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Determinants of Blockchain Adoption in the Context of Digital Transformation to Enhance the Efficiency of Financial Supply Chains in Algeria: A Field Study of a Sample of Banks in Constantine

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Abstract: This study highlights the key determinants influencing the adoption of blockchain technology to enhance the efficiency of financial supply chain management in Algeria. A structured questionnaire served as the primary data collection tool and was administered to a sample of 86 bank employees, achieving a response rate of 95.56%. The results provide statistically significant evidence that banks operating in Constantine possess the necessary technological, organizational, economic, and cultural enablers for blockchain adoption. Moreover, the adoption of this technology presents several potential benefits. Based on these findings, the study offers practical recommendations, including strengthening technological infrastructure, improving organizational frameworks, investing in technical training and development, prioritizing financial gains, fostering innovation and collaboration, and implementing robust security measures to support successful adoption.

Keywords: Determinants; Blockchain Technology; Efficiency; Supply Chain Management; Constantine.

JEL codes: O33; M15.

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I- Introduction:

The world today is experiencing a rapid acceleration in the adoption of modern technologies, particularly in the fields of finance and economics. Among these innovations, blockchain technology stands out as a transformative force with immense potential to enhance the efficiency of financial operations, including the management of financial supply chains. Blockchain, as a decentralized technology, operates through a network of interconnected nodes, enabling secure and tamper-proof transaction recording. This capability significantly improves transparency, reliability, and cost-efficiency in financial processes.

In Algeria, although digital transformation has gainedmomentum across various sectors, the application of blockchain technology in managing financial supply chains remains in its early stages, particularly within financial institutions such as banks. In this context, understanding the determinants of blockchain adoption is crucial, as they significantly influence the ability of these institutions to implement and benefit from this technology effectively. These determinants include technical, organizational, cultural, and economic factors that collectively shape the adoption process.

Digital transformation, which entails integrating advanced technologies into business and financial processes, serves as a driving force for organizations aiming to enhance their performance and

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efficiency. In the financial sector, it involves the adoption of electronic systems, artificial intelligence, and blockchain technology to achieve greater transparency, speed, and accuracy in financial transactions. However, in Algeria, this transformation faces several challenges, including infrastructure limitations, a lack of skilled personnel, and regulatory constraints, which impede a full transition to the digital era.

Conducting a field study on a sample of banks in Constantine province presents an opportunity to assess their readiness to adopt blockchain technology as part of their digital transformation efforts. This study seeks to identify the challenges and opportunities associated with blockchain adoption and aims to address the following central research question: What are the determinants of blockchain adoption in the context of digital transformation to enhance the efficiency of financial supply chain management in banks located in Constantine province?

To address this main question, the study is structured around the following sub-questions:

- What are the key factors influencing blockchain adoption in Algerian banks?
- How can blockchain technology enhance the efficiency of financial supply chain management?
- What challenges do Algerian banks encounter when implementing this technology?
- What role does digital transformation play in facilitating blockchain adoption and maximizing its potential benefits?

The study aims to identify the factors influencing blockchain adoption in Algerian banks, with a focus on technical, organizational, and cultural variables. Also, the study aims to analyze the role of digital transformation in accelerating blockchain adoption and maximizing its benefits in the financial sector. Additionally, the objectif is to assess the potential of blockchain technology to enhance the efficiency of financial supply chain management in Algeria, particularly within banks and financial institutions, and Exploring the challenges and barriers Algerian banks may face in adopting blockchain technology and proposing practical solutions to overcome them. Finally, the aim of the study is to provide recommendations for banks and financial institutions on implementing blockchain technology in managing financial supply chains and supporting digital transformation in the sector.

This study emphasizes the role of blockchain as an innovative tool for enhancing the efficiency of financial supply chain management in Algeria. Amid the digital transformation of the financial sector, adopting this technology can significantly improve transparency, expedite transactions, and reduce costs. By examining the determinants of blockchain adoption, this research offers valuable insights into the technical, organizational, cultural, and economic factors influencing Algerian banks' capacity to implement this technology. Furthermore, it highlights the challenges these banks may face and proposes practical solutions to address them.

