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Blockchain Revolutionising Insurance and Takaful Sector: Possibilities, Challenges, and Policy Roadmap for Pakistan

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Abstract

Takaful is an alternative Shariah-compliant insurance product offered by more than fifty takaful companies in Pakistan. The takaful market is currently facing low penetration due to several challenges, including regulatory compliance, payment efficiency, fraud prevention, and transparency. Blockchain technology, a decentralised, transparent and trust-based system, could address these issues efficiently and effectively by offering smart contracts.

This paper examines the feasibility of Blockchain and its impact on Pakistan's insurance market, in general, and the takaful sector, in particular, using a systematic literature review (SLR) and case studies from Malaysia, the UAE, and Indonesia. In Malaysia and the UAE, the success of using Blockchain in Islamic finance highlights potential efficiency and security benefits. However, in Pakistan's regulatory ambiguity, lack of Shariah-compliant frameworks, limited human expertise, and low industry readiness are a few factors that need to be addressed by the Government of Pakistan. This could lead to sustainable growth in Pakistan's digital financial sector, including the takaful industry. Policymakers, the Ministry of Science and Technology, and the State Bank of Pakistan could benefit from this study by establishing a regulatory sandbox and providing current takaful operators with comprehensive IT and regulatory support to develop Shariah-compliant smart contracts. The results reveal that Takaful operators should develop and test pilot digital projects focusing on cost reduction, fraud prevention, and the automation of standard claims where possible. This will streamline the insurance industry and Takaful operations, leading to not only increased Takaful penetration but also helping the Pakistani Takaful market align with global digital trends.

Keywords: blockchain, Takaful, insurance, smart contracts, Shariah in Pakistan.

Introduction

Takaful is an Islamic financial substitute product that is free from Interest, Gambling, and uncertainty associated with traditional insurance, and it operates on the principles of mutual respect, shared responsibility, and ethical risk-sharing. Insurance and takaful companies are offering risk management techniques to individuals in the event of major catastrophes. Takaful plays a vital role in the Islamic financial sector, offering a range of products tailored to the needs and requirements of Pakistanis, in line with their religious values. The industry, however, still faces significant operational challenges, despite this expansion, particularly in payment processing. Often ineffective, prone to fraud, and without the openness required to build policyholders' confidence, conventional digital payment systems are. These restrictions hinder the smooth handling of Takaful donations and claims, resulting in inefficiencies that affect both operators and participants. These structural problems necessitate technical developments that can enhance the efficiency, security, and transparency of family takaful operations.

The study identifies a research gap in the literature regarding the implementation and potential benefits of implementing Blockchain in the insurance and takaful sector of Pakistan. This gap is addressed by conducting

qualitative case studies of insurance and takaful practices through a review. It also demonstrates how Blockchain influences Pakistan's insurance and takaful industry. According to the author's knowledge, this is the first study to address this specific issue.

Blockchain technology provides a distributed, immutable, and transparent foundation for financial transactions. Secondly, Blockchain is helping insurance and takaful companies reduce costs by eliminating intermediaries, improving operational efficiency, simplifying payment processing, and mitigating fraud risks. Blockchain-based smart contracts and distributed ledger technologies have been explored in Malaysia and the UAE, where takaful claim administration and financial transactions have been previously investigated, as well as their applicability in the Islamic financial industry. This implies that Blockchain can revolutionise the takaful industry operations in Pakistan, provided it is implemented with a good spirit. Blockchain technology is a chain of different unchangeable Blocks, and every entry in each Block is stored uniquely. This allows different blocks to be developed throughout the process, from policy origination to final claims settlement. There are, however, several challenges that should be considered before implementing blockchain in the Pakistani insurance and takaful industry, including market readiness, technological viability, data security, Shariah compliance, and regulatory ambiguity.

The potential of Blockchain technology in improving the efficiency, security, and fraud prevention systems of family takaful in Pakistan is systematically reviewed in this study. The study assesses how Blockchain Technology may address legal and financial challenges, enhance payment efficiency, and serve as a viable alternative to traditional digital payment systems by synthesising current research and examining previous case studies. The study also examines practical implementation strategies and policy recommendations to facilitate the integration of blockchain technologies in Pakistan's family takaful sector. Given the rapid development of financial technology, this evaluation provides insightful analysis for legislators, financial institutions, and Takaful operators seeking to modernise their operations by adopting best practices and ensuring Shariah compliance. Drawing on current literature aims to contribute to the expanding conversation on Islamic FinTech by highlighting opportunities and issues that need to be addressed through the comprehensive utilisation of Blockchain in the takaful industry. The results contribute to the growing body of knowledge on Islamic Fintech and its application in takaful. Examining real-world case studies and regulatory viewpoints helps this study give insights for takaful operators trying to modernise payment systems, financial institutions, and legislators. It emphasises legislative suggestions to close legal loopholes and encourages the acceptance of blockchain in Pakistan's insurance and takaful markets. Blockchain can bring competitiveness, build trust, and increase financial inclusion while adhering to Shariah values in takaful operations, which can lead to rapid change in digital banking. Pakistan's insurance and takaful industry can adopt Blockchain technology system by using smart contracts to develop customised products and offer a digital and automated trust-based system, which can cater for the needs and requirements of Pakistani people and increase takaful market penetration.

In section 2 relevant aims and objectives will be discussed along with literature will be reviewed along with simple comparison between traditional and Blockchain system while in section three, aim and objectives of the study will be addressed and fourth, study's methodology will be discussed along with research design and fifth, results and discussion will be presented.

The study aims to explore the potential applications, benefits, and challenges of blockchain technology in the Pakistani insurance and takaful market. Based on its aim, the study has the following objectives:

O_1: To examine the current state of the Insurance and takaful market and the possibility of digital transformation.

O_2: To explore why takaful adoption is low, including regulatory, Shariah compliance, blockchain-related barriers.

O_3: To identify potential uses and perceived benefits of blockchain adoption in the Pakistani insurance and takaful market.

Here, the focus is on the Pakistani insurance market in general and the takaful sector in particular, where the perceived effectiveness of blockchain can be observed. Based on these objectives, the research question is

RQ_1. How can Blockchain revolutionise the Pakistani insurance and takaful industry?

1. Literature Review

The literature study examining Blockchain applications in takaful payment systems covers efficiency gains, fraud prevention, and regulatory obstacles, contrasting with traditional systems. Emphasising papers released between 2015 and 2024, it focuses on research from Pakistan and related Islamic financial markets (Malaysia, UAE, Indonesia).

Blockchain is gaining popularity in Islamic banking, offering distributed, open, and immutable transaction records that align with Shariah's ethical standards for takaful companies. Much research has examined how Blockchain technology can be utilised in takaful and how it may enhance operational effectiveness. For instance, Abdeen et al. (2019) presented a distributed Takaful model utilising blockchain to improve transparency and trust; their proposed method employed smart contracts to share risk while adhering closely to Islamic norms automatically. Leading in Blockchain-enabled Islamic finance are Malaysia and the United Arab Emirates. (Ibrahim et al. 2024) Underlined how Blockchain technology helps Malaysia's takaful claims handling digitise, lowering processing times and enhancing transactional security. Several takaful operators (Aman, Noor Takaful, and Watania) worked closely with an InsurTech business in the UAE to incorporate a Blockchain platform for motor claims; this pilot shortened claim settlement from days to minutes and removed inter-company documentation. These worldwide experiences demonstrate how Blockchain Technology might simplify insurance procedures and inspire similar developments in Pakistan, where demand for replicating such achievements is increasing. With an eye towards micro-takaful and microfinance integration, Indonesia is also investigating Blockchain in Islamic banking. Research shows that an immutable, shared ledger could speed up micro-insurance claims and payments, enhancing timeliness and transparency for grassroots-level participants, which could help Pakistan's takaful sector.

