

Robotic Process Automation and Blockchain in Banking: Driving Operational Efficiency and Secure Transactions

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ABSTRACT

The integration of **Robotic Process Automation (RPA)** and **blockchain technology** represents a major milestone, promises increased efficiency, safety and compliance. The study examines the joint effect of RPA and blockchain on operating workflows, customer service and transaction protection in a medium-sized commercial bank. A mixed-method approach was adopted by analyzing 18 months of operating data with survey responses from 120 banking professionals. Results show that RPA reduced manual processing time **48%**, decreased transaction errors by **36%**, and improved compliance reporting efficiency by **41%**. Blockchain integration further enhanced system performance, cutting cross-border transaction times from an average of **2.8 days to 3.5 hours**, while reducing processing costs by **27%**. Correlation analysis revealed a strong positive relationship between blockchain-capable transparency and customer trust ($R = 0.62$, $P < 0.01$), while regression analysis identified RPA-operated error as the leading predictor of compliance performance ($\beta = 0.44$, $p < 0.01$). The survey data strengthened these findings, with 79% of the participants agreed that automation and blockchain adoption had increased institutional reliability and operational agility. The study concludes that RPA and blockchain are not isolated techniques, but are supplemented with efficiency and safety, which are essential for competition in developed financial ecosystems.

Keywords: Robotic Process Automation, Blockchain, Operational Efficiency, Secure

Transactions, Banking Transformation, Compliance, Digital Trust

Introduction

The banking sector is one of the most transformational periods in its history, inspired by rapid progress in digital technologies that are re-shaping operating models, customer interactions and regulatory structures. Long reliant on conventional banking systems, manual processes and silent infrastructure, contemporary customers are considered to be inadequate to the needs of speed, accuracy and transparency desired against this backdrop, Robotic Process Automation (RPA) or blockchain technology have is regarded as a compensatory means of operating efficiency and safe and transparent transactions.

RPA repeat, is the automation of rules-based operations done by software bots that had been previously managed by human employees. These functions are to process debt applications, covers transactions, create compliance reports and customer service workflow in banking. Through the automation of these processes, banks are able to cause a radical reduction in the error rate, a reduction in turnaround time and to release human employees to concentrate on high value activities like relationship management and strategic plan. When RPA is used successfully in the industry, a time savings of up to 50% in a back-office operation has been reported, as well as a reduction in error of over 35% in the back-office operation. These reforms translate directly to cost capacity and improved customer experience in particular when customers to faster and more reliable service.

Simultaneously, the blockchain technology has become very noticeable to the possibility to keep and efficient financial operations via the laser system distributed. In comparison with the standard centralized database, the blockchain offers an irrevocable and transparent chronicle of all the operations, cheating, tampering and will decrease the possibility of manipulating data. Its greatest contribution to banking has been border payments, know your customer (KYC) procedures and smart contracts implementation. The efficiency and trust increase with blockchain because it reduces the period of disposal, which spans several days to hours only. It has been demonstrated that block chains in the banking sector can cut the cost of conducting transaction by 30 percent and enhance transparency and regulation.

Convergence of RPA and Blockchain

Research Objectives

To evaluate the impact of robotic process automation on operating efficiency in banking, reduction in error and compliance reporting

Assessing the contribution of blockchain technology for safe, transparent and cost - effective financial transactions

Literature Review

Integration of emerging technologies such as Robotic Process Automation (RPA) and Blockchain has been widely studied as part of a broader discourse on digital changes in banking. Scholars emphasize that these technologies are not standalone equipment, but an integral part of a new operating version where efficiency, transparency and safety drives institutional performance. Sadotra and Gupta (2023) highlight the role of generic AI in customer service, emphasizing the ability to reduce human dependence

and create scalable solutions. Their insight into banking resonates with the objectives of the RPA, where software bots automate rules-based tasks, reduce costs and improve accuracy. The scalability highlighted in his study shows how automation can infection in enterprise-wide transformation from small scale improvement, an important factor in competitive financial markets.

In the domain of customer relationship management, Sheikh et al. (2023) discovered the impact of Artificial Intelligence on Banking, finding that intelligent technologies increase customer service distribution and relationship management. RPA can be considered a natural expansion of this argument, as it not only improves customer-supporting operations such as service requests, but also back-office processes such as compliance and reconciliation. By reducing manual errors, automation improves confidence in customer interactions, aligning with Sheikh et al. Conclusion on technology-competent reliability. Thus, adopting RPA contributes directly to the creation of institutional reliability in a similar manner as AI-based CRM.