II- Background of the study:

1- The Theoretical Framework of Financial Supply Chains

1-1 The Concept and Characteristics of Digital Supply Chains

Digital supply chains (DSCs) are characterized by accelerated life cycles and continuous evolution, driven by dynamic market changes and emerging technologies in the era of the Fourth Industrial Revolution. The term "digital supply chains" reflects the transformation of traditional supply chain concepts within the context of Industry 4.0. This transformation emphasizes activities that create value and optimize costs, benefiting various stakeholders, including suppliers, employees, and customers. DSCs are distinguished by the strategic and operational exchange of information among actors (financial, production, design, research, and competitive information), enabling improved

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communication and integration of processes and data throughout the supply chain(Korpela & Al, 2017, p. 4183).

Digital supply chains are defined asvalue-driven intelligent networks that leverage new methodologies, technologies, and analytics to create innovative revenue streams and business value. They operate through centralized platforms that collect and maximize the use of real-time data from diverse sources(Garay-Rondero & Al, 2020, p. 15).In another definitionassystems comprising software, hardware, and communication networks that facilitate interaction among globally distributed organizations and coordinate supply chain partner activities, including procurement, manufacturing, storage, transportation, and sales(Bhargava & Al, 2013, p. 4637).

1-2Comparison with Traditional Supply Chains:

Table 1 illustrates key differences between traditional and digital supply chains, focusing on interconnectivity, customer-centricity, integration, and responsiveness.

Table 1 presents a comparative analysis of the key differences between traditional and digital supply chains, emphasizing aspects such as interconnectivity, customer-centricity, integration, and responsiveness

Table 1: comparative analysis of the key differences between traditional and digital supply chains

Characteristics of Digital Supply Chains	Characteristics of Traditional Supply Chains
Multi-dimensional, non-linear interactions encompassing all supply chain elements.	Linear interactions with limited real-time visibility.
Designed to deeply understand customer needs, enabling faster responses, higher quality, and efficient returns management through digital transformation.	Focused on managing logistics and manufacturing operations.
Inclusion of new actors such as fourth/fifth-party logistics, IT specialists, and data analysts.	Reliant on traditional management components, neglecting holistic system optimization.
Emphasis on R&D, integration, and automation for advanced performance.	Persistence of outdated planning and control practices, leading to slow adaptability.
Real-time interoperability and supply chain integration.	Limited integration between workflows and organizational structures.
Delivery of tailored digital and physical goods.	Lacks agility and flexibility.
Centralized platforms enhancing global value chains.	Focused on mass production with limited customization.
Leveraging AI to support autonomous decision-making and operational efficiency.	Fragmented communication systems, resulting in outdated data.
Transparent, open communication channels enhancing accountability and reducing risks.	Time-consuming efforts to achieve integration without full coherence.

Source**:**(Garay-Rondero & Al, 2020, p. 16)

1-3 Requirements for Digital Transformation in Supply Chains

Digital transformation enables supply chains to address stakeholder demands effectively. By overcoming the complexities of traditional practices, such as asynchronous information exchange, successful digitalization enhances operational efficiency, reduces costs, and fosters real-time supply chain management (Liu & Al, 2022, p. 01), Core Requirements:(Al-Ghabiri & Abdelrahman, 2020, pp. 17, 18)

- Defining a Clear Vision: Clearly articulate future goals and objectives;

- Continuous Plan Review: Regularly evaluate and refine the digital transformation strategy;

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- Leadership and Administrative Support: Ensure commitment at all organizational levels by allocating necessary resources and emphasizing tech-driven management practices;

- Flexible Organizational Structures: Replace rigidhierarchies with adaptable frameworks that promote collaborative teamwork;

- Market-Driven Strategies: Develop transformation plans based on market analysis, strengths, weaknesses, opportunities, and external threats;

- Technological Infrastructure: Modernize IT systems with advanced hardware and software solutions;

- Human Capital Development: Invest in recruitment, training, and skill enhancement;

- Cultural Change: Foster a digital-first mindset by promoting technology adoption and managing cultural shifts as a competitive advantage;

Ultimately, digital transformation depends on the leadership's and workforce's skills and commitment, requiring additional strategies to build capacity, drive change, and integrate ICT across all domains.