The digital financial landscape of Pakistan is evolving as the government's interest in Fintech and Blockchain technologies intensifies. Although the State Bank of Pakistan (SBP) has announced openness to digital finance and developed quick payment systems (e.g., Raast), regulatory uncertainties and technological constraints mean that blockchain use in takaful remains embryonic. Examining Pakistan's Islamic financial market, Iftikhar & Saba (2020) noted that blockchain-based smart contracts could simplify premium collection and claims in takaful, thereby reducing administrative expenses and delays. Their work on blockchain "smart Sukuk" demonstrated how digital ledgers may reduce issuing costs and increase transparency in Islamic financial instruments, which can apply to takaful contributions and rewards.

Notwithstanding these benefits, there are a few well-defined rules set by government departments. Pakistani organisations like SBP and the Securities and Exchange Commission of Pakistan (SECP) have not yet issued specific instructions on Blockchain in Islamic finance. Local takaful operators have thus been cautious; as of 2024, no significant Blockchain-driven takaful platform functions locally. The lack of specific cases in Pakistan highlights the need for a supportive ecosystem, compared to trials in surrounding regions.

Eliminating intermediaries and allowing real-time processing helps Blockchain technologies promise efficiency in financial transactions. According to Alam et al. (2019), Blockchain-based solutions can save operating expenses and transaction times in Islamic financial services. Smart contracts, self-executing agreements on a Blockchain, can automatically handle regular tasks such as premium collecting, claims validation, and reward distribution in takaful. By running predefined policies, they reduce manual involvement and delays, enabling speedier and error-free payments. For a vehicle accident, for example, if a claim event is validated, such as by an IoT sensor or an oracle, a smart contract may instantly pay the beneficiary without requiring any administrative actions.

Since a smaller workforce is required to process transactions, this automation streamlines settlements and reduces administrative expenses. Blockchain also improves openness as every transaction is noted on a tamper-proof ledger available to authorised parties. Transparency fosters confidence in takaful operations, particularly in Pakistan, where faith in insurers is vital and underlined. (Kaunain & Akhtar, 2016). Blockchain enables users to collect real-time rewards and audit contribution pools, ensuring accountability and increased transparency that helps correct knowledge asymmetry and reassure policyholders that their money is being used ethically. Research indicates that Blockchain can simplify takaful processes, provide speedier service, and ensure trustworthiness, two crucial elements for Islamic insurance to be scaled in the financial market.

In Pakistan's financial industry, fraud is an ongoing problem involving takaful, whereby fraudulent claims, identity theft, or document fabrication could compromise the system. The firm aims to mitigate the risks associated with blockchain technologies. All transactions are encrypted using cryptography and recorded on an immutable ledger, ensuring they cannot be undone or altered within the blockchain system. According to Chowdhury et al. (2020), this immutability prevents illegal entries and unauthorised changes, as any attempt to alter data will be immediately visible via the distributed network. This drastically reduces the chances of theft or double claiming by providing a single source of truth for donations. Blockchain also improves identification validation. Blockchain-based digital identification solutions, for example, leveraging distributed ledger technology for KYC (the process of verifying customer identity), as suggested by Ayaad et al. (2024), can securely authenticate takaful members. Every policyholder may be issued a distinct digital identity on the blockchain, which would be used for transaction signing; this makes it challenging for fraudsters to impersonate clients or submit false claims. Moreover, modern systems combine Blockchain with Artificial Intelligence to identify fraud. Insurance researchers outline scenarios wherein Artificial Intelligence algorithms examine Blockchain, claim data to identify abnormalities, enabling automated claim verification. For example, a shared Blockchain ledger will promptly show a duplicate claim if a policyholder files many claims across several organisations. Reducing human fraud detection helps insurance companies cut running expenses and operational risk. The research generally shows that the security elements of Blockchain, decentralisation, encryption, and consensus validation significantly improve fraud prevention and cybersecurity in takaful systems. This is especially pertinent for Pakistan, where increasing digital fraud has been observed; by practically removing some fraud routes, a safe Blockchain platform might boost faith in Islamic insurance.

While blockchain has technological benefits, regulatory ambiguity remains a primary obstacle to its use in takaful. The Shariah compliance challenges faced by financial authorities in Pakistan have not yet led to the development of a comprehensive blockchain policy in finance. Examining these legal obstacles, Jan et al. (2021) discovered that policymakers are cautious about data privacy, system interoperability, and verifying Shariah compliance with Blockchain applications. One issue is whether automated systems and smart contracts fully align with Shariah rules, including the ability to sufficiently address the intricacies of Riba (Interest), Gharar (Uncertainty), and Maysir (Gambling) avoidance. Some Islamic academics remain wary, wondering if intricate algorithms may inadvertently contravene Shariah rules.

Meanwhile, others contend that Blockchain may be used to enforce Shariah principles by programmatically incorporating scholars' advice into smart contracts (brecorder.com). Blockchain's openness and immutability help ensure that transactions adhere to Islamic agreements, that is, without hidden clauses or post hoc adjustments. Another regulatory concern is Pakistan's absence of legislation or rules about cryptocurrencies and digital assets, which are sometimes closely related to the blockchain debate. In early 2024, cryptocurrencies are not yet accepted as legal currency in Pakistan; a ban on crypto trading was even suggested in 2023 due to concerns over fraud and AML issues. This wary attitude to cryptocurrencies generally clouds blockchain innovation. Using regulatory sandboxes to allow controlled experimentation with Fintech, including Blockchain, Bank Negara Malaysia and the Securities Commission Malaysia have been proactive in supporting innovation under control. Similarly, the UAE's Insurance Authority approved experimental initiatives (such as the Addenda Blockchain platform) by offering permissions and a conducive atmosphere for InsurTech businesses.

These cases underscore the importance of transparency and official support from the authorities. Regulators (SECP and SBP) of Pakistan would have to provide rules defining how blockchain could be used for takaful in a Shariah-compliant manner (e.g., standards for innovative contract-based policies, consumer protection on distributed platforms, and data privacy compliance). Literature, therefore, draws attention to a paradox. Although blockchain might increase compliance and openness, takaful operators would be reluctant to use this technology without revised laws and Shariah governance systems.

Several studies directly compare blockchain-based takaful payment systems with the standard digital payment methods now utilised by insurance companies. While conventional systems benefit from established rules and familiarity, the consensus is that blockchain technology offers clear advantages in terms of efficiency, security, and transparency. Noch (2024) examined the ability of blockchain to automate financial transactions compared to traditional banking. The study concluded that blockchain-based payments can significantly reduce transaction costs by eliminating the need for third-party intermediaries and extensive verification, resulting in more cost-effective operations. Unlike traditional e-banking, which may have cut-off times or delays, takaful implies that contribution collecting and claim disbursements via blockchain might incur reduced expenses (no intermediate bank charges) and settle quickly. Similar observations were made by Iftikhar & Saba (2020), who stated that blockchain transactions provide more security and speed than conventional gateways; conversely, solid legal structures and control support Pakistani traditional digital payment systems. Consumers also understand them and are somewhat connected with the financial system.

Table 1 presents a simple and quick comparison between blockchain-based takaful payments and traditional digital takaful payments.

