Blockchain Integration in Algerian Banks as a Strategic Driver for Enhancing Financial Supply Chain Efficiency: A Field Study within the IFAC Compliance Framework

Saida SLIMANI [1],

[1] University of Batna 1 (Algeria) ⬤ , saida.slimani@univ-batna.dz

Abstract:

This study investigates the readiness of Algerian banks to adopt blockchain technology to enhance financial supply chain efficiency. It examine technical, regulatory, economic, and cultural determinants influencing adoption, as well as potential benefits and challenges. Employing a descriptive-analytical approach, data were collected via a questionnaire distributed to 216 bank employees and analyzed using SPSS 26, with hypothesis testing conducted through T-Tests. Results indicate sufficient technical infrastructure and supportive, yet evolving, regulatory conditions. Economic and cultural factors are conducive to adoption, although technical awareness requires improvement. Blockchain implementation is associated with enhanced transparency, faster transactions, and reduced operational costs. The study recommends strengthening digital infrastructure, updating legislation, and improving cybersecurity measures, blockchain adoption represents a strategic move toward modernizing Algeria's banking sector and aligning it with international standards.

Keywords: Blockchain, Supply Chains; Digital Transformation; IFAC; Algeria.

JEL Classification Codes: O33, M15.

ملخص:

تهدف هذه الدراسة إلى تقييم جاهزية البنوك الجزائرية لاعتماد تقنية البلوكشين لتعزيز كفاءة سلاسل التوريد المالية. تركز على العوامل التقنية والتنظيمية والاقتصادية والثقافية المؤثرة على تبني هذه التقنية، بالإضافة إلى تحديد الفوائد والتحديات المرتبطة بالتكامل. استخدمت الدراسة المنهج الوصفي التحليلي، بإستخدام استبيان وزع على 216 موظفا في البنوك الجزائرية، وتم تحليلها ببرنامج SPSS 26، مع اختبار الفرضيات بواسطة اختبارT . أظهرت النتائج توفر البنية التحتية التقنية ودعما تنظيميا مع الحاجة لتطوير تشريعات إضافية. كما تتيح العوامل الاقتصادية والثقافية بيئة مناسبة للاعتماد رغم الحاجة لتحسين الوعي التقني. ويساهم تطبيق البلوكشين في تعزيز الشفافية، وتسريع المعاملات، وخفض التكاليف التشغيلية. توصي الدراسة بتطوير البنية الرقمية، وتحديث التشريعات، وتعزيز الأمن السيبراني.

كلمات مفتاحية: بلوك تشين.، سلاسل التوريد.، تحول رقمي.، اتحاد دولي للمحاسبين.، جزائر.

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Corresponding author: Saida SLIMANI, e-mail: saida.slimani@univ-batna.dz

1. Introduction

The global financial system is undergoing a profound transformation driven by rapid technological advancements. Among the most influential innovations is blockchain technology, which is playing a pivotal role in enhancing the efficiency of financial operations, while promoting transparency and security. Blockchain is a decentralized ledger system that enables the recording of transactions in a secure and tamper-proof manner, leading to reduced operational costs, faster execution of transactions, and minimized risks of fraud. These developments have prompted numerous financial institutions worldwide to adopt blockchain to improve the performance of financial supply chains and align more effectively with international financial and accounting standards. In Algeria, efforts to implement digital transformation in the banking sector are steadily growing. However, the adoption of blockchain technology remains in its early stages, raising critical questions regarding the determinants that influence its acceptance. This topic becomes especially relevant as Algeria seeks to strengthen its compliance with international standards set by the International Federation of Accountants (IFAC), where the adoption of cutting-edge technologies such as blockchain is considered a key step toward integration.

This study aims to examine the readiness of Algerian banks to adopt blockchain technology as a means of improving the efficiency of financial supply chains within the broader context of aligning with international accounting and financial governance standards. Through a field investigation involving a sample of Algerian banks, this paper seeks to analyze the key factors influencing blockchain adoption, identify major challenges, and propose strategic solutions to support digital transformation and enhance the capacity of Algerian financial institutions to integrate with global financial systems.

1.1 Research Problem

Based on the above context, the central research question guiding this study is as follows: What are the key determinants contributing to the adoption of blockchain technology in Algerian banks to enhance the efficiency of financial supply chains in light of IFAC integration requirements?

1.2 Research Hypotheses

To answer the research problem, the following hypotheses are proposed:

H1: There are statistically significant positive indicators regarding the availability of the necessary technical factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains.

H2: There are statistically significant positive indicators regarding the availability of the necessary organizational factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains.

H3: There are statistically significant positive indicators regarding the availability of the necessary cultural and economic factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains.

H4: There are statistically significant positive indicators that the adoption of blockchain technologies by Algerian banks leads to potential benefits that enhance the efficiency of financial supply chains.

