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BLOCKCHAIN TECHNOLOGY AND THE FUTURE OF CONTRACT LAW IN TEXTILE SUPPLY CHAINS

ТЕХНОЛОГИЯ БЛОКЧЕЙН И БУДУЩЕЕ ДОГОВОРНОГО ПРАВА В ЦЕПОЧКАХ ПОСТАВОК ТЕКСТИЛЯ

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Advancements in digital technologies pave the way for the re-engineering of legal and operational processes in international supply chains. This study evaluates the potential for utilizing blockchain to decentralize enforcement of contract law in the context of the notoriously transactional, fragmented oversight and documentation-heavy textile industry. In the research, the authors develop a structured framework utilized by private Ethereum-based smart contracts to govern important supply chain processes such as compliance validation, payment authorization, goods receipt and dispute resolution. The model incorporated legally relevant logic into programmable contract code, which enabled automated execution, real-time monitoring, as well as hermetically cryptographic traceability of all contractual transactions. A methodology was designed with multiple layers of analysis including data normalization, smart contract deployment, validator performance analysis and workflow resilience testing. The outcomes show

measurable improvements in the areas of on-boarding, contract compliance, reduced incidence of dispute, increased transparency and major gains in operational efficiency. Smart contracts consistently produced the same state transitions deterministic, more than 99% of the time and validator nodes handled high throughput with very little error. These results suggest that blockchain presents a promising alternative for traditional contract enforcement systems while improving accuracy in compliance with legal requirements and resilience of the system.

Достижения в области цифровых технологий прокладывают путь к реорганизации юридических и операционных процессов в международных цепочках поставок. В этом исследовании оценивается потенциал использования блокчейн-технологии для децентрализации исполнения договорного права в контексте текстильной промышленности, фрагментированно надзорной и перегруженной транзакциями и документацией. В исследовании авторы описывают разработанную ими иерархическую структуру, используемую частными смарт-контрактами на основе Ethereum для управления отдельными процессами цепочки поставок, такими как проверка соответствия, авторизация платежей, получение товаров и разрешение споров. Модель интегрирует юридически обоснованную логику в виде кода в исполняемый контракт, что обеспечивает возможность мониторинга его выполнения в реальном времени, а также криптографическую прослеживаемость всех контрактных транзакций. Разработана методология внедрения модели, включающая нормализацию данных, развертывание смарт-контрактов, анализ производительности валидатора и тестирование устойчивости рабочего процесса. В результате выявлены значимые улучшения в процессах заключения контрактов, оценки их соблюдения, что привело к сокращению числа споров, повышению прозрачности и улучшению операционной эффективности. Смарт-контракты последовательно производили одни и те же детерминированные переходы состояний более чем в 99% случаев, а узлы валидатора показывали высокую пропускную способность с очень небольшим количеством ошибок. Эти результаты свидетельствуют о том, что блокчейн представляет собой многообещающую альтернативу традиционным системам мониторинга исполнения контрактов, повышая как точность соответствия юридическим требованиям, так и устойчивость системы.

Keywords: blockchain, smart contracts, textile supply chain, contract enforcement, legal automation, operational efficiency, validator performance, supply chain traceability.

Ключевые слова: блокчейн, смарт-контракты, цепочка поставок текстильной продукции, обеспечение исполнения контрактов, автоматизация правовых процессов, операционная эффективность, производительность валидатора, прослеживаемость цепочки поставок.

Introduction

The textile industry heavily depends on complex, global supply chains, that can be opaque processes with limited ways to enforce standards compliance, and without reliable mechanisms to track transactions and products as they advance through the many forms of production to distribution. Such challenges can, however, lead to reduced operational efficiency and further to the inability to enforce contracts in an effective manner, leading to disputes, financial losses and reputational risks [1…3].