Table 1: Comparative analysis of blockchain-based Takaful payments vs. traditional digital payment systems

Aspect	Blockchain-Based Takaful Payments	Conventional/Traditional Digital Payments
Transaction Speed & Cost	Near-instant settlement; low transaction fees due to the removal of intermediaries.	Involves intermediaries, resulting in slower processing and higher fees.
Fraud Prevention	An immutable ledger prevents data tampering, double spending, and fraudulent claims.	Centralised systems are more prone to data breaches, identity theft, and manipulation.
Regulatory Clarity	The legal framework is still evolving, with limited oversight in jurisdictions like Pakistan.	Operates under clear and established regulatory frameworks (e.g., SBP, SECP in Pakistan).
Transparency	Real-time, decentralised records accessible to all stakeholders; enhances trust and auditability.	Data is siloed, access is limited, and periodic manual audits are required.
Security	High-level cryptographic security, resistant to unauthorised access and cyberattacks.	Security depends on centralised systems, which are more vulnerable to breaches.
Intermediary Involvement	The peer-to-peer model eliminates the need for third parties in payment processing.	Requires banks, clearing houses, and payment gateways as intermediaries.
Operational Costs	Lower operational and administrative costs due to automation via smart contracts.	Higher operational costs due to manual processing and third-party service charges.
Dispute Resolution	Lacks structured mechanisms for resolving disputes; depends on smart contract logic.	Well-defined channels for complaints and dispute handling under regulatory bodies.
User Accessibility	May require technical knowledge and internet access; still limited in reach.	Broadly accessible with user-friendly interfaces supported by banks and fintech companies.
Scalability	Scalability challenges remain due to network congestion and energy concerns in some blockchain models.	Mature infrastructure allows easier scaling across various sectors and geographies.
Environmental Impact	May have a high energy footprint depending on the blockchain protocol used (e.g., Proof of Work).	Typically, lower energy use, but still significant in centralised data centres.
Smart Contract Integration	Enables automated execution of Takaful agreements and claims via smart contracts.	Traditional systems do not offer built-in automation for contractual terms.

Blockchain-based solutions satisfy the demands of a trust-based system, such as takaful, by outperforming in technical criteria of performance and security, as stated above (Bagloee et al., 2021). However, the absence of legislative backing in Pakistan and the novelty of the technology means traditional systems now have a practical edge. According to the literature, legislators should modify rules to accommodate blockchain, and stakeholders should become more comfortable with its application to level the playing field. For Pakistan's takaful industry, the advantages of blockchain may thus remain primarily theoretical.

Blockchain has a beneficial impact on various businesses, including the insurance and takaful industries. It is getting attention from different industry leaders and academics due to its disruptive nature, and the process can be transformed into the market landscape (Collomb & Sok, 2016; Perera et al., 2020). The impact of blockchain is growing to the point where it is laying the groundwork for a new economy.

According to experts, there are several advantages to using Blockchain in the insurance and takaful sector, including transparency and accountability, which alleviate participants' concerns about how their funds are being managed, thereby increasing their trust. Secondly, Shariah compliance monitoring ensures that all investments and operations are compliant with Shariah law, thereby eliminating human error. Thirdly, Blockchain helps takaful companies decentralise governance, as takaful is a community-based product, allowing every participant to feel engaged in the governance process. Fourth, Blockchain also helps takaful companies process claims efficiently, but only standard claims can be handled; some complex cases require human interaction and involvement. There are also some complexities involved, and it is better to discuss them in advance and reach a mutual agreement. For example, Shariah compliance interpretation varies among different scholars in different regions. Secondly, the level of participants also matters, as it is difficult for less literate participants to understand this process. Although there are some complexities in implementing Blockchain in Pakistan, it aligns well with takaful values, including trust, transparency, and mutual respect.

2. Research Methodology

Under the direction of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, this study employs a systematic literature review (SLR) strategy to ensure a methodical and transparent procedure. Selected and carefully assessed pertinent material to examine the effects of blockchain on family takaful payment systems in Pakistan. The approach was designed to capture both local subtleties and global insights.

Research Design

The SLR was conducted in several phases: (1) Defining straightforward research questions aligned with the objectives; (2) Doing a thorough literature search with predefined keywords; (3) Applying inclusion/exclusion criteria to filter studies; (4) Classifying selected studies by key themes (efficiency, fraud mitigating, regulatory challenges and (5) Synthesising findings through thematic analysis and comparative assessment.

Combining qualitative thematic synthesis with comparative case analysis assures the conclusions are based on high-quality sources (peer-reviewed journals, conference papers, and reputable industry reports). Scholarly and commercial databases were searched, including Google Scholar, IEEE Xplore, SpringerLink, ScienceDirect, and Web of Science. Since Blockchain is a relatively new topic in finance, the search was limited to papers from 2015 to 2024 to catch the most critical and current developments. Using Boolean operators to hone results, A search for combinations of terms such as "Blockchain and Islamic Finance," "Family takaful and Smart Contracts," "Digital Payment Systems and Pakistan," "Blockchain and takaful and fraud," "Shariah Compliance and Blockchain," etc., Given Blockchain is a relatively new issue in finance. Other sources of regulatory updates included Islamic financial news media and websites of regulatory bodies (SBP, SECP).

Technical and financial literature, including legal/regulatory analysis, was examined. Studies from 2015 forward focused on Pakistan or similar Islamic finance markets (Malaysia, UAE, Indonesia). They addressed Blockchain in Islamic finance, takaful, or digital insurance transactions, being peer-reviewed or credible whitepapers. Studies unrelated to takaful, such as the widespread use of blockchain in non-Islamic environments, were not mentioned. Non-peer-reviewed sources were excluded, except when explicitly offering industry statistics. Additionally, repetitions or earlier versions were removed. Out of 50 articles, thirty papers underwent PRISMA evaluation, and nine matched all criteria. During the screening process, thirty papers were evaluated for their relevance and insight. Fifty studies were examined for post-filtering to align with Blockchain and takaful. A quality evaluation was conducted using the CASP checklist to assess credibility and methodology. The remaining studies were only those that were outstanding, clear, data-based, and peer-reviewed.

Table 2: PRISMA Summary

Stage	Number of studies
Total articles identified	50
Articles after duplicates are removed	30
Articles screened (title/abstract)	30
Full-text articles assessed	30
Studies included in the final review	9

Data Extraction and Thematic Study

Data were gathered for each of the nine included studies regarding their goals, approaches, key findings, and relevance to our study topics. Findings were arranged under topics generated from the framework, including efficiency improvements, fraud prevention, regulatory issues, and comparative insights (Blockchain vs. conventional/Traditional). In some research, there are more categories, such as macroeconomic background and financial inclusion, than qualitative thematic analysis, which is used to group ideas from several research studies under each subject to identify consensus and differences. For instance, several experiments emphasising faster transactions were combined to assess consistency in this result. This themed approach provided a thorough understanding of how Blockchain affects takaful and highlighted gaps (e.g., if few studies addressed consumer views, this is underscored as an issue for further research).

Comparative Case Study Method

A comparative case dimension was included to ground the review in practical terms. After examining documented blockchain implementations, pilot projects in takaful in Malaysia, the UAE, and Indonesia that drive Islamic finance markets were considered. These case studies are benchmarks for the study:

- Malaysia: Early acceptance of Blockchain in Islamic banking under strong legislative support. For Takaful claims processing using Blockchain, for instance, Malaysia's authorities helped to enable a pilot that supposedly drastically reduced claim settlement times. Established in 2016, Malaysia's Fintech Sandbox enables Islamic insurance start-ups to explore Blockchain ideas under controlled conditions.
- UAE: In the UAE, The Government supported insurance-based blockchain projects. Notably, the UAE's "InsurTech Hive" incubator in Dubai, along with start-ups like Addenda, which collaborate with Takaful operators, has developed a live Blockchain platform for inter-company vehicle claim exchange. Regulators approved of this teamwork, and as a result, faster claims recovery was achieved.
- Indonesia: In Indonesia, takaful and Blockchain integration in microfinance compliance with Shariah. Early on, Indonesia views Blockchain as a means of scaling micro-takaful to its vast population by guaranteeing openness and confidence in community insurance pools, ensuring trust.