1.3 Significance of the Study

The significance of this study lies in its focus on blockchain as an innovative tool to improve financial operational efficiency and to enhance the readiness of Algerian banks to comply with international standards. By shedding light on the challenges hindering blockchain adoption and proposing practical strategies, the study contributes to ongoing digital transformation efforts within the banking sector. It also aims to facilitate the broader integration of Algeria into the global financial system by aligning domestic practices with international norms.

1.4 Study Objectives

This study seeks to achieve the following objectives:

- To analyze the technical, regulatory, and economic determinants of blockchain adoption in Algerian banks;

- To assess the role of digital transformation in accelerating the implementation and maximizing the benefits of blockchain technology;

- To explore the contribution of blockchain technology to improving financial supply chain management in the Algerian banking sector;

- To identify the challenges that hinder the application of blockchain in Algerian banks and propose actionable solutions;

- To provide recommendations for enhancing the preparedness of Algerian banks to adopt blockchain technology in alignment with IFAC standards.

1.5 Research Methodology

This study employs a descriptive-analytical methodology, combining theoretical analysis of the blockchain concept and its role in financial supply chain management with an empirical field study conducted on a sample of Algerian banks. Data collected will be analyzed using appropriate statistical techniques to test the proposed hypotheses and draw conclusions supported by empirical evidence.

1.6 Literature Review

Recent literature has shown growing interest in blockchain technology, particularly in relation to its applications in managing financial supply chains, given its critical role in enhancing efficiency, transparency, and security. Numerous studies have approached this subject from various perspectives, offering valuable insights that

support the academic discussion regarding the potential deployment of blockchain in the Algerian banking sector.

In this context, the study by (Tan & al, 2018) sought to examine the extent to which blockchain technology was adopted in the food supply chains of Walmart, while also exploring the associated challenges and benefits. The study employed an analytical approach based on multi-source data collection and focused on the company's operations to evaluate the role of blockchain in improving supply chain efficiency. The findings revealed that blockchain contributes to reducing food safety risks, enhancing operational efficiency, accelerating collaboration among stakeholders, and lowering carbon emissions. However, the study also highlighted high operational costs as a key obstacle to widespread adoption. Despite the inherent differences between the banking and food sectors, the insights from this study provide a useful analytical framework for examining the integration of blockchain in financial supply chains within Algerian banks, particularly in terms of risk reduction and operational efficiency.

The study by (Peña Ortega & Llivisaca Villazhañay, 2020) adopted a literature review methodology to analyze blockchain applications in food supply chain management in Ecuador, aiming to assess the potential contributions of this technology to overall supply chain performance. The study concluded that blockchain enhances integration among supply chain actors, provides a reliable product traceability system, and ensures the trustworthiness of smart contracts in managing procurement and financing processes. Furthermore, it highlighted the technology's potential to monitor supplier identity and reputation, thereby fostering more transparent commercial relationships. These findings are particularly relevant when considered in the context of Algerian banks, where blockchain could enhance the credibility of financial transactions and mitigate risks associated with cash flows across financial supply chains.

In another study, (Meidute-Kavaliauskiene & al, 2021) examined the impact of blockchain on transparency, flexibility, and trust in supply chains by analyzing data from 1,000 companies published en 2019. The results demonstrated that blockchain plays a crucial role in strengthening operational transparency, improving institutional responsiveness to market dynamics, and increasing trust among supply chain stakeholders. These findings can be extended to the Algerian banking sector, where the integration of blockchain in financial supply chains may lead to higher levels of transparency and reliability, aligning with the requirements for integration into IFAC and ensuring compliance with international standards for financial disclosure and risk management.

Based on the above, previous studies make it clear that blockchain technology represents a promising opportunity for improving supply chain management across various sectors, including banking. Drawing on these insights, blockchain can be

further explored as a strategic tool for enhancing the efficiency of financial supply chains in Algerian banks through greater transparency, improved financial process efficiency, and alignment with international accounting and financial standards.

2. Theoretical Framework of the Study

In light of rapid digital advancements, digital supply chains have emerged as a fundamental pillar for enhancing efficiency and transparency in logistical operations, driven by technologies such as blockchain. Blockchain represents a particularly innovative tool in this context, contributing to increased security, reduced manipulation, and improved traceability of products and services across various stages of the supply chain. This section presents the theoretical foundations related to blockchain applications and supply chain management.

2.1 Blockchain Applications

Blockchain is considered one of the most prominent recent digital innovations, providing a secure and transparent environment for recording data and transactions without the need for a central intermediary. It relie on decentralization and cryptographic algorithms to ensure data protection and verification.