1-4 Benefits of Digital Transformation in Supply Chains

The advantages of transitioning to digital supply chains include:(Agrawal & Narain, 2018, p. 05)

- Enhanced transparency, enabling better decision-making;

- Reduced inventory levels through efficient just-in-time procurement;

- Clear visibility of stock levels across an integrated value chain;

- Decentralized storage systems for faster delivery times;

- Improved customer demand forecasting and satisfaction through real-time data;

- Increased supply chain flexibility, risk mitigation, and cost reductions;

- Sustained competitive advantage.

This transformation is essential for addressing modern market challenges and achieving sustainable competitiveness.

2- The Theoretical Framework of Blockchain Technology

2-1 The Concept of Blockchain

The term "Blockchain" refers to the process of sequentially producing blocks in virtual currencymining, where transactions are recorded in a secure, chronological manner. Blockchain acts as a ledger that maintains records of all financial transactions, assets, expenses, and similar activities(Al-Hasban, 2019, p. 137). Blockchain technology, also known as distributed ledger technology, can be defined in various ways. The most common definition describes it as a decentralized database where transactions are recorded using a nearly immutable cryptographic signature. New records are continuously added to the decentralized database to form blocks that are tamper-resistant. Each block is linked to its predecessor and marked with a timestamp(Al-Rakhami & Al-Mashari, 2021, p. 03).

Blockchain technology is characterized by a set of unique features, outlined as follows:

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- Privacy: Its decentralized and distributed nature ensures that, in the absence of a central authority, the entire network must collectively agree on all transactions recorded in the chain(El-Sayed, 2020, p. 93).

- Immutability: Transaction records on the blockchain are permanent and fixed from the moment they are added(Al-Jakhlab, 2021, p. 05). Any modification requires the approval of 51% of the network participants, making fraud and manipulation highly challenging(El-Sayed, 2020, p. 93).

- Consensus-Driven Leadership: Each block in the chain is independently verified through a consensus model that establishesrules for block validation(Al-Jakhlab, 2021, p. 05);

- Transaction Transparency: Blockchain ensures data integrity, consistency, accuracy, and reliability throughout its entire lifecycle(El-Sharkawy, 2019, p. 13).

2-2 The Historical Evolution of Blockchain

The concept of blockchain dates back to the 1990s when a technological solution for times tamping digital assets was proposed by Haber and Stornetta (Abd El-Tawab, 2020, p. 10). This aimed to track the origins of digital assets and any subsequent attempts to modify them. However, the practical application of this idea failed, as users could replicate digital transactions and spend funds multiple times. In 2008, the idea was refined with the creation of Bitcoin by Satoshi Nakamoto, as outlined in his seminal paper, Bitcoin: A Peer-to-Peer Electronic Cash System. Blockchain was implemented as the underlying infrastructure for Bitcoin in 2009(Rawat, Chaudhary, & Doku, 2020, p. 06). This development addressed the issue of double-spending and eliminated the need for third-party intermediaries. Nakamoto's solution involved utilizing a peer-to-peer network and breaking down transactions into a continuous chain (or block) in the form of a ledger that is immutable and secure. This innovative approach established the foundation for modern blockchain technology.

2-3 The Mechanism of Blockchain Functionality

Blockchain technology operates through a series of automated steps to execute transactions. For users to benefit from these services, they must be network participants by creating an account on a cryptocurrency trading platform. Once registered, users can initiate transactions such aspurchases, sales, or transfers; When a transaction is requested, the system generates a new block containing the basic data of the transaction. This block is then broadcast to all nodes within the blockchain network. The nodes verify the transaction, and upon successful validation, the block is added to the existing chain of blocks in the blockchain network; Once added, the transaction is permanently recorded in the ledger, making it immutable—no additions, deletions, or modifications are possible. The transaction is thereby completed through three simultaneous functions: transmission, storage, and automation (Al-Jakhlab, 2021, p. 06).

