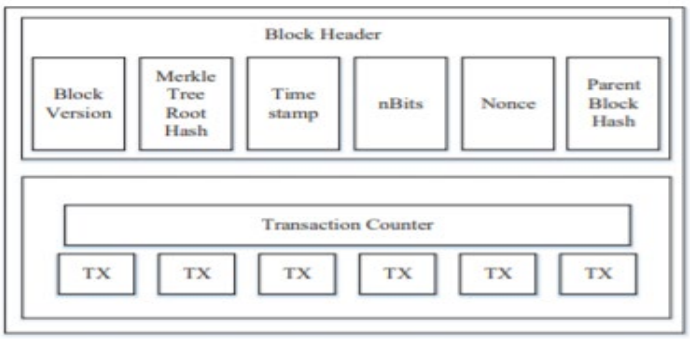
Telecommunications networks, especially the internet, brought novel revolt. The incorporation of the internet of things (objects) (IoT) and advanced software applications combined with the automation of the machines in the operations environment led to the fourth industrial revolution in insurance. InsurTech consists of many technologies like drone, IoT, cloud computing, artificial intelligence, blockchain technology (Kagermann et al., 2013).

History of Blockchain Technology

In 2008, Satoshi Nakamoto published research entitled "Bitcoin: A Peer-To-Peer Electronic Cash System". This study discussed a method of sharing the e-transactions cash directly in detail. Bitcoin was the earliest recognition of this idea. It is an open source program started from a genesis block of 50 coins which anyone can install to make part of the bitcoin peer-to-peer network. Blockchain technology deals with bitcoin, but now it is being extended to other fields. Bitcoin uses cryptographic proof to perform an online transaction protected by a digital signature using private key of sender and this transaction is later send to the public key of the receiver. The receiver verifies the digital signature via the sender's public key on the relevant transaction, which is disseminated to each node in the Bitcoin grid and is then documented in a public ledger after confirmation. To avoid double spending of Bitcoin, Blockchain technology is introduced. The Bitcoin system does transactions in the form of linked blocks through Blockchain where every block has the previous block's hash. Every block will be added in the Blockchain after answering the special mathematical problem. This process is called proof of work, where every node making block have to put sufficient computing resources to solve a mathematical mystery (Nakamoto, 2009).

Blockchain comprises many blocks, consisting of many transaction archives (Chuen, 2015). Figure 4 shows the functioning of Blockchain where a previous block hash is contained in the block header. First block of a blockchain called the genesis block has no parent block. Remaining blocks have a value of previous block, which connects all blocks in a chain form. Each block consists of the following elements: block header, transactions, block version having block validation rules, Merkle tree root hash having the hash value of all the transactions in the block, timestamp having current time, nBits having target threshold of a valid block hash, nonce having a 4-byte field starts with 0 and increases for every hash calculation and parent block hash having a 256-bit hash value that points to the previous block. Each user in the bitcoin network owns two keys: private (confidential key for signing the transactions) and public. Digital signed transactions comprising the signing and verification phases are disseminated through the complete network (Johnson et al., 2001).

Figure 4. Block Structure



Source: (Johnson et al., 2001)

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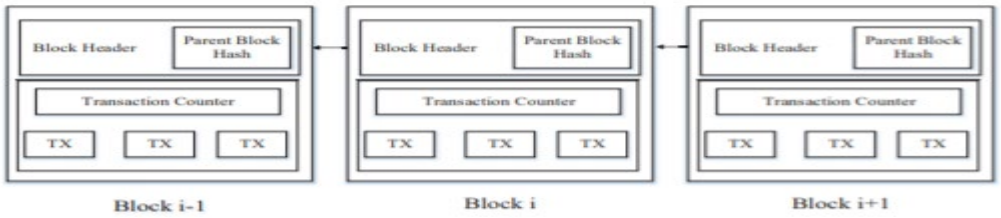
Figure 5. Block Architecture



Source: (Johnson et al., 2001)