2.1.1 Concept of Blockchain

The term blockchain refers to the mechanism of generating sequential blocks within digital currency systems. It serves a eu decentralized digital ledger that maintains all financial transactions, as well as records of assets and liabilities. The system is built upon complex encryption algorithms that prevent data manipulation, reinforcing its reliability as a tool for securely storing and transferring digital assets (Al-Hasban, 2019, p. 137).

According to the concept of Distributed Ledger Technology (DLT), blockchain is defined as a decentralized database where transactions are recorded using a semi-permanent cryptographic signature. New blocks are sequentially added, and previous records cannot be altered. Each block is linked to its predecessor via advanced encryption algorithms and is timestamped to ensure traceability of all operations (Al-Rakhami & Al-Mashari, 2021, p. 03).

The U.S. Federal Reserve offered a comprehensive definition of blockchain, describing it as a type of distributed database shared across network nodes. As the financial sector explores a wide range of blockchain applications, the distributed ledger is viewed as an integrated system comprising decentralized peer-to-peer networks (P2P), distributed data storage, and advanced encryption technologies all of which contribute to a fundamental transformation in how digital assets are recorded, stored, and transferred (Mils & al, 2016).

In summary, blockchain can be defined as a distributed digital ledger composed of interconnected blocks operating in a decentralized environment under strong

cryptographic algorithms. It ensures data integrity and the continuity of record-keeping, while allowing new blocks to be added without modifying previous records.

2.1.2 Historical Development of Blockchain Technology

The initial concept of blockchain dates back to the early 1990s when researchers Haber and Stornetta proposed a system for timestamping digital assets to preserve the authenticity of documents and prevent unauthorized alterations (Abd El-Tawab, 2020, p. 10). However, the concept faced technical limitations, such as the risk of digital transactions being duplicated known as the double-spending problem.

En 2008, the idea was revived by the enigmatic figure Satoshi Nakamoto, who introduced in his groundbreaking paper "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008), a new approach to digital transactions based on peer-to-peer (P2P) networking and an immutable recording mechanism. This model enabled secure and trustworthy financial operations without the need for centralized intermediaries (Rawat, Chaudhary, & Doku, 2020, p. 06).

En 2009, the first practical implementation of blockchain took place with the launch of Bitcoin, which employed block hashing mechanisms to securely document each transaction within an immutable ledger. This innovation laid the foundation for a secure and decentralized digital financial system (Rawat, Chaudhary, & Doku, 2020, p. 06).

2.1.3 Distinctive Attributes of Blockchain Technology

Blockchain is characterized by a set of foundational properties that distinguish it as a disruptive force in digital transactions and financial ecosystems. These attributes contribute to its increasing adoption across various sectors:

- Decentralized Architecture: At its core, blockchain operates through a distributed network in which transaction validation is collectively maintained by multiple nodes, eliminating reliance on a central authority (El-Sayed, 2020, p. 93).

- Data Immutability: Once a transaction is encoded onto the blockchain, it becomes immutable. Altering any record requires consensus from over 51% of participating nodes, making unauthorized manipulation exceedingly unlikely (El-Sayed, 2020, p. 93).

- Consensus Protocols: The validation of new blocks relies on algorithmic agreement across nodes, typically via mechanisms such as Proof of Work (PoW) or Proof of Stake (PoS), ensuring integrity without centralized control (Al-Jakhlab, 2021, p. 05).

- Operational Transparency: Blockchain systems allow for real-time traceability of transactions, enabling higher levels of security, auditability, and stakeholder trust (El-Sharkawy, 2019, p. 13).

- Anonymized Interaction: Blockchain preserves user privacy by allowing transactions to be processed without disclosing personal identities, reinforcing data protection in digital environments (Al-Jakhlab, 2021, p. 05).

2.1.4 Functional Mechanics of Blockchain

Blockchain systems function through a structured and sequential process designed to preserve transactional integrity and transparency. The typical operational flow includes the following stages: (Slimani, 2025, p. 221)

1. Network Participation: Users initiate engagement by registering with a blockchain-enabled platform and establishing a digital account;

2. Transaction Creation: Any transaction whether purchasing, transferring, or exchanging digital assets generates a new block encapsulating the transaction data;

3. Distributed Validation: The block is propagated across the network, where nodes collectively validate its contents using pre-defined consensus algorithms;

4. Block Finalization: Upon successful validation, the block is permanently added to the existing chain, ensuring the record is tamper-resistant;

5. Ledger Update: The verified transaction becomes part of the distributed ledger, completing the process with an irreversible and time-stamped record.

2.1.5 Blockchain Implementation Across Sectors: A Holistic Overview

Blockchain's rapid evolution has positioned it as a cornerstone technology with the capacity to reshape operational paradigms across industries. Its inherent trust-enabling and decentralized features offer transformative potential for public institutions, private enterprises, and hybrid systems alike.

