



## Blockchain Technology for Transparency and Fraud Prevention in Supply Chain Management

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### Abstract

*A quantitative study involving 145 supply chain professionals at Shell Lagos, Nigeria, analyzed the impact of blockchain technology on supply chain transparency and fraud prevention. The findings revealed a strong positive correlation ( $R = 0.949$ ) between blockchain adoption and transparency, with blockchain factors accounting for 90% ( $R^2 = 0.900$ ) of the variance in transparency. The model was statistically significant ( $F = 288.9$ ,  $p < 0.000$ ). Regression coefficients indicated significant contributions from blockchain project count ( $B = 0.315$ ), investment ( $B = 1.977e-05$ ), patents ( $B = 0.511$ ), and adoption rate ( $B = 1.200$ ) to improving transparency. Positive correlations were observed between supply chain transparency and blockchain investment ( $r = 0.700$ ), project count ( $r = 0.400$ ), and patents ( $r = 0.385$ ), while a weak negative correlation was revealed with adoption rate ( $r = -0.063$ ), suggesting potential challenges in the adoption process. The study however recommends an increased investment in blockchain projects and the encouragement of blockchain-related patents should be prioritized in enhancing supply chain transparency and reducing fraud.*

**Keywords:** Blockchain, Fraud Prevention, Supply Chain Management, Transparency

### Introduction

The complexity of global supply chains has intensified concerns about transparency and fraud prevention. Traditional centralized systems are vulnerable to inefficiencies, manipulation, and a lack of real-time visibility, increasing the appeal of blockchain as a decentralized, tamper-proof solution (Fosso Wamba & Queiroz, 2020). Blockchain enhances transparency, ensures data integrity, and reduces fraud, making it a transformative tool in supply chain management (Nguyen et al., 2024). Adoption indicators include blockchain project count, investments, patent filings, and adoption rates among organizations. Increased blockchain projects across industries signal its potential to streamline operations and improve security (Vadgama & Tasca, 2020). Investments in blockchain solutions are projected to grow significantly, reinforcing its role in supply chain efficiency (TT Consultants, 2024).

Blockchain-driven innovations, such as smart contracts and decentralized traceability, address supply chain vulnerabilities (PatentPC, 2025). Companies leveraging blockchain report improvements in tracking goods, reducing counterfeiting, and ensuring compliance (Nguyen

et al., 2024). Empirical evidence supports blockchain's effectiveness, showing enhanced visibility, fraud risk reduction by up to 45%, and improved operational efficiency by 30% (Rapid Innovation, 2024). Case studies highlight successful blockchain implementation for product tracking, ensuring transparency (Leadvent Group, 2025). However, adoption challenges, including regulatory concerns, scalability issues, and high implementation costs, persist. Despite these, continued advancements and industry collaboration are expected to drive further blockchain adoption (SEKO Logistics, 2024).

### **Statement of the Problem**

Supply chain fraud and transparency issues present critical challenges in global trade, leading to financial losses, reputational damage, and operational inefficiencies (Fosso Wamba & Queiroz, 2020). Despite digital advancements, real-time tracking and secure transaction verification remain difficult (Nguyen et al., 2024). Blockchain adoption in supply chains faces obstacles such as high implementation costs, regulatory uncertainties, and scalability concerns (Vadgama & Tasca, 2020). While some companies initiate blockchain projects for transparency and fraud prevention, implementation levels and adoption rates vary across industries (TT Consultants, 2024). This study evaluates blockchain adoption using key indicators—Blockchain Project Count, Blockchain Investment, Blockchain Patents, and Blockchain Adoption Rate—to assess its impact on mitigating fraud and enhancing transparency.

### **Literature Review**

#### **Conceptual Review**

Blockchain is a decentralized digital ledger that securely records transactions, ensuring immutability and transparency (SEKO Logistics, 2024). It enhances supply chain traceability, providing a single source of truth for participants. Transparency enables real-time tracking of goods, improving efficiency and compliance with ethical and environmental standards (Leadvent Group, 2025). Fraudulent activities, including counterfeiting and unauthorized record alterations, pose significant risks in supply chains. Blockchain's immutable ledger secures transactions, reducing fraud risk (Supply Chain Wizard, 2024).