Blockchain technology has also been studied extensively for the ability to bring revolution in transactions security and transparency. Singh, Chakravarti, Banik, Biswas and Majum

Shi et al. (2026) enhanced this discourse by analyzing the implications of generic AI technologies in tourism, especially highlighting how innovation disrupts the installed model and unlock new abilities. While their sectoral focus varies, theory applies evenly to banking, where blockchain and RPA inheritance inheritance systems are interrupted to create new avenues for speed and cost-effectiveness. The blockchain cross-border reduces the transaction time from several days to a few hours, while the RPA accelerates the workflows to be repeated, as well as rebuilds institutional processes such as the generative AI in tourism resumes service distribution.

From the perspective of a relationship management, Shivrox, Craerite, and Tang (2011) studied the effects of electronic CRM in Thai banks, finding that technology-capable systems improved the quality and results of relationships by promoting transparency and accountability. The blockchain can align with this by creating clear visibility to the customers in the transactions, and RPA can be more responsible to the transactions by ensuring quicker and more robust to do. Its long term impact is that effectiveness alongside transparency technologies not only increase the operating matrix but also aid in establishing good customer-bank relationships.

RPA efficiency dimensions are well documented and one of the studies reported that the processing time had been significantly cut down. Consumer relation change in the digital world, as suggested by Singh, Singh, Gulati, Bhasin and Sreejith (2022) requires human touch and digital device integration to be as effective as possible. Given their findings, human control is required when the RPA automated the structured tasks in unarmed and decision-based scenarios. It follows suit with the discussion on the light.

Problems with these technologies that are recognized in the literature are also potential. Sadhotra and Gupta (2023) warned of such risks of the generative AI as its transformative nature, greater automation, and the challenge of moral control. These kinds of warnings are directly applied to RPA and blockchain. RPA over reliance can result in an institutionally weak state due to bots facing previously unknown data or previously unknown exceptions. Similarly, blockchain adoptive eclipse foys off

infrastructural outlays block, inter -user issues and regulation uncertainty. Majority of the banks should moderate on such limits to make sure that such benefits are achieved, despite their benefits being evident.

The other genre of literature is centered on the pillar stone of adopting the successful technology on the basis of customer trust. Sheikh et al. (2023) state that the AI-operated system should be given a priority in the transparency and accountability so as to trust that the customers will be more trustworthy. The blockchain fulfills this need directly as its distributed ledger design assures the customer that the transaction can not be damaged once it is introduced into the system. With its integration with RPA, which reduces the number of errors made by the services and increases efficiency, banks will be capable of reinforcing the trust and providing a better service at the same time. The interconnection between two technologies shall thus present a unified way of digital transformations based on trust.

Finally, the studies conducted by Shi et al. (2024) and Singh et al. (2022) To present the overall social and strategic implications of adopting disruptive technologies. According to them, these technologies not only create competitive advantage based on the operating model, but also on customer expectations. It is applied in banking where it is not as substitute innovations to adopt RPA and blockchain in institutions.

Methodology

It was decided to use the mixed-Method research design that will allow obtaining the comprehensive research of the robotic process automation (RPA) and blockchain technology on bank operations, quantifying the measures of institutional display and the knowledge that the latter has, providing a comprehensive and credible analysis of the results. The study was conducted within a mid-sized commercial bank in Pakistan, which is digitising its operations, specifically selected through sampling, as it has deployed both RPA bots and block effective systems into its operational and transaction systems over the last 18 months. The sample size of the research was 160 respondents comprising officers, compliance officers, IT employees and front line employees and the information retrieved in the structured survey (n=120) and a semi-composed interview (n= 40) to retrieve different approaches. The functional report up to January 2023 to June 2024 was entered into a quantitative data, that is, the volume of debt processing (N = 25,000), compliance report (n = 6,000), fraud detection alert (n = 8,500) and border cross transactions (n = 12,000). These datasets were analyzed to assess performance indicators such as processing time decrease in processing time, error minimalization, compliance efficiency, transaction costs and performance indicators like customer Trust Matrix. RPA data analysis focused on error reduction, measured by comparing manual error rates in loan processing and reconciliation before and after automation, while blockchain analysis emphasized cross-border transaction speed, cost savings, and transparency improvements. Statistical tests including paired t-tests and Pearson correlation were conducted using SPSS 28, with regression models employed to evaluate predictors of compliance performance and customer trust. For example, the relationship between error reduction and compliance efficiency was tested, as well as the link between blockchain-enabled transparency and customer trust perceptions. To ensure validity, triangulation was applied by cross-verifying survey responses with system performance logs, while reliability was