Blockchain use cases can be mapped across sectors based on their operational orientation (public, private, or hybrid) and the mode of implementation either as a service layer providing secure data infrastructure or as an application layer enabling advanced functional capabilities. This framework is instrumental in aligning blockchain deployment with specific organizational or sectoral demands.

According to the model proposed by (Sultan & al, 2018, p. 56), each implementation scenario can be critically assessed through key dimensions:

- Access Mode: Is the blockchain designed primarily to offer data services, or does it function as a transactional application?

- Adoption Scope: Is the technology deployed universally across the sector, or is its use case tailored to proprietary, institution-specific needs?

2.2 The Concept and Characteristics of Digital Supply Chains

Digital supply chains represent an advanced evolution of traditional supply chain models, integrating cutting-edge technologies such as artificial intelligence, blockchain, the Internet of Things (IoT), and cloud computing. These technologies enable seamless coordination of the flow of goods, services, and information among suppliers, manufacturers, distributors, and customers. The primary objective is to optimize operational efficiency, reduce costs, and improve responsiveness to market demand.

2.2.1 Digital Supply Chains and Their Core Features

The rapid acceleration of technological innovation, particularly within the framework of the Fourth Industrial Revolution, has given rise to a new paradigm in supply chain management one that is digitally integrated and intelligently connected across all stakeholders. This paradigm marks a departure from conventional supply models, offering enhanced value creation through the effective synchronization of data and operations.

Digital supply chains are defined as "interconnected networks that leverage advanced analytics and artificial intelligence to generate new revenue streams and maximize business value, using a centralized platform that collects and processes real-time data from multiple sources" (Korpela & al, 2017). Another perspective conceptualizes them as comprehensive technological ecosystems comprised of software, hardware, and communication networks, enabling real-time coordination of operational activities from procurement and manufacturing to warehousing and distribution (Bhargava & al, 2013, p. 4637).

2.2.2 Requirements for Digital Transformation in Supply Chains

Achieving digital transformation within supply chains necessitates a complete reengineering of traditional workflows to align with contemporary technological advancements. This transformation should be guided by a clearly defined strategy encompassing a series of progressive phases beginning with the assessment of current digital maturity, identifying capability gaps, allocating resources, and culminating in phased, adaptive implementation.

According to (El-Barbary & Awad, 2021, p. 114), the foundational pillars of successful digital transformation include:

- Establishing a Clear Strategic Vision: Defining long-term goals that ensure added value from digitalization efforts;

- Adaptability to Technological Change: Continuously revising strategies to keep pace with emerging innovations;

- Digital Leadership Enablement: Engaging top management to champion transformation initiatives and secure necessary resources;

- Flexible Organizational Structures: Reducing bureaucratic complexity and fostering cross-functional collaboration;

- Customer-Centric Market Analysis: Aligning digital strategies with evolving consumer expectations and market shifts;

- Investment in Digital Infrastructure: Implementing advanced solutions for data management and IoT integration;

- Digital Skills Development: Upskilling human resources in emerging technologies and enhancing organizational digital literacy;

- Fostering a Culture of Innovation: Encouraging digital-first mindsets across all institutional levels.

2.2.3 Digital Transformation Strategies in Supply Chains

A range of strategic approaches have emerged to support the digitalization of supply chains, including:

- Sustainable Supply Chains: These strategies employ environmentally conscious technologies to promote operational sustainability and reduce ecological footprints (Wang & al, 2020, p. 03).

- Agile Supply Chains: Focused on adaptability and speed, these strategies enable organizations to respond swiftly and effectively to market fluctuations (Pourbabagol & al, 2023, p. 02).

- Digital Supply Chain Governance: This strategy emphasizes enhanced control over operational processes and fosters collaboration and transparency among partners (Lin & al, 2023, p. 05).

2.2.4 Strategic Benefits of Digital Transformation in Supply Chains

Digital transformation in supply chains brings a paradigm shift to institutional performance, enabling substantial improvements in operational efficiency and responsiveness to market dynamics. The key strategic advantages include: (Agrawal & Narain, 2018, p. 05)

- Enhanced Transparency and Data-Driven Decision-Making: Real-time visibility across the supply chain improves the quality and speed of strategic decisions;

- Operational Cost Reduction: Optimized inventory management and streamlined logistics reduce overhead expenses;

- Greater Agility and Risk Mitigation: Digitally enabled supply chains are better equipped to adapt to disruptions and uncertainties;

- Accelerated Processes and Customer Satisfaction: Automation and intelligent systems speed up operations, leading to improved client experience;

- Strengthened Competitive Edge Through Continuous Innovation: Digital tools foster innovation cycles that sustain long-term market positioning;

In sum, digital transformation serves as a catalyst for sustainable growth in today's rapidly evolving business landscape, enabling organizations to transition from reactive to predictive models of supply chain management.