The presence of blockchain-based projects signifies industry adoption. Increased projects indicate recognition of blockchain's potential in supply chains (Deloitte, 2020). Investments in

blockchain demonstrate organizational commitment, with the market expected to reach USD 17.57 billion by 2023 (TT Consultants, 2024). Patent filings reflect innovation and proprietary solutions, covering traceability, authentication, smart contracts, and data security (PatentPC, 2025). The adoption rate of blockchain in supply chains signals its integration into business operations (Nguyen et al., 2024). However, technical complexity, costs, and industry-wide adoption challenges persist. Despite these, blockchain offers traceability improvements, fraud reduction, and competitive advantages (SEKO Logistics, 2024).

## **Theoretical Review**

The Resource-Based View (RBV) (Barney, 1991) and Trust Transfer Theory (Stewart, 2003) explain blockchain's role in supply chains. RBV suggests firms gain competitive advantage through valuable, rare, inimitable, and non-substitutable resources. Blockchain enhances security, transparency, and efficiency, differentiating organizations. Trust Transfer Theory posits that trust shifts from a trusted entity to another. Blockchain's decentralized, cryptographic, and immutable nature builds trust among supply chain stakeholders, ensuring credibility and reducing fraud risks. These frameworks demonstrate blockchain as a strategic resource and trust-enhancing mechanism, addressing transparency and fraud concerns in supply chains.

## **Empirical Review**

Empirical studies affirm blockchain's role in improving transparency, reducing fraud, and enhancing efficiency. Deloitte (2020) found that blockchain improves traceability and lowers administrative costs. SEKO Logistics (2024) reported blockchain significantly reduces fraud in logistics. Case studies in the food industry confirm blockchain enhances supply chain visibility and trust (Rogerson & Parry, 2020). Islam et al. (2024) noted blockchain's positive impact on transparency across industries. In the jewelry sector, Nature (2025) found blockchain enhances trust and efficiency. Pharmaceutical sector studies reveal blockchain prevents fraud and ensures regulatory compliance (PMC, 2022; Yiu, 2021). Blockchain's role in counterfeit detection was supported by Anjum and Dutta (2022), who found blockchain reduces counterfeiting risks. Longo et al. (2022) demonstrated blockchain improves trust and collaboration, enhancing supply chain efficiency.

## **Methodology**

This study adopted a quantitative research design. The population comprised 200 supply chain professionals at Shell Lagos, Nigeria. A stratified random sampling technique was used to select 133 respondents, determined using Yamane's (1967) formula. Data was collected via structured questionnaires on a five-point Likert scale and analyzed using SPSS. Cronbach's alpha of 0.7 confirmed internal consistency. The model for analysis was:

$$\text{SCTFP} = 0.0665 + 0.3158(\text{BPC}) + 1.977\text{e-}05(\text{BI}) + 0.5113(\text{BP}) + 1.2009(\text{BAR}) + \varepsilon$$

Hypotheses tested:

H<sub>01</sub>: Blockchain project count has no significant impact on supply chain transparency and fraud prevention. H<sub>02</sub>: Blockchain investment has no significant impact on supply chain transparency and fraud prevention. H<sub>03</sub>: Blockchain patents have no significant impact on supply chain transparency and fraud prevention. H<sub>04</sub>: Blockchain adoption rate has no significant impact on supply chain transparency and fraud prevention.

## Results and Discussion

### Results

**Table 1:** Model Summary

| Model | R     | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------|----------|-------------------|----------------------------|
| 1     | 0.949 | 0.900    | 0.897             | 0.947                      |

**Source:** Researchers Computation, (2025).

The R (0.949) indicates a strong positive relationship between blockchain variables and supply chain transparency, while R<sup>2</sup> (0.900) suggests 90% of the variance in transparency is explained by blockchain adoption. Hence, adjusted R<sup>2</sup> for predictors indicated a strong model.