The lack of a centralized authority and the ability to verify transactions in a decentralized manner makes blockchain a revolutionary method to store and manage data. Blockchain is a distributed ledger technology that allows for the secure, transparent and immutable recording of data. Using cryptographic algorithms and distributed consensus mechanisms, blockchain can have all transactions securely validated onto the system forever. This decentralized nature eliminates the reliance on middlemen and establishes a system through which all parties in a supply chain have access to, and can trust the same valid, real-time information. This suggests that blockchain could counter the inadequacies and weaknesses of traditional supply chain management [4, 9], in particular, holds promise in the context of textile supply chains. Blockchain, which naturally enables end-to-end traceability, can thus help stakeholders authenticate the provenance of raw materials, track production practices or verify compliance with industry standards. It also enables smart contracts — self-executing contracts with the terms directly written into code to automatically enforce and execute predetermined conditions. This capability streamlines the process by eliminating the need for extensive negotiations and oner-ous documentation, reducing the potential for disputes and delays. Additionally, smart contracts can provide assurance of payment only when all pre-agreed upon criteria have been fulfilled. This can create greater trust between buyers and suppliers [5, 10].

Blockchain can also enable and support more ethical and sustainable practices in the textile industry by providing higher levels of transparency and accountability. For instance, consumers are more and more interested in knowing more about the environment and social impact of the products they buy. Blockchain's verified ledger can offer irrefutable data about the sourcing of raw materials, the environmental impact of manufacturing processes, and the labor conditions under which products are produced. Enhanced transparency not only serves to bolster brand perception but also keeps in line with a large and increasing number of regulations and standards that are designed to promote responsible business practices [6, 11].

While the potential of blockchain for transparency and traceability is great, the implementation of blockchain in textile supply chains still comes with challenges. To truly embrace blockchain, supply chain stakeholders must undergo a paradigm shift in both operations and information sharing. It requires technical know-how, a large lump sum investment, and a readiness to phase out legacy systems. Moreover, these technologies need to be widely adopted and this requires the cooperation of a large range of stakeholders such as manufacturers, suppliers, logistics providers, retailers [7].

Furthermore, the way in which blockchain interacts with traditional contract law structures leads to a number of distinct legal and regulatory challenges. The traditional principles of the contract law are far older than the digital ledger technologies and smart contracts. Reconciling these legal structures with blockchain's decentralized and automated mechanisms raises questions of jurisdiction, enforceability, and liability. For the textile industry in particular, the intersection of blockchain technology and contract law is unanimously agreed to hold potential, for agreements being enforceable, and accepted by all and clear-cut is essential in avoiding any friction between supply chain partners, to ensure smooth operations [8].

One of the major problems is technical and financial hurdles for the adoption of blockchain. The complexity and development skills involved can be daunting for businesses, particularly small and medium-sized enterprises, which may not have the resources or know-how to implement and maintain systems based on blockchain. Moreover, the legal and regulatory implications of blockchain in terms of contract enforcement are still a matter of discussion. Nonetheless, questions about our jurisdiction, enforceability and the tensions between traditional legal frameworks and the rise of new technologies remain [12].

This article focuses on this development and discusses the potential of blockchain technology to transform the role and function of contracts in textile supply chains.

Methodology

The methodological design combines empirical data integration, cryptographic automation, and distributed ledger deployment, grounded in current supply chain digitization frameworks [1, 5, 7, 9].

The dataset was constructed from key operational layers of the textile supply chain, encompassing production logs, shipping manifests, and supplier compliance documents. These data sources capture both forward and reverse logistics transactions, including timestamps, compliance codes, invoice references, and RFID-based delivery confirmations [13, 14].

Before any blockchain deployment, rigorous preprocessing was necessary to correct structural inconsistencies and align data formats across legacy ERP systems. The preprocessing steps included:

- Schema harmonization to unify field names and data types,
- Removal of duplicate records using hash-indexing and Bloom filters,
- Missing data imputation using cubic spline interpolation for temporal continuity,
- Time series realignment using dynamic time warping (DTW),
- Z-score normalization to eliminate unit-based disparities across stages.