2.2.5 The Relationship Between Blockchain Integration in Algerian Banks and the Efficiency of Financial Supply Chains Under IFAC Compliance

The integration of blockchain technology in the Algerian banking sector holds transformative potential for enhancing financial supply chain efficiency, particularly within the framework of compliance with the International Federation of Accountants (IFAC). This relationship can be articulated through the following dimensions:

- Blockchain as a Catalyst for Digital Transformation: The adoption of blockchain represents a foundational step in the digital modernization of Algerian banks. By

leveraging a decentralized ledger system, financial operations such as payments, transfers, and settlements become faster, more secure, and less susceptible to fraud. These improvements ultimately reduce operational costs and improve transactional transparency;

- Enhancing Financial Supply Chain Efficiency Through Blockchain: Blockchain automates verification and authentication processes, minimizing delays and manual interventions. It also facilitates efficient capital flow and financial information exchange, thereby reducing dependency on intermediaries and associated transactional costs. Moreover, the immutable nature of blockchain records enhances trust and accountability among stakeholders involved in the financial supply chain;

- Blockchain's Role in Supporting IFAC Compliance: The integration of blockchain directly supports adherence to IFAC standards by ensuring transparency, auditability, and consistency in financial data. The technology enables real-time, tamper-proof recording of transactions, thereby simplifying both internal and external audit procedures. In addition, it facilitates accurate financial disclosures, which reinforces stakeholder confidence in the reliability of banks' financial reporting;

- The Interplay Between Financial Supply Chain Efficiency and IFAC Standards: Efficient financial supply chains are a prerequisite for aligning with IFAC's accounting and auditing frameworks. Higher process efficiency and reduced accounting discrepancies improve transparency, which is central to international compliance. Blockchain, in this context, acts as a governance mechanism that promotes global best practices in financial transactions thereby accelerating the integration of Algerian banks into international financial ecosystems.

3. Empirical Investigation of Blockchain Integration in Algerian Banks a eu Mechanism to Enhance Financial Supply Chain Efficiency Under IFAC Alignment

To carry out the empirical phase of this study, it was essential to first define the target population and determine an appropriate sample size. This was followed by the validation of the primary data collection instrument the questionnaire and a detailed analysis of the sample's demographic characteristics, as outlined below:

3.1 Preliminary Procedures

3.1.1 Study Population and Sampling Frame

The study population consists of employees working within Algerian banks. A simple random sample of 225 individuals was selected for the field survey. Of the distributed questionnaires, 216 were completed and returned in usable form, yielding a response rate of 96%, which is considered robust for quantitative analysis.

3.1.2 Data Collection Instrument

This study relied on a structured questionnaire as the primary quantitative tool for addressing the research problem and testing the proposed hypotheses. The

questionnaire was divided into two main sections: (Section One: Captured demographic and professional characteristics of the respondents; Section Two: Contained Likert-scale items targeting respondents' perceptions regarding each construct of the study). The design of the instrument was informed by relevant prior studies in the field and grounded in the theoretical framework underpinning the research. To ensure the validity and precision of the instrument, the questionnaire was reviewed by a panel of academic experts. Additionally, statistical analysis was conducted using SPSS (version 26) and AMOS to verify reliability and support robust interpretation of the results.

3.1.3 Instrument Reliability and Descriptive Characteristics of the Sample

A- Reliability of the Measurement Instrument (Cronbach's Alpha)

To assess the internal consistency of the questionnaire, Cronbach's Alpha coefficient was employed. The results are presented below:

Table 01: Cronbach's Alpha Coefficients

Construct	No. Items	Cronbach's Alpha
Technical Factors	5	0.881
Organizational Factors	5	0.814
Economic and Cultural Factors	5	0.836
Potential Benefits of Blockchain Adoption	5	0.768
Constraints and Challenges	5	0.755
Future Directions	5	0.874
Overall Scale	**30**	**0.857**

Source: Prepared by the researcher based on SPSS Version 26 outputs.

As shown in Table 01, Cronbach's Alpha coefficients for the six constructs ranged from 0.755 to 0.881, with an overall reliability of 0.857, exceeding the acceptable threshold of 0.70. These results confirm that the instrument demonstrates strong internal consistency and reliability across all dimensions. The highest reliability values were recorded for technical factors and future directions, reflecting stable respondent perceptions regarding technological readiness and strategic prospects of blockchain adoption in Algerian banks. Accordingly, the scale is deemed statistically sound for further analysis.

B- Descriptive Characteristics of the Study Sample

Table 02: Descriptive Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	142	65.74%
	Female	74	34.26%
Job Position	Manager	28	12.96%
	Staff (Admin/Technical/IT)	188	87.04%

Age Group	21–30 years	38	17.59%
	31–40 years	116	53.70%
	Above 41 years	62	28.71%
Education Level	Bachelor's Degree	58	26.85%
	Master's/Magister Degree	126	58.33%
	Doctorate	32	14.82%

Source: Prepared by the researcher based on SPSS Version 26 outputs.