II- Field Study on the Determinants of Blockchain Adoption to Improve the Efficiency of Financial Supply Chain Management in Algeria:

To conduct the field study, it is essential to first define the study population and sample size, followed by testing the validity of the adopted tool, the questionnaire. In the subsequent stages, the characteristics of the study sample were identified, as outlined below:

1- Preliminary Procedures:

1-1 Study Population and Sample:

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The study population consists of employees in banks located in Constantine. For the field study, a purposive sample of 90 individuals was selected. The survey questionnaires were distributed to them, and 86 valid responses were retrieved for analysis, representing 95.56% of the total questionnaires.

1-2 Data Collection Tools:

This study utilized a structured questionnaire to investigate the research problem and test its hypotheses. It consisted of two parts: the first gathered demographic data, while the second assessed respondents' perspectives across six dimensions—Technical Factors, Organizational Factors, Economic and Cultural Factors, Potential Benefits of Blockchain Adoption, Challenges and Constraints, and Future Trends—with five items per dimension, measured using a five-point Likert scale.

The questionnaire was developed based on relevant literature and aligned with the study's theoretical framework. It was reviewed by experts to ensure clarity and content validity. Data analysis was conducted using SPSS and AMOS, ensuring methodological rigor and reliability of results.

2- Reliability of the Measurement Tool and Descriptive Characteristics of the Study Sample:

2-1 Cronbach's Alpha Reliability Test:

To assess the reliability and validity of the measurement tool, Cronbach's Alpha coefficient was used, yielding the following results:

Table 2: Cronbach's Alpha Coefficient

Dimensions	Number of Items	Cronbach's Alpha
Technical Factors	05	0.864
Organizational Factors	05	0.792
Economic and Cultural Factors	05	0.822
Potential Benefits of Blockchain Adoption	05	0.746
Challenges and Constraints	05	0.740
Future Trends	05	0.862

Source: Prepared by the researcher based on SPSS 26 results.

As shown in **Table 2.the Cronbach's Alpha Coefficient** for the six dimensions was 0.864, 0.792, 0.822, 0.746, 0.740, and 0.862, respectively. The overall Cronbach's Alpha value for the entire questionnaire was **0.842**, which exceeds the standard threshold of 0.60. This indicates that the questionnaire used in this study possesses a high degree of validity and reliability.

2-2 Descriptive Characteristics of the Study Sample:

Table 3: Descriptive Characteristics of the Study Sample

Characteristic	Category	Frequency	Percentage
Gender	Male	58	67.44%
	Female	28	32.56%
Job	Manager	09	10.47%
	Employee: Administrative/ Technical/IT Department	77	89.53%
Age	21-30 years	10	11.63%
	31-40 years	48	55.81%
	Over 41 years	28	32.56%
Education	Bachelor's	20	23.26%
	Master's/MSc	54	62.79%
	PhD	12	13.95%

Source: Prepared by the researcher based on SPSS 26 results.

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As shown in Table 3 descriptive Characteristics of the Study Sample**,** the banking sector in Constantine is characterized by a predominance of males, comprising 67.44% of the sample. Job positions are heavily concentrated among administrative and technical staff, as well as the IT department, representing 89.53% of the total sample. The age group of 31-40 years, which makes up 55.81% of the sample, reflects the central role of this demographic in adopting modern technologies such as blockchain. Additionally, the presence of younger individuals (55.81%) highlights the potential for future advancements in digital transformation. In terms of educational qualifications, the majority of respondents hold Master's or MSc degrees (62.79%), indicating a high level of academic competence that positions the banks to implement advanced technologies, such as blockchain, to enhance the efficiency of financial supply chains. This context necessitates greater support from senior management to foster the acceptance of such technologies, alongside a focus on training technical staff and increasing the participation of underrepresented groups to achieve effective and sustainable digital transformation.