Results from these examples were matched to the Pakistani setting to evaluate viability. Pakistan can save time and resources by drawing on these examples to identify what worked and what did not work in these countries. Although this study is qualitative, a brief statistical overview of the literature's features is presented. Two-thirds of the nine studies, spanning 2016 to 2024, were published in 2019 or later, suggesting that study interest in this issue is recent and increasing rapidly. The coverage was somewhat balanced thematically. On average, one to two studies covered each main issue (efficiency and fraud), with no single theme dominating. This harmony implies that academics see the effect of Blockchain on takaful as a complex scenario. It also suggests that any element, for example, fraud prevention, has just a few focused studies, thereby stressing the need for more thorough investigation in every field. A research distribution by subject and year, which reveals an increase in publications around 2020–2024, matching the worldwide Fintech growth.

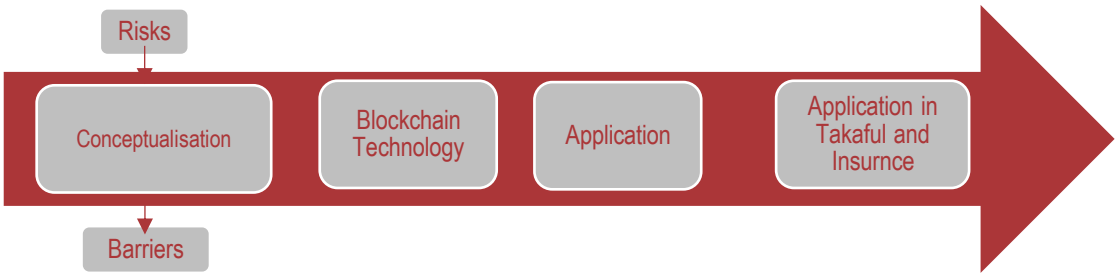
Secondary data from published works forms the foundation of this study. Direct ethical concerns were low as no human beings or private information were involved. To uphold academic integrity and prevent plagiarism, appropriate credit and referencing of all sources is given. When reading research that includes human or organisational data, the authors consider ethical considerations and obtain informed consent in each case study. This cautious treatment of sources ensures the moral requirements of systematic reviews are met. The approach generally guarantees a thorough and open evaluation, and by combining the SLR method with case-study insights and fundamental trend analysis, it provides the research with a detailed picture of blockchain possibilities in takaful and insurance, tailored to Pakistan's specific situation but informed by global experience.

3. Proposed Blockchain Model for Pakistan Takaful and Insurance Sector

Different industries worldwide, including transportation, energy, logistics, and finance, have been drawn to blockchain due to its potential benefits, and they are experimenting with blockchain technology applications in their respective businesses (Hamida et al., 2017). Blockchain-1 was initially introduced in cryptocurrencies, while Blockchain-2 was utilised in economic and financial applications, and Blockchain-3 is being applied in finance and markets.

Swan (2015) and Li et al. (2019) believe that blockchain has the potential to transform many global industries, including takaful and insurance. In Pakistan, various types of risks coexist alongside numerous challenges. Therefore, when introducing any platform, ensure that all types of risk, including regulatory risk, are considered. Although the Pakistan Crypto Council was established in March 2025, confusion persists, especially since the SBP has banned cryptocurrency transactions. The second risk is about the high setup infrastructure cost. Challenges include skills gaps, integration with Pakistan's legal framework, privacy and cybersecurity concerns, gaining trust, and addressing potential cultural resistance, as illustrated in Figure 1.

Figure 1: Risk and barriers/challenges of the proposed design



Blockchain technology is the latest innovation with the potential to enhance decentralisation, transparency, equality, and accountability. It is based on decentralisation, which helps build trust through peer-to-peer transactions and eliminates the need for a middleman. According to Risius & Spohrer (2017), blockchain technology refers to a fully distributed system for cryptographically capturing and storing a consistent, immutable, linear event log of transactions between networked actors. At the same time, Miraz & Ali (2018) state that blockchain comprises two main components: Transactions, which are actions triggered by participants and the Block, which is a collection

of data relevant to the transactions. Various unique features enhance the uses and applications of Blockchain in different industries. There are various blockchain platforms available currently, including the Bitcoin network, Ethereum, EOS.IO, Hyperledger Fabric, and R3 Corda. For this study, Hyperledger Fabric is selected based on features identified by various researchers:

- Blockchain mainly consists of a decentralised peer-to-peer network which provides robustness and avoids delays by eliminating many-to-one traffic flows.
- Anonymity helps the participants or policyholders to remain anonymous and protect their privacy and identity.
- Security allows the participants to authenticate through a digital signature, which allows the privacy of private data and ensures authenticity, data integrity and non-repudiation.
- Once transactions are added to the blockchain, they cannot be undone, which results in the ledger being an immutable record of all previous transactions.
- The participants or policyholders can easily trace the previous record by assessing any nodes in the distributed network because the transactions are recorded and validated with a timestamp.
- Blockchain provides validity of the stored records, and if any fake entry is created, then it will be automatically identified and eliminated due to failure to reach consensus.
- All transactions are transparent and declared to the users.
- Blockchain technology works against the involvement of third parties, and this helps the takaful and insurance companies to reduce the operational costs and increase the efficiency of the sharing service. Besides this, Blockchain also provides the element of trust among its participants or users, which ultimately helps companies avoid intermediaries.
- Blockchain supports smart contracts, which help to improve the performance and scalability. Here, performance (transactions per second) is mainly related to speed, efficiency, resource consumption, and response time. Scalability refers to the ability to adjust the workload and storage capacity in response to an increasing number of tasks.

There are various challenges, including data privacy, data storage, scalability, code vulnerability, private key security, criminal activity, and identity exposure. These challenges can be addressed in Table 3 below.

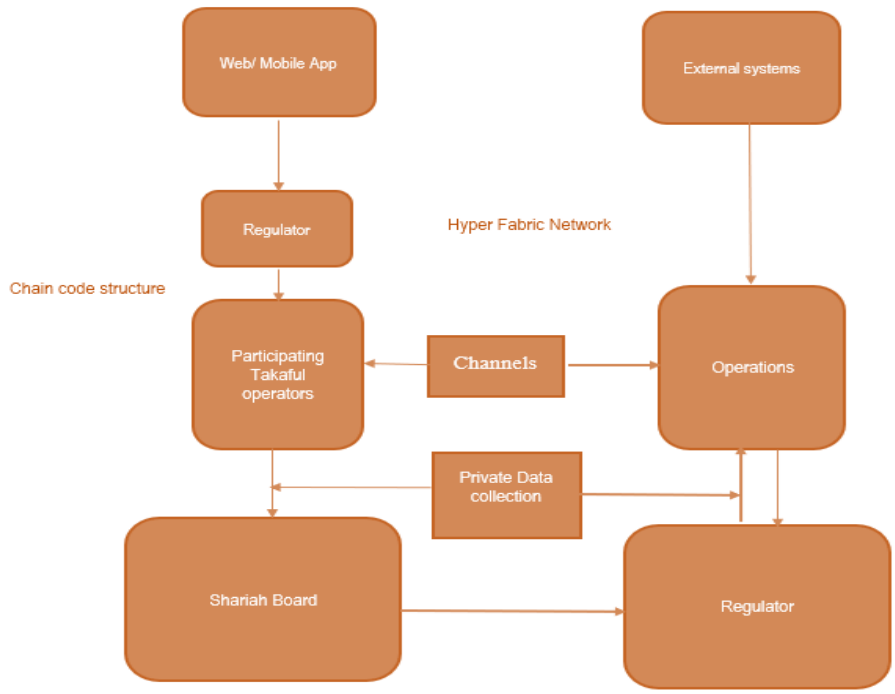
Table 3: Challenges and possible solutions

