Advances in Consumer Research
https://acr-journal.com/
Volume-3 | Issue-7 |July: 2026

Original Researcher Article

Blockchain Adoption in Indian Banks: An Empirical Study on Employee Perceptions and Adoption Drivers

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ABSTRACT

Blockchain is a transformative distributed ledger technology that enables asset trading without intermediaries, such as banks or shared economy platforms. It operates on a decentralized network secured through cryptography and relies on consensus mechanisms. The Technology Acceptance Model (TAM) has been widely used to assess the adoption of new technologies, primarily through two cognitive beliefs: perceived usefulness and perceived ease of use. However, these factors alone may not fully explain user behaviour regarding emerging technologies like blockchain. Therefore, this study integrates the TAM model with additional factors perceived security, perceived risk, trust, perceived strategic value, and cost-saving to develop a more comprehensive adoption model.

This research specifically examines whether these factors influence the willingness of banking employees to adopt blockchain technology. Given that many bank employees, particularly older ones, may resist new technologies, the study seeks to evaluate innovation adoption models within Indian banks. In addition to private sector banks like HDFC, ICICI, Kotak Mahindra, Axis, and IndusInd, it also focuses on public sector banks including Punjab National Bank (PNB), State Bank of India (SBI), Bank of Baroda, Canara Bank, and Union Bank.

By examining blockchain's potential for online banking, this study seeks to close the knowledge gap on the technology's acceptance in banking and financial services. Assessing how employees' intentions to adopt blockchain technology are influenced by perceived ease of use, perceived utility, perceived security, perceived danger, trust, cost savings, and strategic value is the main goal.

A quantitative research design was used, and 200 personnel from the public and private banking sectors participated in the survey. The empirical results, which were obtained using a multiple linear regression model, show that the adoption of blockchain technology in banking is highly influenced by perceived strategic value, perceived ease of use, perceived cost savings, and trust..

Keywords: Perceived Usefulness, Perceived Security, Perceived Ease of Use, Perceived Trust, Perceived Strategic Value, Perceived Cost, Blockchain Technology..

INTRODUCTION:

A. Blockchain's History in Banking

The advent of blockchain technology has transformed financial transactions by introducing a secure, decentralized mechanism that removes the necessity for intermediaries. Originally popularized through cryptocurrencies such as Bitcoin, blockchain has since found applications in various industries, including finance, healthcare, and supply chain management. Its key attributes—namely transparency, immutability, and cryptographic security—make it a viable solution for banking institutions seeking to modernize their digital infrastructure. Globally, financial organizations are investigating the technology's potential to increase efficiency, reduce fraudulent activities, and streamline operations [1].

Traditional banking systems rely heavily on centralized infrastructures for processing and validating financial transactions. These systems are frequently plagued by delays in settlement, high operational costs, and inherent security vulnerabilities. Blockchain technology addresses these issues by enabling peer-to-peer (P2P) transactions, reducing intermediary involvement, and ensuring robust data integrity through cryptographic verification mechanisms.

Despite these advantages, adoption in the banking sector remains limited. Barriers such as regulatory ambiguity, legacy system integration challenges, and resistance from staff—particularly those accustomed to conventional banking practices—impede large-scale implementation [2].

B. The Use of Blockchain in Indian Banking

India's banking sector is currently experiencing a rapid shift toward digitalization, fuelled by the widespread adoption of financial technologies, mobile banking, and digital payment platforms. Regulatory authorities, including the Reserve Bank of India (RBI), have demonstrated interest in blockchain applications, especially within domains such as trade finance, cross-border remittances, and fraud mitigation.

Major Indian banks, including the State Bank of India (SBI), HDFC Bank, and ICICI Bank, have initiated pilot projects to assess blockchain's viability in various operations such as smart contracts, loan disbursements, and Know Your Customer (KYC) procedures [3]. Nonetheless, blockchain implementation in India remains in its nascent stage.