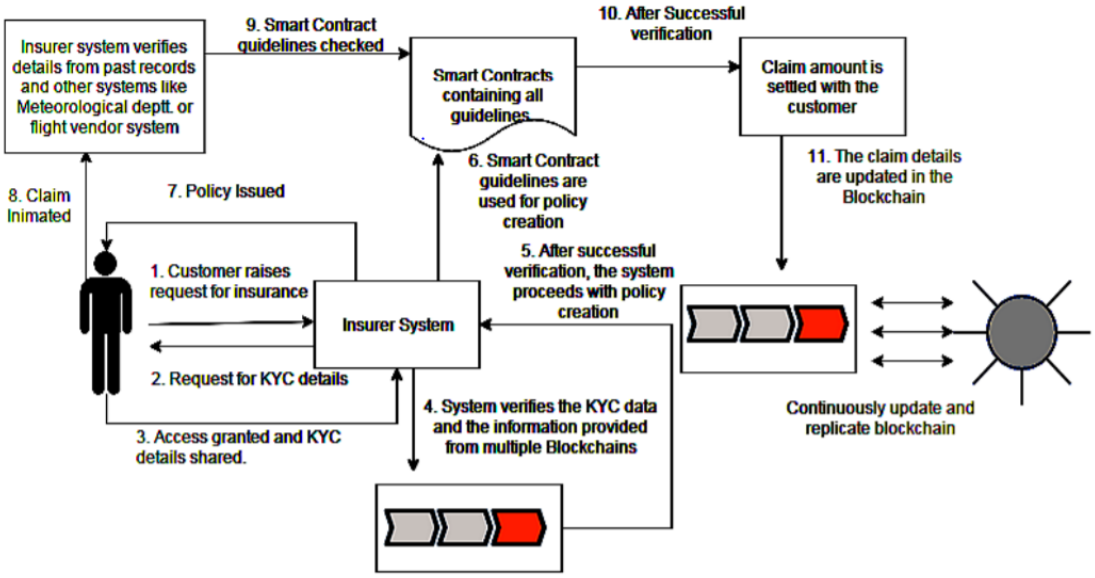
Many consensus models are applied to determine which user publishes the next block: Proof of Stake Consensus Model, Proof of Work consensus model (Yaga et al., 2018). In this proof of stake consensus model, there is no need to perform resource intensive computations (time, electricity, and processing power) as found in proof of work consensus model as it uses the amount of stake or cryptocurrency for publishing new blocks to the overall blockchain network. There are three types of blockchain system: public Blockchain (everybody can join in the consensus process), private Blockchain (specific node from a specific organization can join), and consortium blockchain (chosen nodes can take participation in the consensus process) (Buterin, 2015).

Blockchain technology benefits in Insurance Industry

There are the following benefits of blockchain technology (Anokye & Adebayo, 2021):

- Policyholders can share health data collected by IoT or Fitbit sensors with an insurer. This data is stored in Blockchain by health insurers which are read by artificial intelligence to charge premiums to policyholders.
- The blockchain technology cut the role of intermediaries in the insurance industry as copies of shared ledger are saved in different localities and give access to relevant stakeholders like insurers, brokers, and agents.
- In health insurance, blockchain assists to encrypt and saving the medical records, which are also shared between insurer and hospital to avoid latency in claim processing, bogus claim, multiple processing of the same claim, and manipulation in insurance policy ownership.
- Blockchain helps Insurance companies to form complete KYC (know your customer) or customer profiles and eradicate identical archives.
- Blockchain helps in clearing claim amounts without involving a third party by the new feature of a smart contract. Smart contract is coding of insurance policy, which is executed automatically to pay claim amount if data by IoT matches with coding. It also improves transparency.

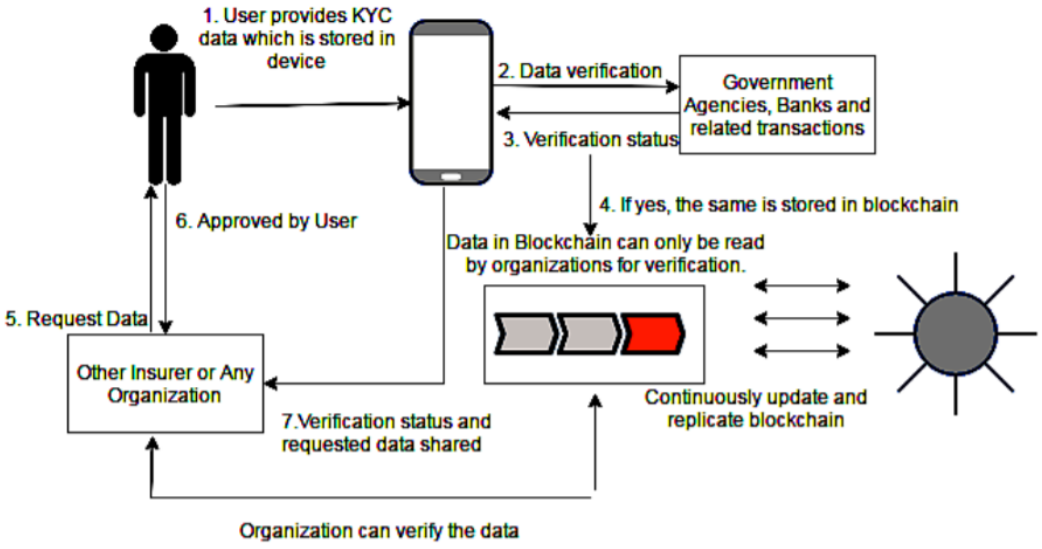
Figure 6. Claim Submission and Processing using Blockchain



Source: (Anokye & Adebayo, 2021)

- This digital ledger system saves the cost of paperwork or surveys and reduces human error as all data is stored in chain form.
- Insurers, reinsurers, and brokers perform auditing processes to know their customers, increasing the processing cost and time.