The demographic profile presented in Table 02 provides an overview of the structural composition of employees within the surveyed Algerian banks. The results indicate that male respondents constitute 65.74% of the sample, reflecting a workforce still dominated by men, while females account for 34.26%, signaling gradual but meaningful progress toward gender diversity in the sector. In terms of job hierarchy, the majority of participants (87.04%) are employed in administrative, technical, or IT-related roles positions that are directly involved in operational and digital functions critical to blockchain implementation. Meanwhile, 12.96% of respondents hold managerial positions, emphasizing that strategic leadership engagement in technological adoption remains relatively limited. The largest proportion of respondents (53.70%) falls within the 31–40 age group, a segment characterized by professional maturity and adaptability to innovation, making it central to digital transformation initiatives. Younger employees (21–30 years) represent 17.59% of the sample, signifying a promising generation capable of advancing future technological evolution if adequately empowered and trained. Regarding education, a strong majority hold Master's or Magister degrees (58.33%), while 26.85% possess Bachelor's degrees and 14.82% Doctorates. This high educational attainment highlights the intellectual readiness of the banking workforce to engage with sophisticated financial technologies such as blockchain, fostering an enabling environment for enhancing the efficiency and transparency of financial supply chains.

3.1.4 Descriptive Measures of the Study Variables and Hypothesis Testing
A- Descriptive Measures of the Study Variables

This section aims to provide a descriptive analysis of respondents' perceptions regarding each variable studied. Two key descriptive statistics were employed: the arithmetic mean and standard deviation. Based on the five-point Likert scale utilized in the questionnaire, mean values were interpreted according to the following intervals: [1–1.80]: Strongly Disagree; [1.80–2.60]: Disagree; [2.60–3.40]: Somewhat Agree; [3.40–4.20]: Agree; [4.20–5]: Strongly Agree;

Table 03: Descriptive Statistics for Study Variables

Dimension	Mean	Std. Deviation	Level of Agreement

Availability of modern IT infrastructure	4.35	0.66	Strongly Agree
Compatibility of blockchain with existing systems	4.21	0.70	Strongly Agree
Adequacy of technical expertise	4.18	0.72	Agree
Efficiency of data security systems	4.28	0.69	Strongly Agree
Quality of digital communication channels	4.24	0.67	Strongly Agree
Technical Factors	**4.25**	**0.69**	**Strongly Agree**
Clarity of digital transformation strategy	4.12	0.74	Agree
Existence of regulatory support mechanisms	4.05	0.77	Agree
Leadership commitment to blockchain adoption	4.09	0.80	Agree
Efficiency of inter-departmental coordination	4.00	0.78	Agree
Flexibility of organizational structure	3.94	0.83	Agree
Organizational Factors	**4.04**	**0.78**	**Agree**
Awareness of blockchain's economic potential	4.06	0.75	Agree
Cost-effectiveness perception	3.98	0.79	Agree
Availability of financial resources	3.92	0.81	Agree
Cultural openness to technological innovation	4.03	0.77	Agree
Management willingness to invest in digital tools	4.01	0.80	Agree
Economic and Cultural Factors	**4.00**	**0.78**	**Agree**
Enhances transaction transparency	4.30	0.70	Strongly Agree
Improves operational efficiency	4.19	0.73	Agree
Reduces fraud and manipulation	4.24	0.72	Strongly Agree
Strengthens customer trust	4.33	0.68	Strongly Agree
Lowers operational costs	4.20	0.76	Agree
Potential Benefits of Blockchain Adoption	**4.25**	**0.72**	**Strongly Agree**
Limited technical expertise	4.12	0.81	Agree
High implementation costs	4.09	0.85	Agree
Resistance to organizational change	4.04	0.83	Agree
Inadequate regulatory framework	4.00	0.87	Agree
Integration difficulty with legacy systems	4.14	0.79	Agree
Constraints and Challenges	**4.08**	**0.83**	**Agree**

Increasing governmental support for blockchain	4.09	0.86	Agree
Expansion of fintech partnerships	4.03	0.84	Agree
Improvement in cybersecurity measures	4.06	0.88	Agree
Expected decline in implementation costs	3.95	0.90	Agree
Rising public awareness of blockchain benefits	4.00	0.85	Agree
Future Directions	**4.03**	**0.87**	**Agree**

Source: Prepared by the researcher based on SPSS Version 26 outputs.