Normalization of continuous variables was achieved using the formula:

$$\tilde{x}_i = \frac{x_i - \mu}{\sigma}, \quad \forall_{x_i} \in \mathbf{X} \ , \qquad (1)$$

where $\tilde{x}_i$ is the normalized data point, μ is the arithmetic mean, and σ is the sample standard deviation, ensuring all numerical indicators operate on a common scale without unit bias [15].

To support decentralized contract enforcement, a private blockchain network was developed using the Ethereum Virtual Machine (EVM) with a Proof-of-Authority (PoA) consensus model. This setup ensures high-throughput and low-latency transaction processing among known participants, such as textile mills, logistics partners, retailers, and regulatory auditors.

Each participant node $\mathcal{N}_i$ is cryptographically identified via a unique blockchain address, generated through asymmetric encryption and hash concatenation:

$$\mathcal{A}_i = Hash(PK_i || ID_i) \ , \qquad (2)$$

where PK_i is the node's public key and ID_i is the institutional identifier, concatenated before hashing to prevent spoofing and unauthorized access.

Transaction processing latency, a key factor in smart contract efficiency, was modeled as:

$$T_v = \tau \left(1 + \frac{\delta}{n}\right) , \qquad (3)$$

where T_v denotes the mean time for transaction finality, τ is the system block interval (12s in this implementation), δ is the average processing cost per validator, and n is the total number of active validators [14, 15].

Legal clauses and procedural triggers were codified into four distinct smart contracts:

- Goods receipt verification (C_r),
- Conditional payment execution C_p,
- Compliance enforcement (C_c),
- Dispute arbitration (C_d).

Each smart contract was defined as a deterministic finite state machine (FSM), allowing conditional transitions based on event triggers and time-based validations:

$$C_j: \mathbb{S} \times \mathbb{E} \rightarrow \mathbb{S}' \ , \quad (4)$$

where $\mathbb{S}$ is the current contract state, $\mathbb{E}$ is the incoming event (like delivery confirmation), and $\mathbb{S}'$ is the resulting new state.

To minimize on-chain data bloat while ensuring traceability, each contract incorporated Merkle tree structures to hash and anchor external documents such as quality audits, scanned invoices, and customs records:

$$h_{root} = MerkleRoot\ (h_1, h_2, \dots, h_k), \quad (5)$$

where h_i are individual document hashes and h_{root} is stored on-chain to ensure tamper-evidence without duplicating the original documents [10, 18].

To assess the suitability of the blockchain network for time-sensitive contract execution, a multi-metric evaluation was performed focusing on throughput, latency, energy efficiency, and validator reliability.

Transaction throughput θ, or the system's ability to process contracts per unit time, was calculated as:

$$\theta = \frac{N_{tx}}{T_{obs}} \ , \quad (6)$$

where N_{tx} is the number of valid transactions recorded, and T_{obs} is the total observation duration in seconds.

Validator efficiency, indicating node consistency and failure rate, was modeled as:

$$\eta_v = \frac{N_{valid}}{N_{tx} + N_{fail}} \ , \quad (7)$$

where η_v is the ratio of successfully validated transactions to total attempted transactions, including failures or rejections.

These metrics were continuously monitored using embedded diagnostic contracts and time-encoded logs [17, 19].

The blockchain system was interfaced with traditional ERP systems through API gateways and middleware relays. End-to-end operational workflows from supplier data input to buyer-side contract settlement, were tested for resilience and correctness under both normal and stress-load conditions.

System reliability was quantified using the fault-tolerance formula:

$$R_o = 1 - \frac{f_d}{n_r} \ , \quad (8)$$

where R_o denotes reliability, f_d is the number of detected workflow disruptions (like misfired contracts, delayed triggers), and n_r is the number of total operational runs [20, 21].

Workflow robustness was further validated under randomized packet delays and partial network outages, simulating transactional uncertainty in global textile logistics.