Figure 7. KYC Compliance Framework using Blockchain



Source: (Anokye & Adebayo, 2021)

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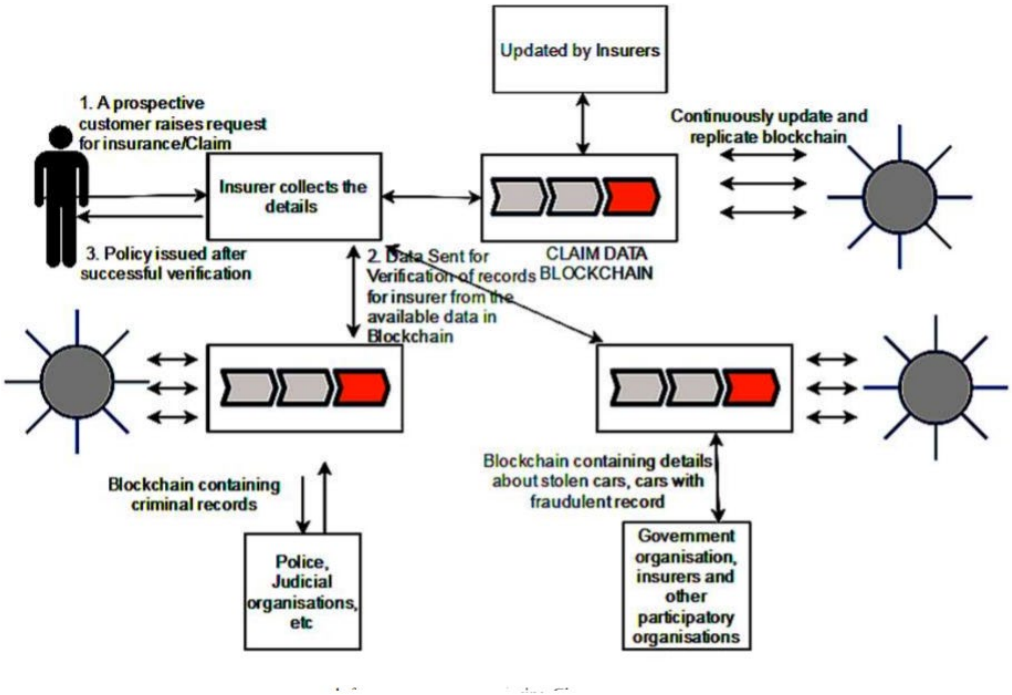
Figure 8. Framework for Fraud Detection during Claim Submission or Policy Issuance



Source: (Anokye & Adebayo, 2021)

PROBLEM STATEMENT

What are the challenges & solutions in adopting blockchain technology in Indian Insurance Industry to enhance insurance penetration?

RESEARCH QUESTIONS

Q1. What are the challenges in adopting blockchain technology in academic studies conducted in the context of Indian?

Q2. What are the solutions to adopting blockchain technology in academic studies conducted in the context of Indian?

RESEARCH OBJECTIVES

1. The first objective set by this study is to assess the literary point of view regarding the challenges in the adoption of blockchain technology in India.
2. The second objective set by this study is to assess the literary point of view regarding the solutions in adopting blockchain technology in India.