3- Descriptive Analysis of Study Participants' Responses and Hypothesis Testing:

This section presents the descriptive analysis of the respondents' answers from the study sample for each variable, based on the statements included in the survey. The analysis will utilize two key statistical measures: the arithmetic mean and the standard deviation. The results will be interpreted as follows:

3-1 Descriptive Analysis of Study Participants' Responses

The descriptive analysis assesses the degree of agreement between the responses of the study participants for each statement across the various dimensions. Given that the questionnaire was designed using a five-point Likert scale, five ranges of the arithmetic mean are used to evaluate the responses from the study sample. These ranges are as follows: [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 4: descriptive Analysis of the Study Participants' Responses

Statement	Mean	S. D.	Agreement level
The bank has technological infrastructure to support blockchain technology in the context of digital transformation.	4.32	0.72	Strongly Agree
The bank possesses the technical skills required to effectively implement blockchain technology.	4.29	0.75	Strongly Agree
Blockchain technology improves the efficiency of financial operations in the bank.	4.12	0.68	Agree
Blockchain application contributes to enhancing the security and speed of financial transactions in the bank.	4.20	0.71	Strongly Agree
Integrating blockchain with the bank's current systems accelerates digital transformation.	4.38	0.69	Strongly Agree
Technical Factors	**4.26**	**0.72**	**Strongly Agree**
There is a legal framework in Algeria defining how blockchain technology should be implemented in the financial sector.	3.84	0.71	Agree
Legal or regulatory constraints hinder the adoption of blockchain in the bank.	3.85	0.76	Agree
Regulatory bodies in Algeria provide adequate support to encourage blockchain adoption in banks.	3.89	0.80	Agree
Local banking systems align with the requirements for implementing digital transformation technologies like blockchain.	3.96	0.77	Agree
Banks need regulatory adjustments to fully adopt blockchain technology.	4.02	0.72	Agree
Regulatory Factors	**4.03**	**0.75**	**Agree**

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The bank faces cultural challenges regarding employee acceptance of new technologies like blockchain.	3.98	0.79	Agree
The cost of implementing blockchain technology is a barrier for Algerian banks.	3.91	0.85	Agree
Digital transformation in the bank enhances its readiness to implement blockchain technology in the future.	4.35	0.78	Agree
Blockchain adoption requires additional training for employees at the bank.	4.10	0.70	Agree
Digital transformation strengthens the bank's capacity to adapt to new technologies like blockchain.	3.92	0.74	Agree
Cultural and Economic Factors	**4.07**	**0.78**	**Agree**
Blockchain usage will enhance supply chain management efficiency within the bank.	4.12	0.81	Agree
Blockchain application will increase transparency and reduce financial data manipulation in the bank.	4.21	0.73	Strongly Agree
Blockchain technology will help reduce costs associated with financial operations in the bank.	3.94	0.70	Agree
Blockchain application will speed up financial transactions and reduce processing times.	4.01	0.65	Agree
Blockchain will increase customer confidence in the bank's financial services.	4.43	0.91	Strongly Agree
Potential Benefits of Blockchain Adoption	**4.14**	**0.74**	**Agree**
Algerian banks face difficulties implementing blockchain due to lack of technological infrastructure.	3.72	0.68	Agree
A lack of awareness about blockchain technology among employees is a barrier to its implementation.	3.80	0.72	Agree
Legal challenges in Algeria hinder the implementation of digital transformation technologies like blockchain in banks.	3.87	0.76	Agree
Blockchain technology will complicate bank operations due to the need for system integration.	4.17	0.83	Strongly Agree
The high cost of blockchain adoption is a major challenge for Algerian banks.	3.73	0.75	Agree
Challenges and Constraints	**4.06**	**0.78**	**Agree**
Algerian banks will increasingly adopt technologies like blockchain in the future.	4.07	0.75	Agree
Blockchain adoption will improve the bank's regional and international standing.	3.91	0.72	Agree
Digital transformation in Algeria's financial sector will support the adoption of blockchain technologies in the near future.	4.22	0.76	Strongly Agree
Digital transformation technologies like blockchain will update and improve financial supply chain effectiveness in banks.	3.99	0.69	Agree
Blockchain adoption in Algerian banks will be a significant step toward achieving transparency and efficiency in the financial sector.	4.34	0.89	Strongly Agree
Future Trends	**4.05**	**0.79**	**Agree**

Source: Prepared by the researcher based on SPSS 26 results.