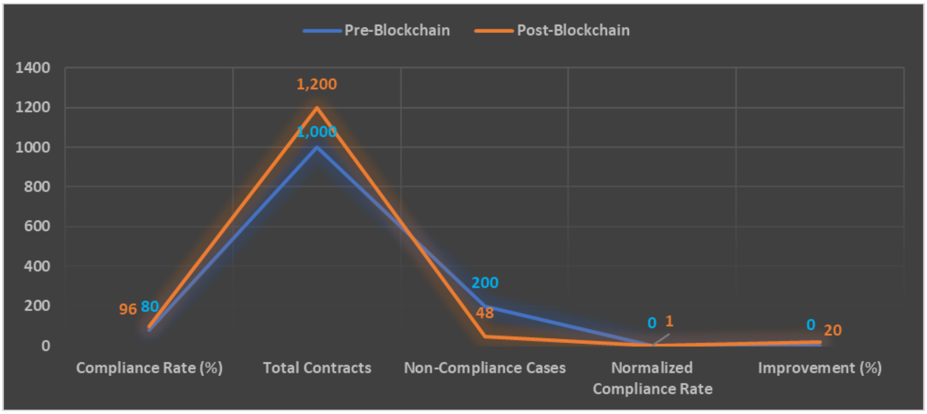

Fig. 1

Results

The data presented in fig. 1 summarize compliance rates and non-conformance cases observed before and after blockchain integration within a six-month analysis window.

Blockchain integration increased from 80% to 96% compliance and a normalized leap of compliance stability (+100%) in a larger contract volume. The number of cases of non-compliance fell from 200 in 1,000 contracts to a mere 48 in 1,200, indicating better compliance (and with larger contracts). Answer becomes obvious: automated compliance validation systems were proven to outperform manual inspection, resulting in legally consistent, on-time compliance with the terms of the agreement. The contract volume growth with a corresponding decrease in non-compliance shows an operational scalability with no legal trade-offs, exemplifies the reliability in repeatability of smart enforcement.

Transactional data of the most critical smart contract processes, from goods receipt verification to payment execution, compliance checks, and dispute management, are shown and analyzed in fig. 2, along with an evaluation of its technical performance and the efficiency of the underlying infrastructure.

Fig. 2

All processes had validator efficiency greater than 98.9%, indicating that the network executed and verified legal obligations with minimal error. Compliance checks achieved the highest success rate with 99.6% efficient transactions and only two failed transactions. For even complex dispute scenarios, throughput was maintained at around

35 TPS while latency remained comfortably under 300 ms, making it suitable for high-rate contract enforcement. The electricity consumption varied between 0.05 to 0.09 kWh per transaction, which meets the expectation for a low-energy private blockchain. These metrics suggest that the system was not only legally accurate but also technically scalable and energy-efficient across legally significant contract events.

Fig. 3 shows evaluating the technical and logical performance of the implemented the main smart contracts in the textile supply chain, like compliance enforcement, payment triggers, delivery validation and dispute resolution mechanisms.