Challenge	Possible Solution
Data privacy	▪ Private channel (Fabric) ▪ Confidential transaction ▪ Access control policies ▪ Use TLS + AES encryption ▪ Off-chain storage
Data storage	▪ Use an off-chain data system, like IPFS, or Cloud storage ▪ Store hashes on chain ▪ Data-based integration
Scalability	▪ Parallel channel (Fabric) ▪ Horizontal scaling ▪ Chain code optimisation
Smart contract	▪ Formal verification ▪ Secure development life cycle ▪ Restrict access
Private key security	▪ Use hardware security modules ▪ Key rotation ▪ Recovery protocol
Criminal activity	▪ Know your customer (KYC) and AML compliance ▪ Audit trails

Challenge	Possible Solution
	▪ Track user past behaviour ▪ Establishment of a strong legal framework
Exposing identity	▪ ZKP integration ▪ Access control policies ▪ Self-sovereign identity

While keeping in mind this feature, Blockchain features and challenges, this Hyper Fabric Network technical model, presented in Figure 2, can be used in the Pakistani financial environment.

Figure 2: Technical design for takaful using Hyperledger Fabric



In this model, takaful and insurance companies are collaborating with multiple trusted parties, including participants (policyholders), Takaful operators (insurance companies), Shariah board, and regulators (SECP & SBP).

4. Results and Discussions

The main conclusions are organised by subject categories of the review and are presented in the following sections: efficiency enhancements, fraud reduction, regulatory issues, and comparative perspectives. Following this, a review of the ramifications for Pakistan's insurance and takaful industry will be conducted, combining these results with case study teachings to determine what must be addressed to leverage Blockchain technologies properly.

4.1. Transparency and Efficiency Enhancements

Blockchain's ability to improve transparency, simplify processes, and lower inefficiencies are among its most important benefits for insurance and takaful payment systems. According to the literature, Blockchain can automatically and quickly speed up several slow-moving operations in traditional systems. Its smart contracts can help automate the performance of insurance and takaful agreements, and its self-executing contracts can be programmed to handle premium contributions, fee deductions, and claims pay-outs. According to Abdeen et al. (2019), smart contracts can automatically enforce risk-sharing based on Takaful regulations, thereby guaranteeing

that rewards align with Islamic values and established criteria. When a claim event (such as death in a family takaful plan or insurance) occurs, the smart contract will quickly verify the policy data and initiate the pay-out to beneficiaries without requiring human intervention. This reduces paperwork, delays, and the possibility of human mistakes. Insurance and takaful operators can significantly reduce administrative costs by eliminating manual intervention. According to one study, automating claims using smart contracts resulted in faster resolution and higher customer satisfaction in a pilot environment. Unlike the days or weeks under older systems, participants received almost real-time claim approvals, sometimes within minutes. Traditional takaful and insurance transactions often involve several intermediaries (agents, banks, clearing systems), resulting in delays in payment processing. Through a distributed ledger, all stakeholders can trust that blockchain enables real-time, peer-to-peer transactions. Using a Blockchain ledger for payments cleared congestion and drastically shortened transaction times, according to Alam et al. (2019). In Pakistan, where cross-institution payments or interbank transfers might be delayed, a private or consortium Blockchain among banks, takaful operators, and insurance companies could enable rapid transfers to the Takaful fund or claimants. Every transaction Block is verified in minutes or seconds using a speedier consensus technique, therefore offering finality of payment. Since donations are updated in real-time and may be invested or distributed without delay, this speed enhances the client experience and facilitates liquidity management for takaful funds. Real-time processing aligns with the demands of a digital economy; for example, contributions can be made using blockchain mobile wallets, making takaful more accessible to the younger, tech-savvy population.

Transparency is not only vital in takaful, but it is also important in insurance, as participants or consumers want guarantees that pooled money is handled morally, and dividends are fair. Full auditability of Blockchain implies that every transaction contribution, claims out, operator fees, and excess distribution are noted and accessible to authorised stakeholders. This generates just one source of truth. According to Akhtar (2024), such openness might boost confidence in Takaful operations. Under a Blockchain-based Takaful paradigm, a participant might check in and view the rationale for any rewards made and the past transactions of the risk pool, which may be anonymised for privacy, ensuring that no theft is taking place. An auditable Blockchain gives regulators more control; the SECP may be a node on the network tracking real-time compliance issues.

This degree of openness is challenging with traditional databases, which are compartmentalised and prone to manipulation. Blockchain may also encourage greater consumption of Takaful and insurance by building confidence through openness, particularly among a sceptical segment of the public, due to prior mismanagement in the insurance sector. People may be more eager to contribute if they know a tamper-proof ledger handles their donations, thereby increasing the number of takaful customers. More transparency corresponds with an increase in the efficiency of Blockchain (automation and speed). The mix can provide a takaful system or insurance company with better dependability and responsiveness. These results align with global Fintech trends, where digital technology is providing faster and more affordable financial services. Particularly, Blockchain is underlined as a technology that guarantees both speed and trust, a balance that aligns well with the values of Islamic banking, where operational excellence should not sacrifice ethical supervision. However, realising these advantages in Pakistan would depend on overcoming some obstacles or barriers.

4.2. Security and Deception Reduction

Strong defences against fraud and cyber threats provided by Blockchain design help to solve one of the leading insurance challenges. Essential results on how Blockchain improves Takaful security consist of every transaction entered on a Blockchain is encrypted using cryptographic hashes and connected to the next Block, therefore rendering the ledger unchangeable. Once data is entered (and verified by the network nodes), it cannot be changed retroactively without upsetting the network consensus. This serves as a strong deterrent to fraud. For example, the Blockchain would reject a false claim pay-out or backdated policy contribution as they would not match the hash chain. Chowdhury et al. (2020) emphasise that this immutability ensures openness and prevents false record changes. Immutability in a multi-operator environment, for example, an industry-wide Blockchain for

all takaful operators and insurance companies in Pakistan, means that no one company or administrator can covertly alter the data, thereby encouraging integrity even if some insiders are compromised. It also streamlines audit procedures; auditors may depend on Blockchain data as a definitive log, limiting the possibility of fraud that is often exploited. Identity theft or impersonation, where someone claims another person's policy, is a common path for insurance fraud. Blockchain-based certificates or distributed identities (DIDs) enable blockchain to incorporate digital identity verification using these technologies. Ayaad et al. (2024) advises policyholders to keep digital identities safe by utilising Blockchain technology. Practically, this may mean that every Takaful participant or insurance company has a Blockchain address or token that reflects their identity, validated through secure onboarding. Like submitting a claim, transactions would require a cryptographic signature from the participant's private key, which is almost impossible to provide. This would stop illegal claims, as only the authentic identity with the private key can start certain activities. Blockchain identity solutions may also help combat double-dipping fraud. For instance, a shared Blockchain identity and claims history will quickly highlight the duplicate claim if a person has policies with two distinct Takaful operators and attempts to claim from both for the same incident. The background of changing digital IDs (such as Nadra's digital ID card) in Pakistan might be combined with Blockchain to provide a strong KYC and fraud avoidance mechanism for Takaful.