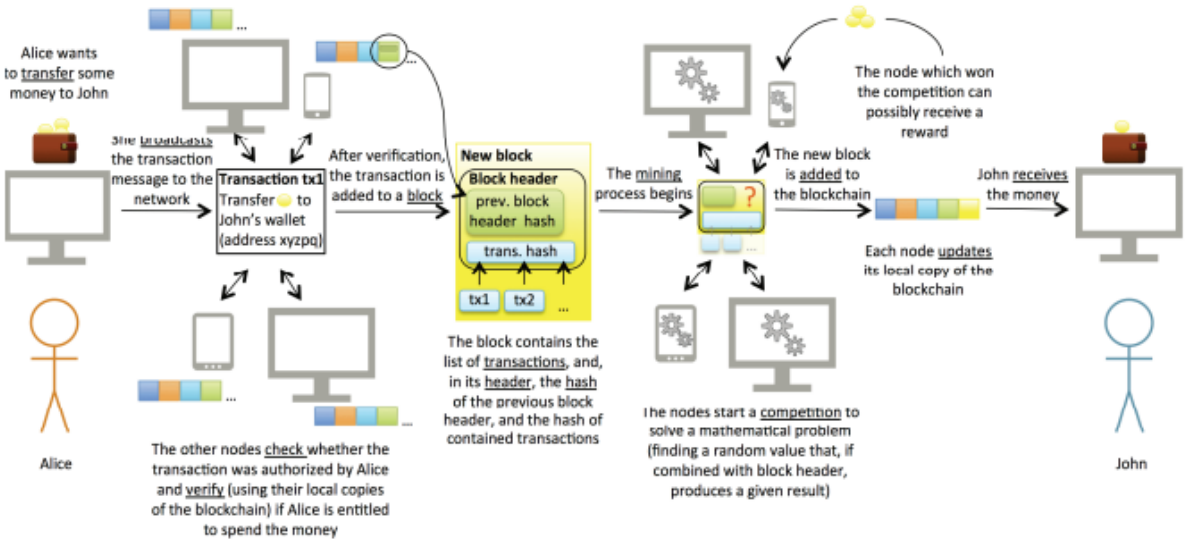
3. Literature Review

Several studies in the context of India have discussed the challenges in the adoption of blockchain technology in the Indian Insurance sector (Bishwajit et al., 2019; Namrata et al., 2020). These studies have listed several problems and challenges in transforming the insurance sector. These listed studies have explored the problems in the specific domain. However, there is a lack of studies, which have tried to connect the problems with potential solutions. This study has used the SLR method to integrate the problems mentioned and the solutions proposed.

In this 21st century, financial inclusion relies mostly on stable and cheap internet connections. An empirical study found an important positive link among cryptocurrency, internet connection, smartphone penetration, and financial inclusion (Olusegun & Olaniyi, 2019). Another empirical study also proved that adoption of blockchain technology has a positive link with increasing organization operational capabilities and reducing sales expense rate (Pan et al., 2019).

There are many versions of blockchain technology. Blockchain 1.0 refers to blockchain technology in electronic money transfer and payments. Blockchain 2.0 refers to the application of blockchain technology along with a feature of smart contracts in financial markets. Blockchain 3.0 is an application of blockchain technology in more aspects of social life. Figure 9 shows a business model of blockchain technology in financially based transactions (Pan et al., 2019).

Figure 9. Blockchain architecture in Financial Transactions



Source: (Gatteschi et al., 2018)

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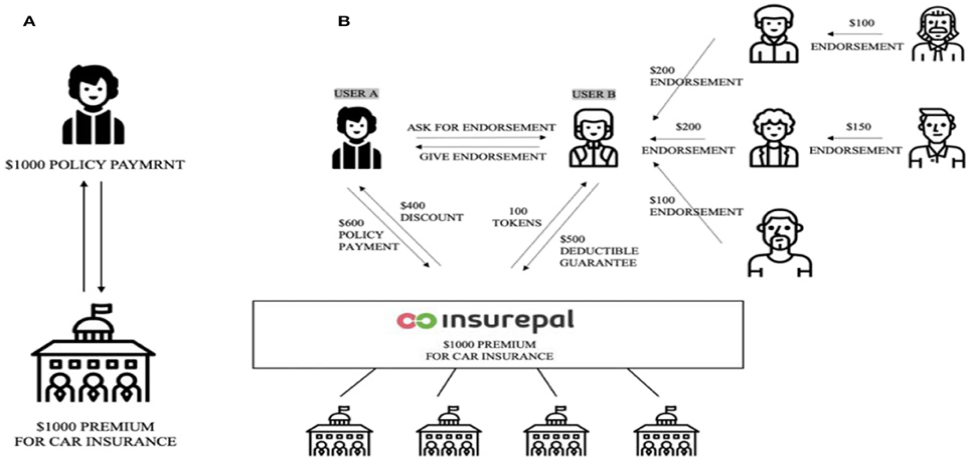
InsurePal, a Switzerland based company, offers peer-to-peer insurance based on social proof endorsements by including insurers, policy holder and blockchain platform providers (InsurePal). The business model of this platform is explained in figure 10, which will revolutionize the entire insurance sector and its best for offering micro-insurance to the poor at low cost. InsurePal helps the policyholder in allocating perils to the reliable network. The data from the policyholder, the endorser, and the insurer is shared with all, and it is difficult to alter data in this technology that built trust. InsurePal also motivates endorsers by offering utility tokens or digital currency as a reward (Sun et al., 2020).

Figure 10. Insurepal business model for insurance



Source: (Sun et al., 2020)

In Figure 10, the User wants to buy car insurance with having premium $1000 on $600. User A uses InsurPal to buy a car insurance policy shared by the insurer on this platform. For the remaining $400, user A asks for a social endorsement from B, who accepts it by making a member of this InsurPal by registering his financial credentials. This B can further ask for social endorsements from others who will directly link with the endorser but indirectly link with an anonymous person. Token is distributed to endorsers like B in this figure to motivate his commitment to giving. This token is later rated by using social proof trust score. User A can get insurance premiums at a reduced rate by its social trust network (Sun et al., 2020).