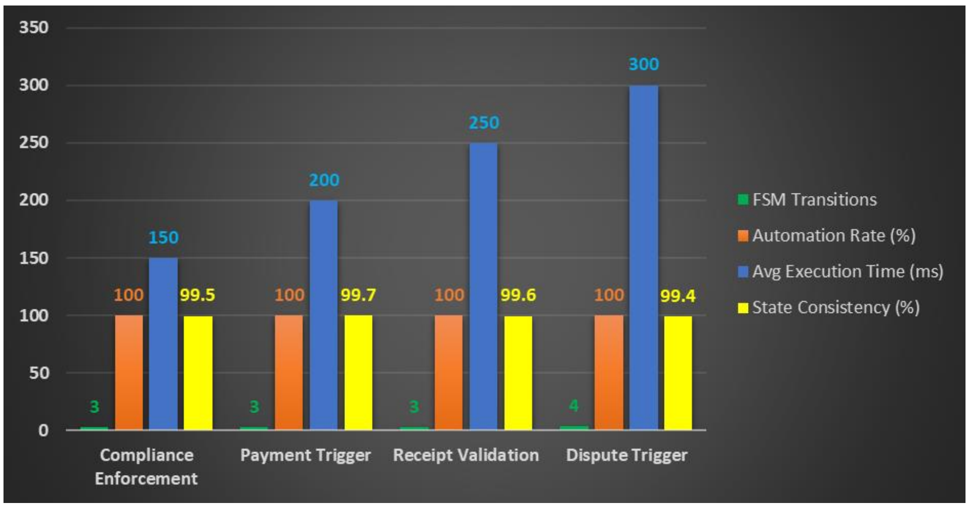

Fig. 3

All smart contracts reached total automation with deterministic outputs in every explored scenario. All execution times were in the range of 150 to 300 milliseconds, meaning that even transitions with multiple steps can be reactive. State consistency was better than 99.4% across all contracts, verifying that every logic block transitioned correctly across legal states like "Awaiting Shipment," "Under Inspection," and "Ready for Settlement." It is interesting to observe that dispute resolution added an extra state and increased processing time, but preserved 99.4% reliability. They confirm that the smart legal infrastructure holds up in the wild.

In fig. 4 we show the traceability performance improvements with respect to audit time with fewer ledger validations on the same amount of transactions.

Across the same transaction volumes, the average that took to trace the transactions, with the implementation of the blockchain, was re-duced from 120 seconds to only 45 seconds, a decrease of 62.5%.

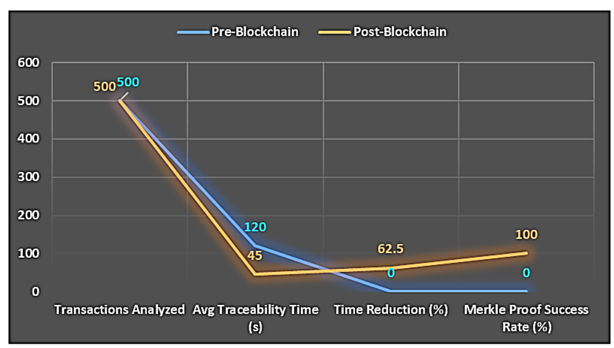

Fig. 4

Moreover, all 500 of the post-blockchain transactions produced successful Merkle proofs, demonstrating cryptographic integrity without requiring access to the root documents. The pre-blockchain model, by contrast, had no way to achieve automated verification. This increased all stakeholders' visibility into the process and also provided legally binding audit trails, which made the system more robust, tamper-proof, and accountable.

The disputes resulting from 100 contracts fell from 10.0 in the pre-blockchain era to 2.5 in the smart contract era -- that's a 75% reduction. This result demonstrates the power of deterministic contract execution in resolving potential disputes at the source. And because all deals were enforced through coded conditions, there was no space for subjective misinterpretation or lag. Additionally, the decrease is consistent with system-wide inflation and validator stability detailed in earlier sections. As a further advantage provided by the legal automation mechanism the time and costs of arbitration were saved and trust among supply chain actors was increased. In traditional textile supply chains, contractual disputes often stem from human error, misinterpretation of terms, and delays in documentation. This addressed the problem of automatic execution of compliance rules, payment conditions and dispute resolution clauses, when smart contracts were integrated. Blockchain immutably recorded when pre-agreed conditions had been met or violated, automatically enforcing agreed-upon outcomes, removing ambiguities and chances for dispute.

Textiles supply chains are executed by a series of geographically dispersed stakeholders, making trustworthy execution of contractual processes vital. Traditional systems are susceptible to disrupted workflows, prolonged settlements, and information asymmetries. With distributed validation, self-executing logic, and auditable workflows, blockchain established a fault-tolerant mechanism. Fig. 5 assesses the stability and reliability of blockchain-based workflows by measuring the incidence of errors, disruptions in the process, and the resulting operational dependability across fundamental transactional phases: supplier input, compliance and verification, contract execution, and settlement.