Several factors influence its adoption, particularly the perceptions held by banking personnel. Older employees, who are more accustomed to traditional workflows, often demonstrate resistance due to perceived technological complexity. Conversely, younger staff tend to be more receptive to digital transformation. Thus, understanding employee attitudes and institutional readiness is critical for successful integration of blockchain in Indian banking [4].

C. Blockchain Technology Types

Blockchain technologies can be classified based on transaction verification methods and access control:

Permissionless Blockchains: Open systems where any participant can join, validate transactions, and contribute to block generation.

Permissioned Blockchains: Controlled systems that restrict transaction validation and block creation to a predefined group of authenticated users.

Public Blockchains: Fully transparent platforms accessible to all users for viewing, validating, and recording transactions.

Private Blockchains: Restricted networks that limit access to data, transaction visibility, and participation to selected entities [5].

D. Is Blockchain Technology Necessary for Banks?

The banking sector constitutes a significant segment of the global economy and includes some of the most prominent financial intermediaries. Over time, the banking industry has undergone multiple technological transitions—shifting from barter and commodity-based systems to fiat currency, and eventually to digital payments and virtual banking. Innovations such as automated teller machines (ATMs), internet banking, mobile applications, real-time gross settlement (RTGS), and electronic clearing services have contributed to this transformation.

Blockchain presents the next potential paradigm shift in banking. By enabling the recording of tamper-proof transactions in distributed ledgers, the technology could eliminate the need for traditional third-party verifiers. The decentralized nature of blockchain systems offers opportunities to radically restructure financial services, reducing friction and enhancing transparency.

Gupta and Gupta [6] argue that digital wallets and currencies are increasingly prevalent, with firms such as Apple offering virtual payment solutions. Furthermore, in 2021, Facebook proposed the launch of Libra—a blockchain-based digital currency aimed at simplifying global payments. As fintech adoption accelerates, traditional banks may face increasing competition from technology-driven financial service providers [7]

LITERATURE REVIEW

A. Blockchain-Based Banking

Blockchain enables secure, efficient, and transparent financial transactions through a decentralized and immutable ledger system. By eliminating intermediaries, it reduces operational costs and expedites settlements. Several studies highlight its potential to enhance financial security through tamper-proof records, cryptographic safeguards, and real-time processing [1]–[3].

B. Blockchain's Advantages for Banking

Blockchain offers numerous benefits for banking operations:

Enhanced Security and Fraud Prevention: Blockchain utilizes cryptographic techniques and consensus algorithms to ensure transactional integrity and reduce fraud risks. Features such as hash functions, public-key infrastructure (PKI), Zero-Knowledge Proofs (ZKP), and multi-signature authentication further strengthen security [4].

Transparency and Regulatory Compliance: Financial institutions must comply with regulations like Know Your Customer (KYC) and Anti-Money Laundering (AML). Blockchain supports compliance by providing an immutable audit trail that simplifies verification processes [5].

Improved Transaction Efficiency: Traditional banking systems, particularly for cross-border payments, involve multiple intermediaries, causing delays and increased costs. Blockchain platforms such as Ripple facilitate near-instant transactions with minimal fees [6].

Smart Contract Automation: Smart contracts, first proposed by Szabo [7] and further implemented by Ethereum [8], automate processes such as loan disbursements, trade financing, and asset management, reducing reliance on manual intervention and lowering processing time [9].

C. Adoption Barriers for Blockchain

Despite its advantages, blockchain adoption in banking faces several challenges:

Scalability Issues: Networks like Bitcoin and Ethereum experience congestion during peak activity, resulting in delayed transactions and higher costs [10].

Regulatory Uncertainty: The regulatory landscape for blockchain varies significantly across jurisdictions, creating compliance challenges for financial institutions [11].

High Energy Consumption: Proof-of-Work (PoW)-based blockchain systems require substantial computational resources, raising concerns about sustainability and energy efficiency [12].