4. Methodology

Many researchers have applied SLR and published papers in international journal. SLR consists on steps mentioned in this paper by figure 11 to read papers systematically for extracting and reading relevant papers. As evidence following paper applied SLR published in recognized journals:

1. **Review of Technology Adoption frameworks in Mobile Commerce:** This study reviewed 201 articles and adopted systematic literature review

to analyze and highlight the usage of technology adoption theories in mobile commerce.

2. **Barriers to Information Technology Adoption within Small and Medium Enterprises: A Systematic Literature Review:** This paper aims to create a systematic literature review in order to provide a better understanding of barriers to IT adoption within SME. On the basis of 132 selected studies, this study identified 18 barriers categorized according to internal and external parameters.

On the basis of above evidence, this study opt SLR approach to get answers of research objectives. Econometric techniques cannot be applied due to qualitative and exploratory study to derive challenges and solutions in Indian context so that Indian insurance industry can adopt solutions if experiencing the same challenges to enhance insurance penetration rate.

Eligibility criteria

The study eligibility criteria are concise in **Table 1**.

Table 1. Inclusion/Exclusion Criteria

Criteria	Specified Criteria
Inclusion	Literature and conferences proceedings/books that address challenges and solutions in the adoption of blockchain technology in the Indian financial sector, including the insurance sector and health insurance
	Studies available from 2017 onwards
	Primary studies and secondary studies
Exclusion	Studies stated in a language other than English
	Data from magazines, newspapers, thesis, reports
	Studies conducted in other than financial sector like education, manufacturing,
	Studies that merged big data analytics and other technologies

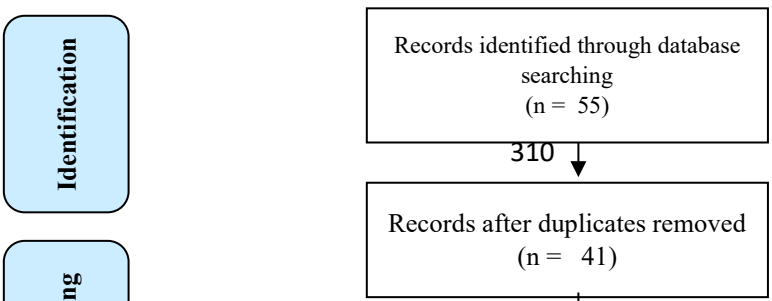
Source: Authors' calculations

Search strategy and Selection process

Research paper publication platforms such as Google scholar, emerald were opted as the search sources for this review. Following blend of search terms are applied: Blockchain technology* AND (health insurance* OR insurance sector*) AND (challenge* OR obstacle* OR issue* OR disadvantage* OR threat). The search was conducted between 2017 to 2021.

The filtering process of studies retrieved from the Google scholar and emerald databases was performed in three phases shown in Figure 11:

Figure 11. PRISMA Framework



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Source: Authors Compilation

5. Results

Data extraction and data synthesis

The two reviewers individualistically take out the following data from the included articles: author name, year of publication, country of publication, publication type and findings. Subsequently, a narrative synthesis of the extracted data was accomplished.

Table 2. Characteristics of the included studies

No.	Journal name/Book/Conference Name	Paper/Conference paper Name	Methodology	Year	Author
1	Journal of Management Studies and Academic Research	Blockchain: A Road Ahead for India	Descriptive study	2020	(Alwyn & Robin, 2020)
2	Women Institute of Technology Conference on	Technology and Innovation in Insurance–	Exploratory Study	2019	(Sumaiya & Ajay, 2019)

	Electrical and Computer Engineering	Present and Future Technology in Indian Insurance Industry.			
3	Journal of Archaeology of Egypt.	Blockchain Technology – Revamping: The Indian Financial Sector Landscape and Roadblocks Ahead.		2020	(Namrata et al., 2020)
4	Rising Threats in Expert Applications and Solutions	The Rising of Blockchain Technology and Its Adoption in India.		2021	(Vijay et al., 2021).
5	Innovations in Computational Intelligence and Computer Vision	Feasibility of Adoption of Blockchain Technology in Banking and Financial Sector of India		2021	(Anuja et al., 2021)
6	Health policy and technology	Implementing healthcare services on a large scale: Challenges and remedies based on Blockchain technology		2020	(Prateek & Ratnesh, 2020).
7	International Journal of Medical Informatics	The benefits and threats of Blockchain technology in healthcare: A scoping review.		2020	(Israa et al., 2020)
8	Alochana Chakra Journal	Usage Of Blockchain Technology In Banking Sector and Its		2020	(Sankaranarayanan & Kamal, 2020)