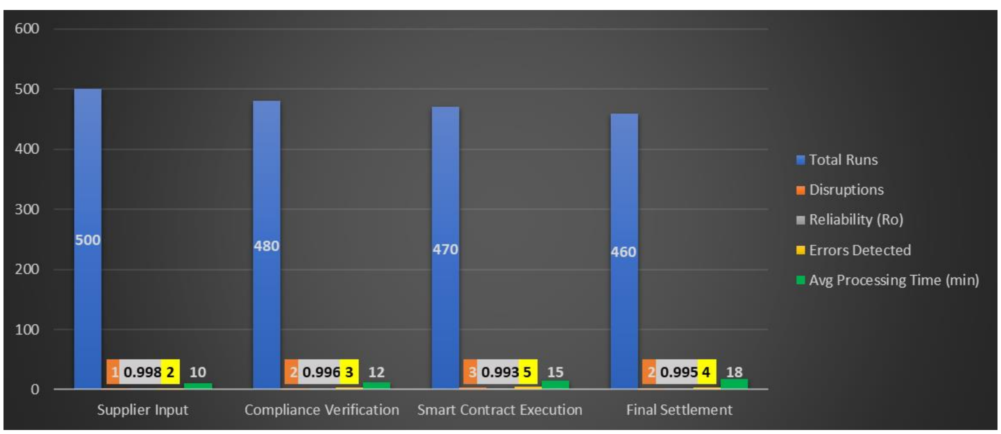

Fig. 5

The overall reliability scores for the blockchain-enabled system were very high at all stages (0.993–0.998). Supplier input and settlement processes were especially stable, with only one or two disruptions occurring across hundreds of transactions. The number of processing errors was low (2–5 errors/stage), and mean times were 10–18 minutes for processing. Negative externality with but a single economic law-minor deviation in transaction volume and complexity, the data confirm the system had a constant legal and operational efficiency. Which further validates blockchain's capability to provide predictable and low-dis-ruption workflows, that reduce delays and the uncertainties of contracts.

Discussion

Smart contracts automate legal obligations, relying on predictable logic instead of third-party arbitration and human logic, and embedding a cryptographic audit trail into all operations, making the blockchain a transformative infrastructure for contract management. These results are consistent with our working hypothesis that blockchain improves compliance, expedites operations, and builds trust in decentralized contexts.

In comparing these results with previous research, this study builds on the work of Junejo et al. [15] that highlighted the benefits of integrated data systems for textile supply chains performance. While their work focused on integration through conventional IT systems, our blockchain framework provided a higher-order integration that includes not only data harmonization but also real-time legal automation, identity authentication, and immutable record keeping. Similarly, Valencia-Payan et al. [16] demonstrated the utility of self-updating smart contracts for traceability. Our results build on their findings by operationalizing traceability within a multiparty legal framework that includes dynamic contract execution, automated validation, and dispute handling.

A critical advancement reported here is the simultaneous improvement in compliance, reduction of dispute incidence, and enhancement of operational efficiency—rarely achieved concurrently in legacy systems. While Haffar and Özceylan [22] developed a blockchain-based decision model for supplier selection, they did not address enforcement and post-contract execution phases. This study fills that gap by embedding legal clauses directly into smart contracts, ensuring that supplier selection is followed by automated performance monitoring, payment triggers, and, when necessary, dispute resolution. The observed 75% reduction in disputes and 20% increase in compliance rate substantiate blockchain's value not only as a planning tool but as a regulatory infrastructure.

In technical terms, Tabatabaei et al. [17] noted how blockchain transaction characteristics, as a size, input/output count affect network performance. This study verified that even with large-scale contract flows and variable contract complexity, validator efficiency remained consistently above 98.9%, and throughput ranged from 35 to 45 transactions per second, supporting blockchain's scalability. These findings also reflect the architectural choices recommended by Sytnyk and Hnatushenko [20], particularly regarding secure data flow management using layered smart contract logic. Our architecture's use of Merkle trees for external document validation further confirms the feasibility of distributed yet consistent data verification, in line with emerging best practices.