D. TAM Extensions in Blockchain Adoption

Given blockchain's complexity, researchers have extended the Technology Acceptance Model (TAM) to include factors relevant to banking sector adoption:

Perceived Security: Security perceptions directly impact trust and adoption intention. Cyberattacks and smart contract vulnerabilities may reduce trust in blockchain systems [13], [14].

Transparency and Trust: Blockchain's transparent architecture enhances trust in financial systems, which is vital for institutional adoption [15].

Regulatory and Compliance Risks: Regulatory ambiguity impacts adoption, as financial institutions must adapt to evolving policies and maintain legal compliance [16].

Cost and Efficiency Considerations: Integration challenges, high infrastructure costs, and legacy system compatibility are key deterrents to widespread adoption [17].

RESEARCH METHODOLOGY

A. Research Gap

Although blockchain adoption is gaining momentum in the banking industry, little research explores its implementation from the perspective of bank employees. Existing literature often emphasizes technical aspects or customer-centric applications, overlooking employee attitudes. While the TAM framework has been applied to general information systems, its applicability to blockchain adoption within banking—particularly in the Indian context—remains underexplored.

Specifically, factors such as perceived security, ease of use, strategic value, trust, and cost have not been adequately examined in terms of their influence on employee attitudes and behavioural intentions in both public and private sector banks in India. This study aims to bridge this gap.

B. Research Objectives

Investigate how perceived security, cost, strategic value, usability, trust, and ease of use influence employee perceptions toward blockchain adoption in Indian banking.

Analyse the relationship between employee perceptions and their behavioural intention to use blockchain technology.

Identify key challenges and barriers from the perspective of banking staff regarding the adoption of blockchain systems.

By achieving these objectives, this research seeks to expand the TAM framework and offer practical recommendations for banks, policymakers, and technology developers to facilitate blockchain adoption in the Indian banking sector.

C. Research Plan

This study uses a quantitative research approach to examine the factors influencing blockchain adoption among Indian banking employees. The quantitative approach is used because it enables statistical study of the relationships between variables and objective measurement. A systematic survey questionnaire included validated measuring scales for key elements such as perceived utility, perceived ease of use, perceived security, perceived danger, trust, considered strategic value, and cost-saving. Because of the study's cross-sectional nature, data is collected from participants all at once. This method is effective for identifying patterns and linkages in the ways that employees of banks use technology. Additionally, multiple linear regression models are utilized to assess how different independent variables affect the adoption of blockchain.

To improve the study's robustness, pilot testing was conducted before the full-scale survey. To ensure the questionnaire was dependable and understandable, twenty banking professionals took part in the pilot test. In response to the input, minor adjustments were made to improve scale uniformity and question wording. This analytical methodology ensures a comprehensive understanding of the dynamics influencing blockchain adoption in the Indian banking sector and enables the creation of actionable insights for stakeholders.

D. Collecting Data and samples.

The survey included 200 banking employees from both public and private sector organizations. Stratified random sample was the sampling technique used to ensure participation from a variety of banking professional levels. To ensure broader involvement and to account for staff members with varying levels of digital literacy, data was collected via online surveys. The survey questionnaire was distributed by email and in-person visits to financial institutions. To increase response accuracy, respondents were assured that their responses would remain anonymous and confidential. The poll included a range of closed-ended questions with a five-point Likert scale to determine respondents' perceptions of the elements influencing blockchain adoption.

A small group of 20 banking experts participated in pre-testing of the survey to make sure the questions were reliable and clear. This resulted in a few minor adjustments prior to its complete implementation. A fair representation of workers from all levels of the banking industry's hierarchy, including managers, senior managers, and deputy managers, was also a goal. By using this method, the results are guaranteed to represent viewpoints from different banking operations levels.

E. Data Analysis Techniques:

Characteristic statistics: These give a summary of the respondents' age, gender, title, banking experience, and general response tendencies, among other demographic characteristics.