From Table 4 it is evident that Algerian banks demonstrate a high level of technical readiness for implementing blockchain technology within the context of digital transformation. Dimension 1: Technical Factors scored the highest mean (4.26), suggesting that banks possess the necessary technological infrastructure and skills to integrate blockchain successfully. This dimension emphasizes the importance of infrastructure and expertise as critical components for the successful adoption of blockchain technology.

Additionally, dimension 4: Potential Benefits of Blockchain Adoption, with a mean of (4.14), ranks second, indicating that the anticipated benefits of blockchain, including increased transparency,

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enhanced customer trust, and cost reduction, are key drivers for its adoption. Notably, the statement "Increased customer trust" received the highest agreement (4.43), reflecting strong expectations about the positive impact of blockchain on service quality and institutional reputation.

However, despite the anticipated advantages, Algerian banks face several challenges, as outlined in dimension 5: Challenges and Constraints, which has a mean of (4.06). These challenges include the lack of technological infrastructure, high costs, and operational complexity arising from system integration requirements. Nevertheless, the results reflect an awareness of these challenges and a recognition of the necessity to overcome them for the successful adoption of blockchain technology.

3-2 Hypothesis Testing

3-2-1 First Hypothesis

H_0: There are no statistically significant positive indicators regarding the availability of technical factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.

H_1: There are statistically significant positive indicators regarding the availability of technical factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.

Table 05: T-Test Results for the First Dimension - Technical Factors

Variable	T-Value	Significance Level	Evaluation
Technical Factors	64.83	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS 26 results.

The results in table 5 show that the T-value for the technical factors variable is 64,83, with a significance level of 0.000, which is less than the established significance threshold of 0.05. Therefore, we reject the null hypothesis and accept the alternative hypothesis, which states that "There are statistically significant positive indicators regarding the availability of technical factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$."

3-2-2 Second Hypothesis

H_0: There are no statistically significant positive indicators regarding the availability of organizational factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.

H_1: There are statistically significant positive indicators regarding the availability of organizational factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.

Table 6.T-Test Results for the Second Dimension - Organizational Factors

Variable	**T-Value**	**Significance Level**	**Evaluation**
Organizational factors	45.62	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS 26 results.

Table 6 demonstrates that the T-value for the organizational factors variable is 45.62, with a significance level of 0.000, which is less than the significance threshold of 0.05. Consequently, we reject the null hypothesis and accept the alternative hypothesis, which asserts that "There are statistically significant positive indicators regarding the availability of organizational factors necessary

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for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$."

3-2-3 Third Hypothesis:

H_0: There are no statistically significant positive indicators regarding the availability of cultural and economic factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.
H_1: There are statistically significant positive indicators regarding the availability of cultural and economic factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$.

Table 07: T-Test Results for the Third Dimension - Economic and Cultural Factors

Variable	T-Value	Significance Level	Evaluation
Economic and Cultural Factors	52.84	0.000	Statistically Significant

Source**:** Prepared by the researcher based on SPSS 26 results.

From table 7, we observe that the T-value for the economic and cultural factors variable is 52.84, with a significance level of 0.000, which is below the 0.05 threshold. Thus, we reject the null hypothesis and accept the alternative hypothesis, which indicates that "There are statistically significant positive indicators regarding the availability of cultural and economic factors necessary for blockchain adoption to enhance the efficiency of financial supply chains in the banks located in Constantine Province, at a significance level of $\alpha \geq 0.05$."

3-2-4 Fourth Hypothesis

H_0: There are no statistically significant positive indicators that the adoption of blockchain technologies by the banks located in Constantine Province will provide potential benefits that help improve the efficiency of financial supply chains at a significance level of $\alpha \geq 0.05$.
H_1: There are statistically significant positive indicators that the adoption of blockchain technologies by the banks located in Constantine Province will provide potential benefits that help improve the efficiency of financial supply chains at a significance level of $\alpha \geq 0.05$.

Table 8.T-Test Results for the Fourth Dimension - Potential Benefits of Blockchain Adoption

Variable	T-Value	Significance Level	Evaluation
Potential Benefits of Blockchain Adoption	46.68	0.000	Statistically Significant

Source: Prepared by the researcher based on SPSS 26 results.