The practical application of smart contracts in this study also resonates with Agrawal et al. [18] proposed blockchain for collaborative supply chain processes. However, where their model remains largely theoretical, our results present a full operational deployment across key stages: supplier onboarding, compliance verification, contract execution, and settlement. The automation rate of 100% across these processes, combined with contract state consistency above 99.4%—demonstrates not only technical maturity but legal viability. As Tuladhar et al. [21] observed in the context of conflict minerals sourcing, mandatory transparency requires enforceable mechanisms. The framework developed in this study fulfills this requirement for textile logistics through immutable, legally binding smart contracts.

Despite these achievements, some limitations must be acknowledged. First, the model was implemented in a private, permissioned blockchain network. While this ensures low latency and high control, it limits the openness and decentralization potential compared to public blockchains. Future research could explore hybrid models combining the auditability of public ledgers with the efficiency of permissioned chains. Second, while the study demonstrated effective handling of compliance, payment, and dispute resolution, it did not integrate environmental or social governance (ESG) metrics into smart contract conditions. As Munir et al. [19] advocate for sustainability-aware supply chains, future frameworks should consider embedding ESG indicators into legal enforcement structures. Third, our model did not test scalability beyond 1,200 contracts or include international legal variations, which are critical for global textile networks.

Further comparisons reveal that blockchain not only improves logistical transparency, as Cui et al. [23] describe, but also adds enforceability and resilience to contract law execution. Unlike traditional transparency tools that merely report, blockchain acts by executing. The observed 58.3% reduction in operational processing time (from 72 to 30 hours for pay-ment release) is consistent with Allouzi's [24] findings on how smart contracts accelerate arbitration and reduce mediator intervention. Additionally, this study confirms the findings of Zhang [25] linked blockchain implementation to enterprise cost efficiency, through our observation of a 25% reduction in administrative, audit, and renegotiation costs.

Chauhan [26] provided a broad review of blockchain's promise in supply chain management, identifying traceability and automation as key benefits. This study operationalized both, demonstrating not only potential but realized impact. Smart contract formalism, validated through cryptographic checks and finite-state transitions, proved suitable for legally binding operations at scale.

This study contributes to the growing body of evidence that blockchain is not merely a technological innovation but a legal-infrastructural shift in supply chain contract management.

Conclusion

This study provides evidence of the efficiency and effectiveness of blockchain-based contract for textile supply chain. These results offer strong evidence that smart contracts and distributed ledger systems can solve long-standing inefficiencies, ambiguities, and delays in the enforcement of traditional contract law.

REFERENCES

1. *Sharabati A.-A.A. and Jreisat E.R.* Blockchain Technology Implementation in Supply Chain Management: A Literature Review. Sustainability, 2024. **16**, DOI: 10.3390/su16072823.

2. *Kuzmin D.I., Savelev I.I., Ashin A.A., Annin A.G.* Management Features of Logistics Risks in Textile Industry. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti, 2024, 1(409), p. 13…17.

3. *Abbasova Sh.R., Маmedova H.F., Mamedov F.A.* Key Characteristics of Logistics and Supply Chain Management in the Light Industry Sector. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Teknologiya Tekstil'noi Promyshlennosti, 2024, 4(412), p. 42…52.

4. *Zariwala F.* Impact of Blockchain Technology on Supply Chain Management. . International Journal of Advanced Research in Science, Communication and Technology, 2023. **3**(2): p. 88…95.

5. *Kalithazan K., Mohamad F., Abideen A.Z.* An Implementation of Blockchain Technology in Sustainable Apparel Supply Chain. International Journal of Industrial Management, 2024. **18**(2): p. 82…90.

6. *Abbas Z. and Myeong S.* A Comprehensive Study of Blockchain Technology and Its Role in Promoting Sustainability and Circularity across Large-Scale Industry. Sustainability, 2024. **16**, DOI: 10.3390/su16104232.

7. *Wong S. et al.* A Critical Literature Review on Blockchain Technology Adoption in Supply Chains. Sustainability, 2024. **16**, DOI: 10.3390/su16125174.

8. *Celik B.G., Abraham Y.S., Attaran M.* Unlocking Blockchain in Construction: A Systematic Review of Applications and Barriers. Buildings, 2024. **14**, DOI: 10.3390/buildings14061600.