Blockchain enables individuals to track the entire claims process, from submission to evaluation and approval, creating a transparent and verifiable system. All stakeholders see any unexpected involvement or delay. A research study on Blockchain in insurance demonstrated how smart contract-driven claims can keep all parties accountable. For example, if requirements are satisfied, the contract immediately executes payment, preventing any party from unjustifiably refusing or postponing the claim. From the insurer's side, this addresses false denials; from the participant's side, it addresses false claims. Symmetrically, the rules are present and obvious, so neither side can readily cheat.

For instance, combining artificial intelligence with Blockchain may automatically verify simple and standard claims (As this dimension of Blockchain is not yet sufficiently developed, it still requires a human element for complex claims), lowering human error or collaboration in fraud detection. If someone submits a fake document, Artificial Intelligence may detect discrepancies, and the Blockchain record ensures that the effort is recorded and can be shared on the NADRA (National Database and Registration Authority) database. Furthermore, the distributed character of Blockchain, with several nodes keeping the ledger, means that hackers cannot find a single point of failure to target. While an adequately secured Blockchain is quite challenging to compromise, as an attacker would need to control a majority of nodes to change records, an unlikely scenario in a consortium of reputable institutions. In contrast, traditional databases can be hacked to alter or steal data.

Beyond deliberate fraud, Blockchain also reduces operational risks, such as unintentional double payments or bookkeeping mistakes, which in traditional systems might be exploited. If a staff member unintentionally pays two payments for one claim, for example, a Blockchain with smart contracts will likely block the second transaction if the set rules (e.g., policy status already closed after the first pay-out) are broken. This self-enforcing reasoning serves as a barrier against both error and corruption. Furthermore, as every member owns the ledger, responsibility is distributed. Should an abnormality arise, all parties' insurers, reinsurers, and regulators can see it and naturally discourage any party from trying manipulations.

Blockchain effectively changes the security paradigm for Takaful by enabling the system to be "secure by design", thereby avoiding numerous fraud routes upfront rather than depending on after-the-fact audits or fraud investigators. Pakistan's insurance sector primarily benefits from this as fraud events have caused confidence problems to some degree. Using a blockchain-based system will enable Takaful operators to inform customers that the platform is secure and that technology is actively reducing fraud from both internal and external parties. Blockchain secures the ledger and transactions, so the insurers still have to guarantee appropriate data inputs (garbage in, garbage out problem), for example, confirming that information entered on the chain is accurate. Therefore, combining Blockchain with dependable oracles and external data validation is a key issue.

4.3. Pakistani insurance and takaful market regulatory difficulties

Notwithstanding the potential advantages of Blockchain technology, its adoption in Pakistan's Takaful industry faces significant regulatory and compliance challenges. According to the assessment, Pakistan is still in the early phases of policy development in this regard, even when other nations are advancing Blockchain-friendly policies:

Lack of Clear Framework

Pakistan still lacks a specific legislative framework for Blockchain in financial services, unlike countries that have developed Fintech rules or crypto legislation. Regarding the use of distributed ledgers or smart contracts in Islamic finance, the SECP and SBP have not yet provided specific guidance. For Takaful operators, this leaves uncertainty about whether they can use a smart contract lawfully to carry out a takaful policy. Will authorities or the court acknowledge a claim paid via Blockchain or in cryptocurrencies? These issues remain unanswered. Without rules, every Takaful firm attempting a Blockchain pilot may encounter legal uncertainty, especially if anything goes wrong. In contrast to Malaysia, where authorities have specifically encouraged innovation, Bank Negara Malaysia's sandbox has included takaful tech innovations, and the country's central bank and securities commission have jointly issued comments on embracing fintech in Islamic finance internationally. Likewise, the UAE has government policies encouraging blockchain (Dubai's government started a Blockchain Strategy 2020), which indicates to sectors that it is safe to test. The authorities in Pakistan have begun to recognise fintech; for example, the 2019 position paper on digital assets by the SECP and the recent actions taken by the SBP, enabling digital currencies, show encouraging signs of unlocking.

In November 2024, the SBP suggested a policy reform to legalise digital assets and allow banks to produce digital currencies, thereby adopting a more Blockchain-supportive posture; however, these advancements have not yet resulted in specific guidelines for insurance or the takaful application of Blockchain. One unique feature of Islamic financial governance is the control by Shariah advisory boards. Every takaful operator in Pakistan has a Shariah board, and national Shariah rules, as outlined in the Islamic Financial Services policies of the SECP, are followed there. Blockchain raises the issue of whether automated procedures and smart contracts fit Shariah-compliant operations. Some academics fear that a self-executing contract may not meet all the requirements to guarantee no injustice. If a smart contract, for instance, rigorously follows programmed rules, might there be circumstances when a human would exhibit compassion or apply Maslahah (Public interest) factors missing from an algorithm. Literature acknowledges scholarly doubt at some level. Conversely, supporters of smart contracts argue that they can be created under the guidance of academics to uphold Shariah standards; in fact, they can eliminate human errors that would lead to non-compliance. Standardising " Shariah-compliant smart contracts" is under active debate. Working with technologists, Pakistan's Shariah boards might create certified templates for Takaful contracts using Blockchain. Without such effort, authorities may be reluctant to permit the use of blockchain. This technical and Shariah-compliance interaction presents a regulatory challenge for multidisciplinary involvement

Pakistan has cybersecurity systems and data privacy rules related to the Personal Data Protection Bill, which is under review; however, the relationship between these and blockchain is unclear. Does consumer data stored on a Blockchain, even a permissioned one, comply with privacy criteria, for example, in a distributed network, who is considered the "Data controller" and its legal meanings are changing throughout time as well. Noch (2024) pointed out that worries about Data privacy and cybersecurity dangers hamper Pakistan's Blockchain adoption. Regulators might be concerned that distributing data exposes more attack surfaces or impedes the implementation of data localisation legislation. On the other hand, modern Blockchain systems can safeguard private data using encryption and permission restrictions. Pakistan's upcoming data protection law is likely to impact how financial institutions utilise blockchain, potentially requiring additional protections or approvals.

Legal Recognition of Blockchain Transactions

The legal standing of digital signatures and Blockchain entries is a less obvious issue. Though it predates Blockchain and does not specifically include distributed ledgers, Pakistan's Electronic Transactions Ordinance (2002) offers legal recognition for digital signatures and records. For competent contract-based insurance, it is essential to clarify the legal enforceability of a policy stored on a Blockchain. If any conflict develops, will judges recognise the Blockchain record as proof? These issues may necessitate new laws or modifications. Other nations have begun to modify their statutes; Dubai has established a Blockchain court to resolve complex contract conflicts. Pakistan could revise its rules to provide clarity, thereby facilitating cooperation between legislators and financial authorities. All factors considered, deploying Blockchain in Pakistan's Takaful and insurance industry is mainly hampered by regulatory lethargy and uncertainty. Global comparisons and the examined studies indicate that increased blockchain use is associated with regulatory proactivity, as seen in Malaysia's sandbox and the UAE's facilitative approach. Pakistan's officials must catch up by creating rules that address Shariah compliance with Blockchain contracts, specifying monitoring methods, and supporting regulated pilot projects, so the country will not be left behind. Policy debates in 2023-24 reveal increased receptivity to digital money; thus, encouragingly, the tide is beginning to flip. Drawing on best practices from other markets, the following section on policy suggestions will explore actions that the industry and authorities might take.