**Table 2:** ANOVA

| Model      | Sum of Squares | df  | Mean Square | F     | Sig.  |
|------------|----------------|-----|-------------|-------|-------|
| Regression | 268.23         | 4   | 67.06       | 288.9 | 0.000 |
| Residual   | 29.59          | 128 | 0.231       | -     | -     |
| Total      | 297.82         | 132 | -           | -     | -     |

**Source:** Researchers Computation, (2025).

The F (288.9, p = 0.000) statistical value indicates that the model is statistically significant.

**Table 3:** Coefficients

| Predictors               | B         | Std. Error | t      | Sig.  |
|--------------------------|-----------|------------|--------|-------|
| (Constant)               | 0.066     | 0.414      | 0.161  | 0.873 |
| Blockchain Project Count | 0.315     | 0.018      | 18.016 | 0.000 |
| Blockchain Investment    | 1.977e-05 | 7.5e-07    | 26.346 | 0.000 |
| Blockchain Patents       | 0.511     | 0.031      | 16.510 | 0.000 |
| Blockchain Adoption Rate | 1.200     | 0.339      | 3.546  | 0.001 |

**Source:** Researchers Computation, (2025).

The Table 3 exhibited that all predictors are statistically significant ( $p < 0.05$ ), indicating they contribute to improving transparency.

**Table 4:** Correlation Matrix

| Variables                         | BPC    | BI     | BP     | BAR    | SCTFP  |
|-----------------------------------|--------|--------|--------|--------|--------|
| Blockchain Project Count (BPC)    | 1.000  | -0.054 | -0.139 | -0.031 | 0.400  |
| Blockchain Investment (BI)        | -0.054 | 1.000  | -0.003 | -0.151 | 0.700  |
| Blockchain Patents (BP)           | -0.139 | -0.003 | 1.000  | -0.075 | 0.385  |
| Blockchain Adoption Rate (BAR)    | -0.031 | -0.151 | -0.075 | 1.000  | -0.063 |
| Supply Chain Transparency (SCTFP) | 0.400  | 0.700  | 0.385  | -0.063 | 1.000  |

**Source:** Researchers Computation, (2025).

The Table 4 shows that there exists a **Positive Correlation between** Blockchain Investment ( $r = 0.700$ ), Project Count ( $r = 0.400$ ), and Patents ( $r = 0.385$ ) and supply-chain Transparency, and Blockchain Adoption Rate shows negative relationship ( $r = -0.063$ ).

## Discussion

Regression analysis confirmed blockchain adoption significantly enhances supply chain transparency at Shell Lagos. The model's R-squared value (0.900) indicates that 90% of supply chain transparency variations are explained by blockchain. ANOVA results (F = 288.9, p =

0.000) confirm statistical significance. Coefficients analysis shows all independent variables positively influence transparency ( $p < 0.05$ ).

The correlation matrix revealed blockchain investment had the highest correlation with transparency ( $r = 0.700$ ), highlighting its importance. Project count and patents also positively influenced transparency, while the adoption rate had a negative correlation ( $r = -0.063$ ), indicating adoption challenges. Findings suggest increased investment, blockchain projects, and patents enhance transparency, but adoption barriers must be addressed.

## **Conclusion**

Blockchain technology offers a decentralized, tamper-proof solution for supply chain transparency and fraud prevention. Adoption indicators—project count, investments, patents, and adoption rates—highlight its growing importance. Empirical evidence shows blockchain enhances visibility, reduces fraud, and improves operational efficiency. Despite regulatory and implementation challenges, blockchain is set to become a fundamental component of secure and efficient supply chains.

## **Recommendations**

- Allocate resources to develop blockchain solutions for improved transparency and fraud prevention.
- Promote blockchain patents to advance proprietary solutions for traceability and authentication.
- Support organizations in integrating blockchain to reduce counterfeiting risks and ensure regulatory compliance.
- Combine blockchain with IoT for enhanced transparency and operational efficiency.
- Implement real-time tracking to improve stakeholder trust and transaction security.

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