As presented in Table 03, the findings reveal that technical factors achieved the highest overall mean (M= 4.25), signifying a strong level of technical readiness across Algerian banks toward blockchain adoption. The high agreement levels on statements such as availability of modern IT infrastructure (M= 4.35), quality of digital communication channels (M= 4.24), and efficiency of data security systems (M= 4.28) indicate that most institutions have developed robust technological environments capable of supporting blockchain integration. These findings confirm that technical preparedness serves as a key enabler for achieving effective digital transformation and ensuring data reliability and operational continuity within the banking sector.

The potential benefits of blockchain adoption dimension also recorded a high mean (M= 4.25), demonstrating a shared perception among respondents regarding the strategic importance of blockchain. Participants strongly agreed that blockchain enhances transaction transparency (M= 4.30), reduces fraud and manipulation (M=4.24), and strengthens customer trust (M= 4.33). These results highlight the growing awareness within Algerian banks of blockchain's transformative potential in improving financial process integrity, fostering customer confidence, and optimizing cost efficiency through automation and secure information sharing.

In contrast, organizational factors obtained a slightly lower mean (M= 4.04), reflecting moderate agreement regarding internal and regulatory readiness. While the existence of clear digital transformation strategies (M= 4.12) and leadership commitment (M= 4.09) were positively assessed, the relatively lower score for flexibility of organizational structure (M= 3.94) points to persistent bureaucratic rigidity and the need for a more adaptive governance model. These findings suggest that effective blockchain implementation requires not only technological preparedness but also institutional agility and supportive leadership.

The constraints and challenges dimension achieved a mean of (M= 4.08), indicating that while respondents acknowledge significant barriers such as high implementation costs (M= 4.09), limited technical expertise (M= 4.12), and integration difficulties with legacy systems (M= 4.14) they also recognize these challenges as

manageable. This finding implies that Algerian banks are aware of the complexities inherent in blockchain deployment but remain optimistic about overcoming them through capacity building and gradual system modernization.

The economic and cultural factors dimension recorded a mean of (M= 4.00), highlighting balanced perceptions regarding financial capacity and cultural readiness. Although cost-effectiveness perception (M= 3.98) and availability of financial resources (M= 3.92) were rated moderately, the higher scores for awareness of blockchain's economic potential (M= 4.06) and cultural openness to innovation (M= 4.03) demonstrate a growing acceptance of technological change and a willingness to invest in innovation over time.

Finally, the future directions dimension achieved an overall mean of (M= 4.03), reflecting a cautiously optimistic outlook for blockchain integration. Respondents agreed that increasing governmental support (M= 4.09) and expansion of fintech partnerships (M= 4.03) are key drivers of blockchain's forthcoming diffusion in the banking industry. Furthermore, the expectation of declining implementation costs (M= 3.95) and rising public awareness (M= 4.00) underscores a positive trajectory for sustained digital transformation.

In sum, the overall pattern of responses suggests that Algerian banks possess a strong technical and strategic foundation for blockchain adoption, complemented by an emerging supportive environment that balances opportunities and challenges. This combination positions the sector favorably for leveraging blockchain to enhance the efficiency, transparency, and resilience of financial supply chains within the broader digital transformation framework.

B- Hypothesis Testing

- Testing the First Hypothesis

The first hypothesis of the study was tested using inferential statistical analysis, specifically the one-sample t-test, as outlined below:

H_0: There are no statistically significant positive indicators regarding the availability of the necessary technical factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

H_1: There are statistically significant positive indicators regarding the availability of the necessary technical factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

Table 04: T-test Results for Technical Factors

Variable	T-value	Significance Level	Interpretation
Technical Factors	64.44	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS Version 26 outputs.

As shown in Table 04, the T-test result for the "Technical Factors" variable yielded a T-value of 64.44 with a p-value of 0.000, which is significantly less than the conventional threshold of 0.05. This result leads to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_1).

Hence, it can be concluded that there are statistically significant positive indicators confirming the availability of key technical enablers in Algerian banks that support the adoption of blockchain technology. These technical factors play a vital role in enhancing the operational efficiency of financial supply chains, reflecting the sector's readiness to transition towards advanced digital infrastructures.

- Testing the Second Hypothesis

The Second hypothesis of the study was tested using inferential statistical analysis, specifically the one-sample t-test, as outlined below:

H_0: There are no statistically significant positive indicators regarding the availability of the necessary organizational factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

H_1: There are statistically significant positive indicators regarding the availability of the necessary organizational factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

Table 05: T-test Results for Organizational Factors

Variable	T-value	Significance Level	Interpretation
Organizational Factors	38.56	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS Version 26 outputs.

The T-value for the "Organizational Factors" variable was calculated at 38.56, with a p-value of 0.000, which is considerably lower than the significance threshold of 0.05. This result supports the rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_1).

Thus, the findings confirm that Algerian banks demonstrate statistically significant organizational readiness to support blockchain integration, particularly through internal regulations, institutional alignment, and structural preparedness. These elements are essential to enable a successful digital transformation of financial supply chains.