4.4. Comparative realisations from world case studies

A deeper understanding of Pakistan's potential future can be gained by comparing Blockchain-based Takaful systems with traditional systems and examining experiences elsewhere. Firstly, Performance improvements compared to more conventional approaches; secondly, case studies from Malaysia, the UAE, and Indonesia; and finally, market readiness considerations.

Performance Gains over Conventional

Blockchain technologies excel in speed, security, and transparency compared to conventional digital payment systems, as the comparison chart above summarises. One significant comparative realisation is the cost economy. Traditional insurance operations incur substantial expenses for record-keeping, reconciliation, and third-party services, such as those provided by bank clearinghouses. Utilising direct value transfer and automated reconciliation, blockchain can significantly reduce these expenses. Noch (2024) reported instances of cross-border transactions whereby Blockchain lowered costs to a quarter of their traditional cost. Adopting blockchain technology may imply reducing operational costs for a Takaful operator or insurance company, which could translate into lower client contribution levels or more effective surplus distribution, thereby making Takaful or insurance more competitive.

The initial investment cost of Blockchain technology and the necessity of technical knowledge, which traditional systems do not demand to the same degree, are the trade-offs, though, since most insurers already have conventional IT systems. Although each operator would have to conduct their analysis, the results suggest that over time, blockchain's operational savings and fraud reduction may exceed the initial expenses. Moreover, existing conventional systems more easily interact with the larger financial ecosystem (banks, payment processors). To be viable in Pakistan, at least during a transition phase, blockchain networks for Takaful may require integration layers, such as those linking with bank accounts or mobile money, to remain relevant.

Lessons Learned from Malaysia

Malaysia's takaful sector offers an appropriate analogy. This suggests a hybrid strategy in the medium term, which is also hinted at in the findings (utilising Blockchain with older systems initially). According to case studies and the literature, Malaysia's authorities and companies have been experimenting with Blockchain in fields such as claims and Sukuk (Islamic bonds) issuance internationally. One prominent example is a 2019 project in which a group of Takaful operators and Malaysian insurers evaluated a Blockchain solution for vehicle insurance claims, reportedly reducing inter-company claim settlement from weeks to a day. Strong regulatory support was credited for the achievement; Bank Negara Malaysia not only allowed it but also engaged through its sandbox, addressing any regulatory issues in the pilot stage. Another lesson from Malaysia is the value of industry cooperation, where Takaful operators, who often rival, came together utilising a shared Blockchain platform to tackle shared challenges (fraud and sluggish claims). This group method involved knowledge sharing and cost-sharing, which helped simplify the adoption process. A similar cooperative approach could be required to apply an industry-wide Blockchain network for Pakistan, where several Takaful businesses operate, including window Takaful operations of conventional insurers. If every business tries to go it alone, the advantages may be limited, and interoperability issues could arise. Malaysia also emphasises the need for research and skills; Fintech entrepreneurs from Malaysian institutions have been actively investigating Islamic fintech solutions. For instance, studies by Ibrahim et al. (2024) in Malaysia, which utilised real Takaful operators to investigate claim procedures, have not remained confined to academia. Use cases were developed in part by this link between academics and industry. Pakistan might consider copying this approach by supporting Blockchain pilot projects between takaful operators and universities, or NUST's Fintech centre, to test the ideas.

Lessons Learned from UAE

Dubai's experience illustrates the need for a top-down approach, which shows that the Dubai Blockchain Strategy and the UAE Vision 2021, the UAE Government's drive for Blockchain integration, created a climate where even traditionally conservative industries, such as insurance, were inspired to innovate. The story of Watania (National Takaful Company) in the UAE is instructive, having managed to reduce processing time and improve earnings, partly attributed to efficiency benefits, by utilising blockchain to manage auto reinsurance claims. The UAE also teamed up with a Tech company to offer a solution, rather than each insurer creating its blockchain, utilising InsurTech businesses like Addenda. This suggests that involving the start-up ecosystem will hasten acceptance. Encouraging indigenous fintech companies, with an emphasis on Islamic financing, could help Pakistan. The UAE experience also illustrates that gradual adoption works, and it can begin with a particular use case (motor claim recoveries between insurers) rather than trying to put everything on Blockchain simultaneously. That targeted strategy yielded a real return on investment, which later helped justify its broader application to other uses. Starting with a single product line or procedure to test Blockchain, Pakistani Takaful operators and insurance companies may scale up from family Takaful death claims or health Takaful hospital bill verification. This might be made easier by regulatory sandboxes or innovation centres like Dubai's FinTech Hive.

Lessons Learned from Indonesia

Although Indonesia boasts a sizable Islamic financial industry, especially in rural areas, Takaful penetration is somewhat low. Micro-takaful alternatives, low-cost, basic insurance for the public, have been under consideration in Indonesia. Because blockchain may lower administrative expenses (making small policies feasible) and establish confidence among those dubious insurers, Indonesian fintech developers see it as a means of managing micro-insurance. Utilising mobile app interfaces on the front end and blockchain technology at the backend, one experiment involved a blockchain-based cooperative microfinance platform that could be extended to micro-takaful. The lesson here is inclusivity, which means that by allowing a transparent structure for contributions and claims, Blockchain might enable new models (like peer-to-peer Takaful or community-based pools) that could draw sectors

of the population hitherto unserved by insurance. Pakistan also has a large uninsured population and a confidence gap with traditional insurance; a Blockchain-driven micro-Takaful product (maybe provided via telecom mobile money services) may draw such individuals in. Indonesia likewise emphasises that buy-in for new Fintech requires robust Shariah governance and public awareness efforts; its national Shariah board is developing rules for "digital Shariah products". Inspired by Pakistan's academics, one may proactively research these models to provide recommendations or fatwas endorsing the use of blockchain in line with Shariah.

A comparative study reveals that effective adoption typically depends on specific market conditions, including technological infrastructure, consumer preparedness, and regulatory backing (as described above). Technically, nations with higher degrees of digital literacy and internet penetration find it simpler to implement Blockchain-based services. Though digital literacy and Fintech awareness remain a challenge (Digital financial inclusion is just 18%, Pakistan has made progress in internet access as of 2024, with 46% internet penetration(brecorder.com). This suggests that user education and simple interfaces are needed beyond implementing a Blockchain system. If consumers mistrust or misinterpret the finest technology, it will also fail. The user base in Malaysia/UAE was considerably more receptive, or the offers were back-end, meaning the end user only saw quicker service without knowing that blockchain was involved. Initially, Pakistan may choose the latter route, which involves using Blockchain in the back end of Takaful processes and presenting customers with a familiar interface, so they will not have to learn Blockchain to benefit from it. As familiarity increases, more creative ideas, such as peer-to-peer Blockchain risk sharing, could be expressed.

Finally, as shown in other markets, the comparative findings confirm that Blockchain may provide advantages not only in insurance but also in takaful, and success is primarily dependent on non-technical elements (regulations, cooperation, customer acceptability). Besides this, Pakistan also needs to look at religious presence, which is currently moderate as compared to the UAE, where it is strong, while in Malaysia, it is powerful. Secondly, Pakistan also needs to consider market share and customer-based products. Finally, Pakistan should adopt a dual regulatory model, comparing it with the strong regulatory model in the UAE, the proactive support in Indonesia, and the highly structured regulator, Bank Negara, in Malaysia. Pakistan is currently facing challenges in trust, awareness, and integration with Islamic finance. The country has much to learn from these forebearers, considering the contextual differences and comparative selling forces, as presented in Table 4. It is now up to the Pakistani government and regulatory bodies to collaborate with insurance and takaful industry players on implementing various actionable steps that can help them overcome obstacles and support Blockchain-based innovation in the insurance and takaful sector.