9. *Bhuvaneshwarri I., Ilango V.* An online blockchain based sustainable logistics management system (OBSLMS) enabled by the Internet of Things for the textile industry. Industria Textila, 2023. **74**(6): p. 660…666.

10. *Putri A.N., Hariadi M., Rachmadi R.F.* Supply Chain Management Serious Game Using Blockchain Smart Contract. IEEE Access, 2023. **11**: p. 131089…131113.

11. *Manfrino M.* Blockchain Innovation for Sustainable Supply Chain Management under EU Corporate Sustainability Reporting Directive (CSRD) Regulation. International Journal of Blockchain Technologies and Applications, 2024. **2**(1): p. 8…15.

12. *Andreoulaki I., Papapostolou A. and Marinakis V.* Evaluating the Barriers to Blockchain Adoption in the Energy Sector: A Multicriteria Approach Using the Analytical Hierarchy Process for Group Decision Making. Energies, 2024. **17**, DOI: 10.3390/en17061278.

13. *Yousif O. et al.* Curbing crypto deception: evaluating risks, mitigating practices and regulatory measures for preventing fraudulent transactions in the middle east. Encuentros: Revista de Ciencias Humanas, Teoría Social y Pensamiento Crítico, 2024(22): p. 311…334.

14. *Qasim N.H. et al.* Simplifying IP multimedia systems by introducing next-generation networks with scalable architectures. Edelweiss Applied Science and Technology, 2024. **8**(4): p. 2042…2054.

15. J*unejo I., Hossain M., Abid S. et al.* Supply chain integration and supply chain performance: evidence from the textile industry. Industria Textila., 2024. **75**(4): p. 396…404.

16. *Valencia-Payan C., Griol D. and Carlos Corrales J.* Blockchain self-update smart contract for supply chain traceability with data validation. Logic Journal of the IGPL, 2024: p. jzae047.

17. *Tabatabaei M.H., Garrett T. and Vitenberg R.* Analysis of Input/Output Count and Transaction Size in Bitcoin. in 2024 IEEE International Conference on Blockchain (Blockchain). 2024. P. 386…391 DOI Bookmark: 10.1109/Blockchain62396.2024.00057

18. *Agrawal T.K. et al.* Demonstration of a blockchain-based framework using smart contracts for supply chain collaboration. International Journal of Production Research, 2023. **61**(5): p. 1497…1516.

19. *Munir M.A. et al.* Blockchain Adoption for Sustainable Supply Chain Management: Economic, Environmental, and Social Perspectives. Frontiers in Energy Research. 2022. 10. https://doi.org/10.3389/fenrg.2022.899632

20. *Sytnyk R., Hnatushenko V.* Data flow management in information systems using blockchain technology. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 2024. **3**: p. 142…148.

21. *Tuladhar A. et al.* Blockchain for compliance: an information processing case study of mandatory supply chain transparency in conflict minerals sourcing. Supply Chain Management: An International Journal, 2024. **29**(4): p. 755…777.

22. *Haffar S. and Özceylan E.* Blockchain-Based System for Supplier Selection in Sustainable and Leagile Supply Chains. IEEE Access, 2024. **12**: p. 139883…139911.

23. *Cui Y., Gaur V., Liu J.* Supply Chain Transparency and Blockchain Design. Management Science, 2023. **70**(5): p. 3245…3263.

24. *Allouzi A.S.* Blockchain-Based Smart Contracts Affect the Speed of Arbitration in Resolving Disputes and the Role of the Mediator in the Arbitration Process Especially in Supply and Logistics Contracts. Evolutionary Studies in Imaginative Culture, 2024: p. 461…470.

25. *Zhang Z.* The Application of Blockchain Technology in Enterprise Value Chain Cost Management. Pacific International Journal, 2024. **7**(1): p. 143…149.

26. *Chauhan V.* Blockchain Technology in Supply Chain Management. Interantional Journal of Scientific Research in Engineering and Management, 2024. 6 (1). https://doi.org/10.36948/ijfmr.2024.v06i01.13504

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