		Implication On Indian Economy			
9	International Journal of Social Sciences & Educational Studies	Applications of Blockchain in Insurance Industry: A Review		2020	(Kalsgonda & Kulkarni, 2020)
10	I.J. Modern Education and Computer Science	Diffusion of Blockchain in insurance industry: An analysis through the review of academic and trade literature		2021	(Arpan & Navin, 2021)
11	Telematics and Informatics.	Big Data and Blockchain supported conceptual model for enhanced healthcare coverage		2019	(Devendra et al., 2019)
12	International Conference on Industrial Engineering and Operations Management. Pilsen, Czech Republic	A Systematic Literature Review of Blockchain Technology in Agriculture		2019	(Vinay & Singh, 2019).
13	11th International Conference on Data Communication Networking	Introduction to Life Blocks: A Blockchain based Insurance Platform		2020	(Shikhar et al., 2020)
14	International European Extended Enablement in Science, Engineering & Management	The Emergence of Blockchain Technology & its Adoption in India		2019	(Shailak, 2019).

15	Journal of Archaeology of Egypt	Blockchain Technology – Revamping the Indian Financial Sector Landscape and Roadblocks Ahead		2017	(Namrata et al., 2020).
16	Technological Forecasting & Social Change	How Blockchain can impact financial services – The overview, challenges and recommendations from expert interviewees		2020	(Victor et al., 2020).
17	Systems and Technologies	Blockchain—Technology to Drive the Future		2018	(Shweta & Manish, 2018)
18	IEEE Xplore.	Financial sector Innovations: Empowering Microfinance through the application of KYC Blockchain technology.	Descriptive	2019	(Lalitha & Soujanya, 2019)

Source: Authors' calculations

Table 3. Blockchain technology adoption in Indian Insurance Industry: Issues & Solutions

No. of Studies	**Issues**	**Solutions**
Study 1	• Lack of awareness about Blockchain technology • Complexity regarding the integration of present technology with Blockchain technology • Data security issues	• Nil

	• Lack of regulation to bring standardization and approval for implementation of this technology	
Study 2	• Poor IT infrastructure • Low digital literacy • Data connectivity issue • Lack of legal framework and guidance from independent regulatory bodies for Blockchain application • Scalability issue due to increase in the number of the transaction creating a need of higher storage capacity • Latency issue • Limited interoperability • Risk of privacy leakages	• Nil
Study 3	• Lack of clear guidelines and compliance procedure • Lack of Blockchain experts • Lack of awareness • Trust issue	• Nil
Study 4	• Scalability and network jamming • Energy depletion • Lack of standardization • Cybercrime • Privacy & Security issues	• Government may impose regulation on Blockchain technology to grow the adoption of this technology.
Study 5	• First line management is not familiar, but top and middle level management have somehow knowledge • Lack of investment in this novel technology due to wait and watch policy • Unclear regulatory policies by Government • Lack of willingness in investing in this technology	Nil
Study 6	• Scalability issue due to high need for computational power and extensive storage on every node.	• Permissioned Blockchain is required by including relevant entities with Byzantine Fault Tolerance (BFT) consensus algorithms to resolve the issue of scalability or excessive storage capacity and performance speed

Study 7	• Energy depletion • Sluggish processing speed after joining of enormous users in the network • Social acceptance • Interoperability issue due to lack of trust between parties regarding exchanging health information • Lack of regulation by legal authorities due to decentralization and disengagement of trusted third parties, • Lack of sufficient technical skills to implement this technology.	• Private or permissioned Blockchain can be utilized for traceability and authenticity for accessing healthcare data
Study 8	• Great Set-up cost of this technology • Enormous amount of computing power to solve computation by proof of work algorithm to verify and process transactions • Network issue • Privacy issue • Difficult to modify information entered mistakenly • Lack of public awareness • Lack of legal framework • Lack of technical knowledge	Nil
Study 9	• Scalability • Transactions latency • Absence of industry standards (B3i standards still seem a long way off, especially in India) • Immutable	• Participation required from industry and Government in the adoption of this technology
Study 10	• Interoperability issue due to lack of integration of big data technologies with existing enterprise solutions • Manageability issue due to big data cluster management and monitoring • Security issue • Rapidly evolving technology requires skills	• Nil
Study 11	• Scalability • Resource consumption • User negative attitude toward adoption of technology • Lack of technical knowledge to understand this technology	• Consortium Blockchain can be used to involve all relevant parties in the transaction, which will augment the security and privacy of the network that will also help in reverting in case of erroneous

		entries made in a network by consensus. • Public Blockchain will be suitable for micro-insurance and peer to peer insurance due to cost
Study 12	• Blockchain technology has no control over the sensor if it is manipulated for food tradability • Scalability • Interoperability • Cyber-attack as someone may attain a majority in a network and abuse it by consensus delay • Double spending attacks • Power consumption • Storage issue	• Nil
Study 13	• Complex policy conditions like intricacies of diseases covered in this technology led to complications at the time of settling claims, thereby delaying running computational analysis on a Blockchain ledger is a strenuous task due to scalability and data retrieval problems in the Blockchain ecosystem.	• Nil
Study 14	• Shortage of skilled staff having expertise in Blockchain application development and implementation • No formal regulatory framework governing crypto exchanges	• Consultative approach by including all stakeholders in the Blockchain community • Enabling regulatory approach to provide clear guidance towards Blockchain by India government helps in its adoption, • Regulatory sandbox can help in bringing innovative products while protecting investor and consumer interest • Blockchain service providers can deliver Blockchain training