Table 4: Comparison of selling forces of takaful

Selling Force	Pakistan	UAE	Indonesia	Malaysia
Level	(Moderate)	(High)	(High)	(Very High)
Shariah Compliance Appeal	It only appeals to religiously attentive people but lacks deep public awareness.	Strong Government and cultural support for Islamic financial products.	Major reason for choosing Takaful over conventional insurance.	Often the primary decision-making factor.
Government & Regulatory Support	Present, but still developing.	Clear and strong guidelines and support.	A Strong Central bank promotes Islamic finance development.	Excellent and robust legal and regulatory system.
Market Awareness & Education	Low to moderate, and it is growing slowly.	Moderate to high, especially among locals and educated expats.	Growing rapidly, with Numerous education and awareness campaigns.	Highly supported by the Government and financial literacy initiatives.
Product Innovation & Digitalization	Limited traditional models dominate.	High digital platforms and AI used in Takaful products	Improving Tech-based models are emerging.	Advanced, highly digital, and customer-centric takaful products.

Perceived Ethical Superiority	Growing awareness, but conventional, is often seen as more "efficient."	Strong beliefs as many see Takaful as both ethical and efficient.	Strong beliefs and ethical values align with consumer behaviour.	Powerful core value proposition for most users.
Surplus Sharing Model (Participant Profit)	Known, but not widely understood.	Marketed actively “A key selling point”.	Emphasised in marketing and value proposition.	Key differentiator “heavily promoted and trusted by users”.

4.5. Implications for the Takaful Industry in Pakistan

The results above underscore the transformative possibilities of Blockchain for Family takaful and insurance, as well as the challenges Pakistan faces in order to reap the benefits of blockchain. Pakistan's takaful and insurance industry is on the verge of adopting blockchain and following world trends. If regulatory bodies and the government prioritise this, it could be beneficial, as the majority of the population is young and fully aware of not only digital technologies but also currently using them in their daily lives.

There are a few obstacles to implementing this blockchain strategy, and first and foremost is regulatory compliance, which requires government support. Regulatory bodies should work closely with insurance and takaful industry professionals to overcome this barrier. This corporation is required because insurance and Takaful providers would be reluctant to invest in blockchain without clarification from SECP and SBP. The consequence is that, like Bank Negara Malaysia did, Pakistani authorities had to act to offer direction, which indicates openness to innovation by granting sandbox permissions or no-objection certifications for trial initiatives. Early engagement with Shariah scholars also helps address compliance issues, and these scholars who participate in the development process might support the eventual blockchain concept, lending credibility to it from the perspective of management and customers. Secondly, Infrastructure and Skill Development barriers are another most important area where Pakistan's financial industry lacks the technological foundation for Blockchain (node servers, safe networks, etc.). Furthermore, competent human resources are also in short supply. Insurance and takaful operators could have to collaborate with tech businesses or fund training for their I.T personnel on Blockchain systems (like Hyperledger Fabric, Ethereum, or any corporate DLTs). The knowledge of Blockchains is expanding worldwide and accessible via many alliances. Consortium architecture is another strategy whereby the industry can create a common Blockchain infrastructure, possibly under the Pakistan Insurance Association, that all takaful operators and insurance companies can utilise instead of each firm building its blockchain network. This would promote standardisation and help to share resources.

Consumer Trust and Awareness

A fear of fraud has led Pakistani consumers to mistrust digital money, often preferring cash or traditional means. Introducing Blockchain technology-based takaful or insurance products means teaching users that the new system is advantageous and safe. The implication is the need for awareness efforts and knowledge acquisition. Together, takaful and insurance businesses should organise outreach (workshops, media campaigns) outlining how Blockchain promotes openness and how their money and data stay safe by emphasising good examples from Islamic nations such as "Dubai's Islamic insurers use Blockchain and saw fraud drop to zero" will help the idea to be more relevant and persuasive to the people of Pakistan. This initiative aligns with the broader movement for financial inclusion, where individuals are more likely to test a Blockchain-Based takaful or insurance product if they know it is reliable and under the control of academics and authorities. Pakistan could employ a staged strategy for utilising blockchain in takaful and insurance by first demonstrating the concept of how internal claim processing or reinsurance settlements can be facilitated under this system. Then, it will progressively widen to other individual uses, for example, creation of policy or simply donation or insurance premium. The current financial system cannot be transformed overnight. Different phases of implementation can be developed and implemented, allowing takaful operators or insurance companies to track the impact, regulators to adjust rules quickly, and customers to adapt

with minimal disturbance. This deliberate approach reflects the inference from how other markets handled fintech developments.

Working with Global Peers

Pakistani stakeholders should not start from scratch, as Malaysia, UAE, and others are ahead on this curve. One might work with colleagues or collaborate with them abroad. For instance, a Pakistani takaful company may collaborate with a Malaysian InsurTech that is already equipped with a Blockchain solution and importing tried-and-tested technology. Similarly, Pakistani authorities may interact with UAE or Malaysian officials to determine how they handled particular legal matters. This international cooperation may hasten Pakistan's learning curve. Pakistan may use the networks established by different forums such as the Islamic Financial Services Board (IFSB), The International Federation of Islamic Takaful and Insurance Companies (IFIC), Asian forum of insurance regulators (AFIR), International actuarial society (IAS) and international insurance society since they already show Fintech in insurance and Islamic finance sector.

Finally, Pakistani regulators can develop this by revising laws, advancing technologies, and enhancing human capabilities, which could foster the trust of policyholders or takaful participants. Although the advantages of Blockchain for insurance and takaful are theoretically apparent, well-coordinated efforts will be required to unlock the potential application of Blockchain in Pakistan.

Conclusion

Currently, Pakistan is facing numerous challenges, but it is also experiencing a momentum. The main Pakistani youth population accounts for more than 60% of the total population, representing a vast untapped market. To tap into this market, Blockchain can offer transformative possibilities for security, efficiency, and transparency while aligning with Islamic financial values. This can be done through digital channels and the potential benefits the insurance and takaful industry could enjoy are lower costs, fraud prevention to zero, hasten standard claim settlements, and increase services' reach. By offering these benefits, Blockchain offers customer confidence, technical preparedness, and legislative clarity.

There is now a significant responsibility on Pakistani regulatory bodies especially SBP and SECP to work on essential and relevant regulations, to develop infrastructural projects, create awareness by different educational projects, change policy which could welcome blockchain, engage with leading insurance and takaful players and get industry cooperation, arrange and availability of required technology, and most importantly create different programs or seminar which help to increase the financial literacy which resulting Pakistan’s strengthen and modernise its insurance and takaful sector. This may motivate other countries to adopt similar policies, combining Islamic values with technology to build a more sustainable financial future. The picture is bright if all the insurance and takaful companies aim towards a modernised, financial system that will also be Shariah-compliant. Future research could be conducted quantitatively by considering the youth population and developing and offering customised products for them after primary data collection.

Credit Authorship Contribution Statement

Qazi, M. A., conceptualised the study, developed the research framework, and conducted the primary literature review focusing on the integration of blockchain technology in insurance and Takaful systems. Husin, M. B., provided critical supervision, offered theoretical insights related to Islamic finance and policy development, and ensured the coherence and academic rigour of the paper. Both authors jointly discussed the findings and contributed to the final approval of the version to be published.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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