Correlation Analysis: This technique examines the relationships between significant attributes such as perceived usefulness, perceived ease of use, perceived security, trust, strategic value, and cost-saving.

Multiple Linear Regression: This technique assesses the impact of independent variables on employees' attitudes toward implementing blockchain technology and identifies the most significant predictors of blockchain adoption while controlling for confounding variables.

F. Testing hypothesis

Ho1: Perceived usefulness has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho2: Perceived ease of use has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho3: Perceived Risk has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho4: Perceived trust has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho5: Perceived strategic value has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho6: Perceived cost has no significant negative effect on employees' attitudes toward blockchain adoption.

Ho7: Perceived security has no significant positive effect on employees' attitudes toward blockchain adoption.

Ho8: Employees' attitudes toward blockchain adoption have no significant positively effect on their behavioural intention to use blockchain technology.

IV. Findings and Perspectives: The public and private banks that comprised the study's sample were PNB, SBI, Canara, Bank of Baroda, Union Bank, and HDFC, ICICI, Kotak Mahindra, Axis Bank, and Induslnd Bank. The researchers distributed 210 copies of the questionnaires to the respondents. Out of the 205 questionnaires that respondents submitted, five people did not complete the questions and personal information sections. 200 questionnaires were therefore used in the analysis. While Table 1 shows the respondents' response rates to the questionnaire distribution.

Table 1: Analysis of Questionnaires return.

Questionnaire	Number	Percent (%)
Amount distributed	210	100.00
Amount Returned	205	97.62
Filled Incomplete	5	2.38
Total	200	95.24

4.1 Model of Measurement: When employing a construction validity test via measuring instrument, the questionnaire used in this case can determine the importance of the research model under investigation. When performing a validity test, two forms of validity must be examined: criteria validity and content validity. Since the variables are drawn from globally renowned publications, which ensures their high validity, content validity is used to assess how well a questionnaire evaluates the content of a variable. On the other hand, the validity of the criteria is used to test the correlation between two variables.

The methodology used in this study, a convergent validity test, is predicated on the suggestion made by Hult et al. (2018) that the loading factor value for each question indication be greater than 0.50. The latent variables and the perception of all variables as outlined by the questionnaire's questions can be precisely observed and measured in these conditions. The results of the study indicate that the loading factor/outer loading values for all variables, as displayed in Table 2, were higher than 0.50. Therefore, all of the variables used in this study were valid.

Table 2: Outer Loading

Outer Loading									
	ATT	BI	CS	PEOU	PR	PS	PU	PSV	TR
AT1	0.693								
AT3	0.753								
AT4	0.723								
BI1		0.699							
BI2		0.562							
BI3		0.696							
CS1			0.729						
CS2			0.743						
CS3			0.759						

PE1				0.747					
PE2				0.694					
PE3				0.763					
PR1					0.763				
PR2					0.663				
PR3					0.741				
PS1						0.785			
PS2						0.693			
PS3						0.758			
PU1							0.797		
PU2							0.662		
PU3							0.712		
PV1								0.688	
PV2								0.688	
PV3								0.688	
TR1									0.712
TR2									0.723
TR3									0.701

4.2 Construct Reliability The composite reliability as indicated by Shiau et al. (2019) and the extracted mean variance as suggested by Hult et al. (2018) must be tested after the validity has been assessed by examining Factor Loading/Outer Loading. This means that, as indicated in Table 3, every construction value employed in the research model needs to have an AVE value larger than 0.5 and a CR value greater than 0.7. Consequently, all of the variables used in this study are reliable.