- Testing the Third Hypothesis

The Third hypothesis of the study was tested using inferential statistical analysis, specifically the one-sample t-test, as outlined below:

H_0: There are no statistically significant positive indicators regarding the availability of the necessary cultural and economic factors in Algerian banks for adopting

blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

H_1: There are statistically significant positive indicators regarding the availability of the necessary cultural and economic factors in Algerian banks for adopting blockchain technologies to improve the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

Table 06: T-test Results for Economic and Cultural Factors

Variable	T-value	Significance Level	Interpretation
Economic and Cultural Factors	48.74	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS Version 26 outputs.

As presented in Table 06, the T-value for "Economic and Cultural Factors" reached 48.74, accompanied by a p-value of 0.000. Given that this value is below the 0.05 threshold, the null hypothesis (H_0) is rejected in favor of the alternative hypothesis (H_1).

This outcome indicates that Algerian banks possess favorable economic and cultural conditions for blockchain adoption, such as adequate financial resources, awareness of the technology's strategic value, and a growing openness among staff to digital innovations. These factors collectively create a supportive environment for enhancing the efficiency of financial supply chains through blockchain implementation.

- Testing the Fourth Hypothesis

The Fourth hypothesis of the study was tested using inferential statistical analysis, specifically the one-sample t-test, as outlined below:

H_0: There are no statistically significant positive indicators that the adoption of blockchain technologies by Algerian banks leads to potential benefits that enhance the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

H_1: There are statistically significant positive indicators that the adoption of blockchain technologies by Algerian banks leads to potential benefits that enhance the efficiency of financial supply chains at the significance level ($\alpha \geq 0.05$).

Table 07: T-test Results for the Potential Benefits of Blockchain Adoption

Variable	T-value	Significance Level	Interpretation
Potential Benefits of Blockchain Adoption	52.24	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS Version 26 outputs.

The results presented in Table 07 indicate that the T-value associated with the perceived benefits of blockchain adoption is 52.24, with a p-value of 0.000, which is well below the conventional significance threshold of 0.05. This leads to the rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_1).

Accordingly, it can be concluded that Algerian banks perceive tangible and statistically significant benefits from the integration of blockchain technology, particularly in enhancing financial supply chain efficiency. These benefits may include improved data transparency, increased customer trust, reduced operating costs, and enhanced security, all of which contribute to more agile and resilient banking operations.

4. Conclusion

The findings of this study underscore the strategic importance of integrating blockchain technology within the Algerian banking sector as a key driver for enhancing the efficiency of financial supply chains. In light of the rapid transition toward a digital economy, the statistical analyses reveal significant positive indicators confirming that Algerian banks possess the technical, organizational, and economic prerequisites necessary for successful blockchain adoption.

Blockchain technology has demonstrated its capacity to foster transparency, accelerate financial transactions, and reduce operational costs factors that collectively strengthen the competitiveness of financial institutions. However, the effective deployment of this innovation faces critical challenges, most notably the limited technological infrastructure, absence of a clear regulatory framework, and a shortage of qualified human resources capable of managing and operating blockchain systems. To maximize the potential of this technology, a coordinated strategic approach is required one that brings together regulatory authorities, financial institutions, and technology providers. This alignment is essential for creating an enabling environment that supports blockchain deployment and positions the Algerian financial sector for sustainable growth and alignment with the standards of the International Federation of Accountants (IFAC).

Recommendations

In response to the study's outcomes, the following strategic measures are proposed to ensure the successful implementation of blockchain technology in Algerian banks:

- Enhance Digital Infrastructure: Strengthen the technological foundation of Algerian banks through investments in cloud computing, cybersecurity, and the Internet of Things (IoT), creating an environment that supports blockchain-based applications;

- Develop a Supportive Regulatory Framework: Urgently establish a clear and enabling legal framework that supports blockchain adoption in banking operations, ensures legal protection for stakeholders, and facilitates secure digital transactions;

- Invest in Human Capital Development: Launch specialized training programs aimed at equipping banking professionals with the skills required to manage smart contracts, cryptographic systems, and real-time data analytics;

- Foster Cross-Sectoral Collaboration: Promote strategic partnerships between banks, fintech companies, and research institutions to co-develop innovative blockchain solutions that optimize financial operations and supply chain processes;

- Raise Awareness among Stakeholders: Implement awareness campaigns targeting financial institutions and their clients to highlight the economic and operational benefits of blockchain, including reduced transaction costs, enhanced transparency, and fraud mitigation;

- Strengthen Security and Governance Standards: Given the critical role of security in blockchain success, banks must adopt advanced data protection mechanisms, deploy decentralized authentication systems, and enforce rigorous digital governance protocols to ensure safe and effective use of the technology.

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