		programs with the collaboration of academia
Study 15	• Lack of clear regulation on this technology • Indian tax authority and reserve bank of India have no favourable opinion about crypto-currency • Lack of Blockchain experts • Lack of awareness • Lack of trust • Lack of clarity regarding parties who will bear the cost of network maintenance and validate the transaction in public Blockchain technology	• Awareness program • Clear guidelines and compliance procedure
Study 16	• Lack of capital to implement Blockchain technology • Lack of abundant energy supplies to adopt this technology used for cooling and high computational power • Super computer needed to run millions of calculations per second, • Intelligent algorithms with mathematical complexity are required to support this technology which runs behind high end computational power • Security issue • Cybercrime • Lack of regulation • Lack of dedicated team having different expertise	• Encryption algorithms • Specialized access control • Creating a knowledge sharing culture to learn new skills by giving awards on learning advanced skills
Study 17	• Risk of stealing participant keys made this technology insecure • Privacy issue due to the ability to trace participants real identities	Nil
Study 18	• Lack of education or information and user friendly	• Creating knowledge on the usage of Blockchain technology can enhance its adoption in India

Source: Authors' calculations

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Findings of the included studies

The challenges are reported in table 4. The first challenge is a lack of awareness. First line management is not acquainted, but top and middle level management in the insurance sector have some knowledge. Public awareness is less understanding and knowledge about usage of this novel technology in the insurance sector. Second challenge is complexity regarding the integration of present insurance technology with Blockchain technology. Third challenge is data security. Followings are familiar attacks: Denial of Service (DoS), Man in the Middle (MitM) and Sybil, which can impede the network operation. In the eclipse attack, attackers can control a node's connections, separating it from the rest of the network and modifying the view of the network for this node. Hackers can still breach apps, systems, and businesses built on blockchains. The prospective reason was stolen private keys, which are personal digital signatures. Fourth challenge is poor IT infrastructure like data connectivity. Trustworthy and scalable hardware, updated software, and a stable internet connection to connect is essential for adopting Blockchain technology. Fifth challenge is low digital literacy which hinders in adoption of Blockchain technology.

The fifth challenge is the scalability issue due to the increase in the number of transactions creating a need for higher storage capacity. Scalability issue arise due to high need of computational power and extensive storage on every node. Running computational analysis on a blockchain ledger is a determined task due to scalability in blockchain ecosystem (Shikhar et al., 2020). Followings are major blockchain scalability issues: block size, response time, and high fees. Capacity of each block in the Bitcoin blockchain was 1 MB and 2,020 transactions. Increased number of transactions which also go through from validation process in network creating scalability issue and latency issue. Process of confirming transactions becomes more complex as mining demands higher computational power. Hence, each payment demands transaction fees. To verify the payment quickly, higher fee is charged for quick confirmation. Sixth challenge is latency issue. Sluggish processing speed appears after joining of enormous number of users in the network. Blockchain network latency is the time between submitting a transaction to a network and the first confirmation of acceptance by the network. After the first confirmation, the transaction becomes more final and ready to add in blocks. Seventh challenge is limited interoperability. Interoperability issues arise due to a lack of trust between parties regarding exchanging health information in health insurance. An interoperable ecosystem permits many users from distinct blockchain networks to cooperate without expenses invested in interpreting the received data. It confirms that data is processed and response is directed appropriately. Eight challenge is risk of privacy leakages. Privacy issues arise due to tracing participants' real identities (Shweta & Manish, 2018). Ninth challenge is the lack of blockchain experts. There is lack of sufficient technical skills to implement this technology. There is also lack of technical knowledge to understand this technology (Sankaranarayanan & Kamal, 2020).