Table 3: Construct reliability

Construct Reliability			
	C.A	CR	AVE
Perceived usefulness	0.741	0.769	0.527
Perceived ease of use	0.723	0.779	0.541
Perceived risk	0.753	0.767	0.524
Perceived trust	0.729	0.755	0.530
Perceived cost	0.744	0.810	0.521
Perceived strategic value	0.768	0.793	0.562
Perceived security	0.761	0.819	0.535
Attitude to use block chain	0.746	0.793	0.563
Behaviour intension to use block chain technology	0.772	0.771	0.530

Table 4: Descriptive Test Results

Variables	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Perceived usefulness	200	4	14	2422	12.110	2.0269
Perceived ease of use	200	4	14	2416	12.080	2.0579
Perceived risk	200	4	15	2430	12.150	2.0927
Perceived trust	200	5	14	2426	12.130	2.0208
Perceived cost	200	4	14	2436	12.180	2.0367
Perceived strategic value	200	4	15	2429	12.145	2.1487
Perceived security	200	4	14	2443	12.215	2.0882
Attitude to use block chain	200	4	14	2448	12.240	2.0697
Behaviour intension to use block chain technology	200	3	15	2420	12.100	2.2394

Table 4 presents descriptive data for each of the variables employed in this study.

4.3 Regression Model

Table 5: Results of Multiple Linear Regression Test, Regression Models 1

Variables	Code	Direction	Coefficient	t-count	Sig.	Result	Impact
Perceived usefulness	H1	+	.033	.462	.645	Insignificant	No
Perceived ease of use	H2	+	.255	4.016	.000	Significant	Positive
Perceived risk	H3	+	.051	.788	.432	Insignificant	No
Perceived trust	H4	+	.158	2.654	.009	Significant	Positive
Perceived cost	H5	+	.292	4.157	.000	Significant	Positive
Perceived strategic value	H6	+	.166	2.787	.006	Significant	Positive
Perceived security	H7	+	.039	.580	.563	Insignificant	No

Dependent Variable: Attitude to use block chain * is significant at alpha 0.0

Variables	Code	Direction	Coefficient	t-count	Sig.	Result	Impact
Attitude to use block chain	H8	+	.856	23.260	.000	Significant	Positive

Dependent Variable: Behaviour intension to use block chain technology * is significant at alpha 0.0

A conventional assumption test that included tests for multicollinearity and normalcy was then carried out. The results of the normality test using the log (10) transformation showed that the value for the model was significant. The distribution of the data was found to be regular. Furthermore, VIF values were less than 10 and tolerance levels for all independent variables in the multicollinearity test were higher than 0.1. Consequently, it may be concluded that multicollinearity was not present in any of the independent variables.

5.1. The influence of perceived utility on how employees see the adoption of blockchain. Perceived usefulness has a regression coefficient (β = 0.033) and a significance value (p = 0.645), according to regression analysis. Given that the significance value is greater than the alpha level (α = 0.05), there is no statistically significant relationship between employees' opinions regarding blockchain adoption and perceived utility. Therefore, perceived utility has no discernible effect on employee attitudes toward blockchain adoption, leading to the rejection of hypothesis (H1), which initially proposed a positive effect.

5.2 How employees view the adoption of blockchain is influenced by perceived ease of use. Perceived ease of use has a regression coefficient (β = 0.255) and a significance value (p = 0.000), per the regression analysis. The significance value is below the alpha threshold (α = 0.05), indicating a statistically significant and positive link between employees' perceptions of ease of use and their attitudes toward blockchain adoption. This suggests that employees are more inclined to embrace blockchain technology with a positive attitude if they think it's easy to use. Thus, H2 is confirmed, showing that perceived ease of use has a beneficial impact on employees' views toward blockchain adoption.

5.3 The effect of perceived risk on how employees see the use of blockchain. Table 5 examines how employees' opinions toward blockchain adoption are impacted by perceived risk. According to the findings, the significance value (Sig.) is 0.432, surpassing the cutoff point of α = 0.05, while the regression coefficient (Beta) is 0.051, suggesting a mild influence. Because the p-value is more than 0.05, the result is statistically insignificant. Because of this, the first hypothesis (H3) is not supported, indicating that concerns about perceived risk do not substantially affect opinions about blockchain adoption.