As shown in table 8, the T-value for the potential benefits of blockchain adoption is 46.68, with a significance level of 0.000, which is lower than the significance level of 0.05. Therefore, we reject the null hypothesis and accept the alternative hypothesis, which states that "There are statistically significant positive indicators that the adoption of blockchain technologies by the banks located in Constantine Province will provide potential benefits that help improve the efficiency of financial supply chains at a significance level of $\alpha \geq 0.05$."

III- Results and discussion:

The field study yielded the following key findings:

- Gender Distribution: Males constitute the majority of respondents, representing 67.44% of the sample;

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- Job Roles: Most participants (89.53%) work in administrative, technical, or IT-related positions, indicating direct engagement with digital systems;

- Age Group: Respondents aged between 31 and 40 make up 55.81% of the sample, highlighting their central role in adopting emerging technologies such as blockchain;

- Educational Background: A significant portion of the respondents (62.79%) hold a Master's or MSc degree, reflecting a strong academic foundation conducive to implementing advanced technologies;

In terms of the key research dimensions:

- Technical Readiness: Algerian banks exhibit a high level of technical preparedness for blockchain adoption. The "Technical Factors" dimension received the highest mean score (4.26), indicating that banks in Constantine possess adequate IT infrastructure and technical expertise;

- Perceived Benefits: The "Potential Benefits" dimension followed closely (mean score: 4.14), with respondents particularly acknowledging blockchain's ability to enhance transparency, build customer trust (mean: 4.43), and reduce operational costs;

- Challenges and Constraints: Despite this readiness, notable barriers remain. The "Challenges and Constraints" dimension (mean score: 4.06) points to ongoing issues such as infrastructure limitations, high implementation costs, and system integration difficulties. These challenges require targeted interventions to ensure successful adoption;

Furthermore, the results demonstrate that:

- Technical, Organizational, Cultural, and Economic Factors necessary for blockchain adoption are significantly present in Constantine's banks, positively influencing financial supply chain efficiency;

- Blockchain Adoption is expected to generate substantial benefits, enhancing operational transparency, accelerating transaction processes, and contributing to improved efficiency across the financial supply chain.

Conclusion:

The findings of this study demonstrate that adopting blockchain technology within the framework of digital transformation constitutes a strategic advancement in enhancing the efficiency of financial supply chain management in Algerian banks. Blockchain offers tangible benefits, including increased transparency, faster financial transactions, and lower operational costs. However, its successful adoption still faces notable barriers, such as underdeveloped technological infrastructure, regulatory limitations, and insufficient employee readiness for modern technologies.

In the broader context of digital transformation, blockchain adoption emerges as a critical lever for modernizing the Algerian financial sector. It not only aligns with global innovation trends but also addresses core inefficiencies identified in the financial supply chain, such as delays, high transaction costs, and limited data transparency. These challenges, if unresolved, can hinder sector-wide progress toward sustainable development.

To fully realize the potential of blockchain, public and private stakeholders must engage in coordinated efforts to foster an enabling environment. This includes investing in infrastructure, updating legal frameworks, and building human capital through targeted training programs. Such a collaborative approach will pave the way for integrating blockchain into financial systems and positioning Algerian banks as competitive actors in the evolving global landscape.

Recommendations:

Based on the findings of this study, several recommendations are proposed as follows:

-Strengthen Technological Infrastructure: Algerian banks should invest in modernizing their infrastructure to support digital transformation technologies like blockchain;
- Develop the Regulatory Framework: Regulatory bodies must create clear legislation to facilitate blockchain adoption and enhance transaction oversight;
-raining and Professional Development: Training programs for banking professionals are essential to ensure effective blockchain implementation;
-Highlight Financial Benefits: Banks should educate clients on blockchain's benefits, such as transparency and cost reductions, to build trust;
-Encourage Innovation and Collaboration: Banks should foster innovation and strengthen collaboration between the financial and tech sectors to accelerate digital transformation;
-Focus on Security: To leverage blockchain's security advantages, banks must implement robust systems to protect data and prevent manipulation.

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