Tenth challenge is trust issue. Eleventh issue is energy consumption. Twelfth challenge is lack of investment or funds in this novel technology due to the wait and watch policy. Thirteen challenge is the high set-up cost required to implement this technology. The Fourteenth challenge is enormous computing power to resolve computation by proof of work algorithm to verify and process transactions. Fifteen challenge is difficult to modify information entered mistakenly in Blockchain. Last challenge is the lack of clarity regarding parties bearing the cost of network maintenance and validating the transaction in public blockchain technology. Government may execute regulation on blockchain technology to grow the adoption of this technology. Regulatory sandbox can help bring innovative products while protecting investor and consumer interest. A sandbox provides a platform for regulators, insurance enterprises, and tech experts to test novel solutions (shown in table 5) and detect problems after implementation. Permissioned Blockchain is required by including relevant entities with Byzantine Fault Tolerance (BFT) consensus algorithms to resolve the issue of scalability or excessive storage capacity and performance speed. These blockchains are favored by persons who need security, identity, and role definition within the Blockchain. Private Blockchain can be utilized for traceability and authenticity for accessing healthcare data. micro-insurance is not offered widely, or insurers avoid offering due to fewer funds available to poor who have high risk as they reside in an unhygienic environment which can be costly for the insurer. Blockchain technology, especially public blockchain technology, offers new products like P2P, which decreases the transaction processing cost at a distant place. In P2P insurance, claims are processed automatically by using blockchain technology's smart contract feature after meeting defined conditions. Digital wallets would facilitate premium payments. Claim payments would be robotically enabled, executed, and recorded by blockchain technology. A consultative approach by including all stakeholders in the blockchain community can help increase its adoption in India, especially in the insurance industry. Blockchain service providers can take the lead in planning and organizing blockchain training programs with the collaboration of academia to spread awareness in the public and insurance sector. Insurance enterprises can create a knowledge sharing culture to learn new skills by giving awards on learning advanced skills to employees who adopt and learn new technology.

6. Policy Implication

This study is helpful for Indian insurance sector who can understand the significance of big data technology in this 21st century. They can apply proposed solutions of challenges if they are encountering same challenges to enhance insurance penetration level by satisfying existing and potential policyholders. They can also understand the benefits of this technology in whole insurance value chain business model. Accordingly, they can adopt this technology to identify the need of policyholders and to work on it for bringing better improvement in their services and capturing more potential market like micro-insurance to enhance insurance penetration which is very less as compared to developed countries. Micro-insurance is less offered due to less money possessed by poor and high administration and risk cost involve, therefore, insurance sector avoids to offer product to this market.

Blockchain technology cut administration cost and make possible to offer insurance products at reasonable premium. This technology is in infancy stage so its study essential in developing countries who is very far behind in technology adoption as compare to western developed countries. This review of studies conducted in Indian context will help in understanding its importance and implementation challenges with solutions.

7. Conclusion and Discussions

This study explores the challenges and solutions in adopting Blockchain technology in the Indian insurance industry by applying for a systematic literature review. There were many challenges pointed out in the study. The synthesis has linked several solutions with mentioned problems. Shortlisted 20 studies in the domain of the Indian insurance sector, which were selected using appropriate keywords. SLR method was applied to generate the themes/variables, which are the constraints and their solutions in adopting Blockchain in the insurance sector. The derived challenges and solutions in the context of India financial sector, including the insurance sector, are explained in detail, which practitioners can apply to enhance insurance penetration, which is very less compared to developed countries like the US, having around 6% insurance penetration. Insurance penetration directly links with financial inclusion, which helps in poverty alleviation. This study is limited to academic literature, which can be extended by taking primary interviews from Indian insurance experts and FinTech/InsurTech experts working at executive-level positions.

This study is helpful for the Indian insurance sector understand the different challenges and adopt solutions recommended in this study to enhance the insurance innovation, insurance penetration and customer satisfaction, which is much less as compared to developed countries and other developing countries.

Table 4. Blockchain Technology Adoption Challenges in Indian Insurance Industry

Lack of awareness among public and insurance enterprises
Complexity regarding integration of present insurance technology with blockchain technology
Data security
Lack of regulation to bring standardization and approval for implementation of this technology
Poor IT infrastructure like data connectivity disruption due to bandwidth speed
Low digital literacy
Scalability issue due to increasing in number of transactions creating need of higher storage capacity
Latency issue
Limited interoperability
Risk of privacy leakages
Lack of blockchain experts
Lack of trust

High energy consumption
Lack of investment due to wait and watch policy
Sluggish processing speed after joining of large number of users in blockchain network
High set-up cost
Enormous amount of computing power to solve computation by proof of work algorithm to verify and process transactions
Difficult to modify information entered mistakenly in blockchain
Lack of clarity regarding parties bearing cost of network maintenance and validate the transaction in public blockchain technology

Source: Author's Calculations

Table 5. Blockchain Technology Adoption Solutions in Indian Insurance Industry

Government may impose regulation on blockchain technology to grow the adoption of this technology.
Permissioned blockchain is required by including relevant entities with Byzantine Fault Tolerance (BFT) consensus algorithms to resolve issue of scalability or excessive storage capacity and performance speed
Public blockchain will be suitable for micro-insurance and peer to peer insurance due to cost
Consultative approach by including all stakeholders in blockchain community
Blockchain service provider involvement in planning and organizing blockchain training programs with collaboration of academia
Creating a knowledge sharing culture to learn new skills by giving award on learning advanced skills

Source: Author's calculations

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