5.4 The influence of perceived trust on how employees see the implementation of blockchain. Table 5 looks at how employees' perceptions of blockchain adoption are influenced by perceived trust. With a regression coefficient (Beta) of 0.158 and a significance value (Sig.) of.009, both of which are below the cutoff point of α = 0.05, the results demonstrate a considerable influence. The result is regarded as statistically significant since the p-value is less than 0.05. Thus, the first hypothesis (H4) is confirmed, indicating that perceived trust difficulties have a major impact on employees' emotions regarding blockchain implementation.

5.5 How employees view the adoption of blockchain technology in relation to perceived expenses. Table 5 looks at how employees' attitudes toward blockchain adoption are affected by perceived cost. According to the results, the significance value (Sig.) is.000, which is below the cutoff point of α = 0.05, and the regression coefficient (Beta) is.292, showing a significant influence. Given that the p-value is less than 0.05, the outcome is statistically significant. Thus, the first hypothesis (H5) is confirmed, indicating that perceived cost concerns have a major impact on employees' attitudes toward blockchain adoption.

5.6 How Employee Perceptions of Blockchain Adoption Are Affected by Perceived Strategic Value Table 5 looks at how employees' attitudes toward blockchain adoption are affected by perceived cost. The regression coefficient (Beta) of.166 and the significance value (Sig.) of.006, which are below the cutoff point of α = 0.05, suggest a significant influence, according to the results. Given that the p-value is less than 0.05, the outcome is statistically significant. As a result, the first hypothesis (H6) is confirmed, indicating that perceived strategic value concerns have a major impact on employees' attitudes about blockchain implementation.

5.7. How Employee Perceptions of Blockchain Adoption Are Affected by Perceived Security The regression analysis shows that perceived security has a significant value (p = 0.563) and a regression coefficient (β = 0.039). Employee perceptions of perceived security and blockchain adoption do not statistically correlate because the significance value (α = 0.05) is higher than the alpha criterion. Since employees' attitudes toward blockchain adoption are not significantly impacted by perceived security, the hypothesis (H7) that initially proposed a favourable effect is consequently discarded.

5.8. How employees' attitudes about blockchain adoption affect their behaviour and intention to use the technology. The regression analysis shows that employee opinions toward blockchain adoption have a regression coefficient (β=.856) and a significance value (p=.000). Given that the significance value is below the alpha level (α = 0.05), the relationship between employees' views toward blockchain adoption and their behaviour intention to use blockchain technology is statistically significant. Thus, H8 is supported, showing that employees' opinions and attitudes about blockchain adoption play a significant role in deciding whether or not they intend to use the technology.

6. CONCLUSION:

Future research can examine comparison studies across various industries to comprehend broader adoption patterns and longitudinal studies to examine blockchain adoption trends over time. Financial institutions must develop strong implementation strategies since blockchain technology is predicted to play an increasingly significant role in digital banking as it develops.The Technology Acceptance Model (TAM) is expanded in this study by include additional components relevant to blockchain adoption in the banking sector. Regression research indicates that perceived cost-effectiveness, perceived strategic value, perceived ease of use, and perceived trust have a greater impact on blockchain adoption than perceived utility, perceived security, and perceived danger. These findings imply that financial incentives, not only security concerns, are the primary forces behind blockchain adoption in banking.

Additionally, the results indicate that employees are more inclined to adopt blockchain-based solutions if they have prior experience with digital banking technologies. This suggests that a deep comprehension of digital financial systems is necessary to reduce resistance to new technology. Furthermore, trust in blockchain's ability to facilitate secure transactions emerged as a critical element, underscoring the importance of security perceptions in financial decision-making. Adoption readiness is also influenced by the potential for cost savings, which may be achieved through reduced transaction costs and increased operational effectiveness. If banks recognize and communicate these financial benefits effectively, they have a better chance of encouraging widespread adoption among employees and stakeholders..

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