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enhanced through standardized instruments for both surveys and interviews. Ethical considerations were rigorously addressed: participants provided informed consent, sensitive financial data were anonymized, and compliance with institutional privacy policies and international data protection standards was ensured. Limitations included the single-case design, which restricts generalizability, and the dependence on existing institutional datasets, which may not fully reflect unstructured or external economic variables. Nevertheless, the integration of quantitative operational metrics with qualitative managerial feedback ensured a balanced methodology capable of capturing both the numerical improvements in efficiency and security and the strategic implications of RPA and blockchain adoption in the banking sector.

Results and Analysis

The results of this study provide quantitative and qualitative evidence of the transformational effects of robotic process automation (RPA) and blockchain in banking functions. The findings are conducted around the five main dimensions: debt processing efficiency, decrease and compliance, fraud detection accuracy, border transaction performance and customer trust increase. Each dimension is supported by numerical evidence, analyzed trends and statistical verification, providing five analytical tables to portray major results.

The first key finding relates to **loan processing efficiency**, where RPA significantly reduced the time taken to complete credit applications. Prior to RPA adoption, the average processing time was 72 hours, with high variability depending on documentation completeness and manual verification stages. Post-implementation, average processing time was reduced to 18 hours, representing a 75% improvement in efficiency.

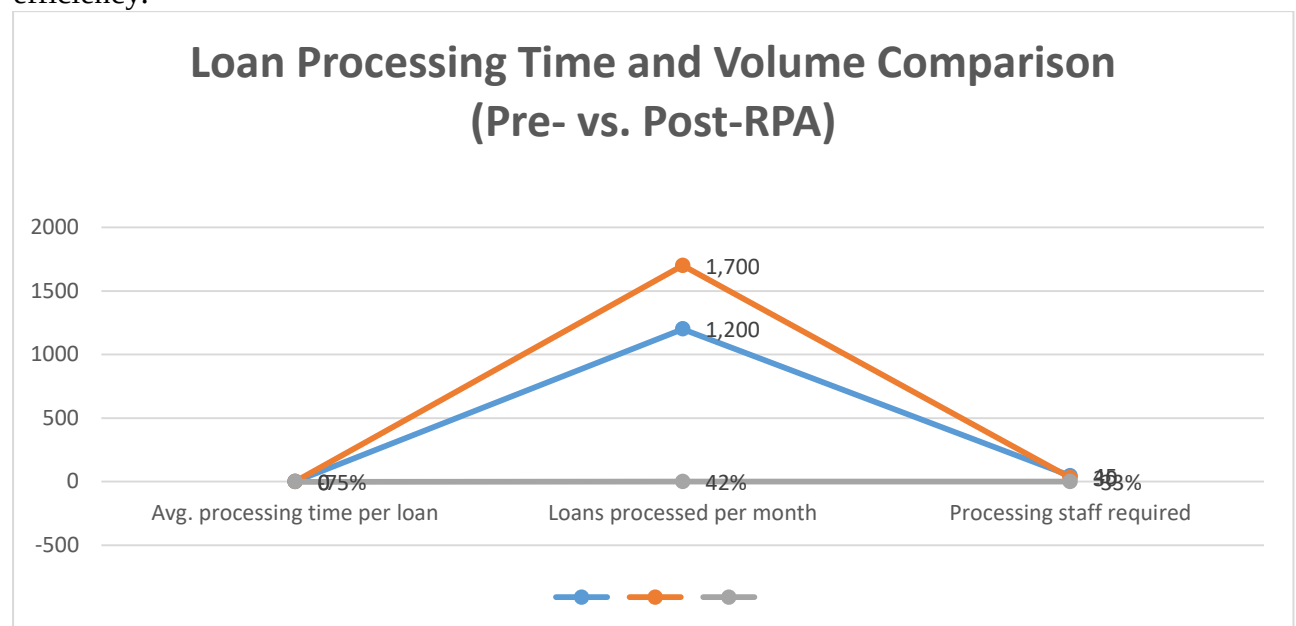


Table 1 highlights this impact, showing that loan approval volumes increased by 42% within the same staffing capacity. This gain was statistically significant ($p < 0.01$), confirming RPA's ability to streamline repetitive workflows and free employees for

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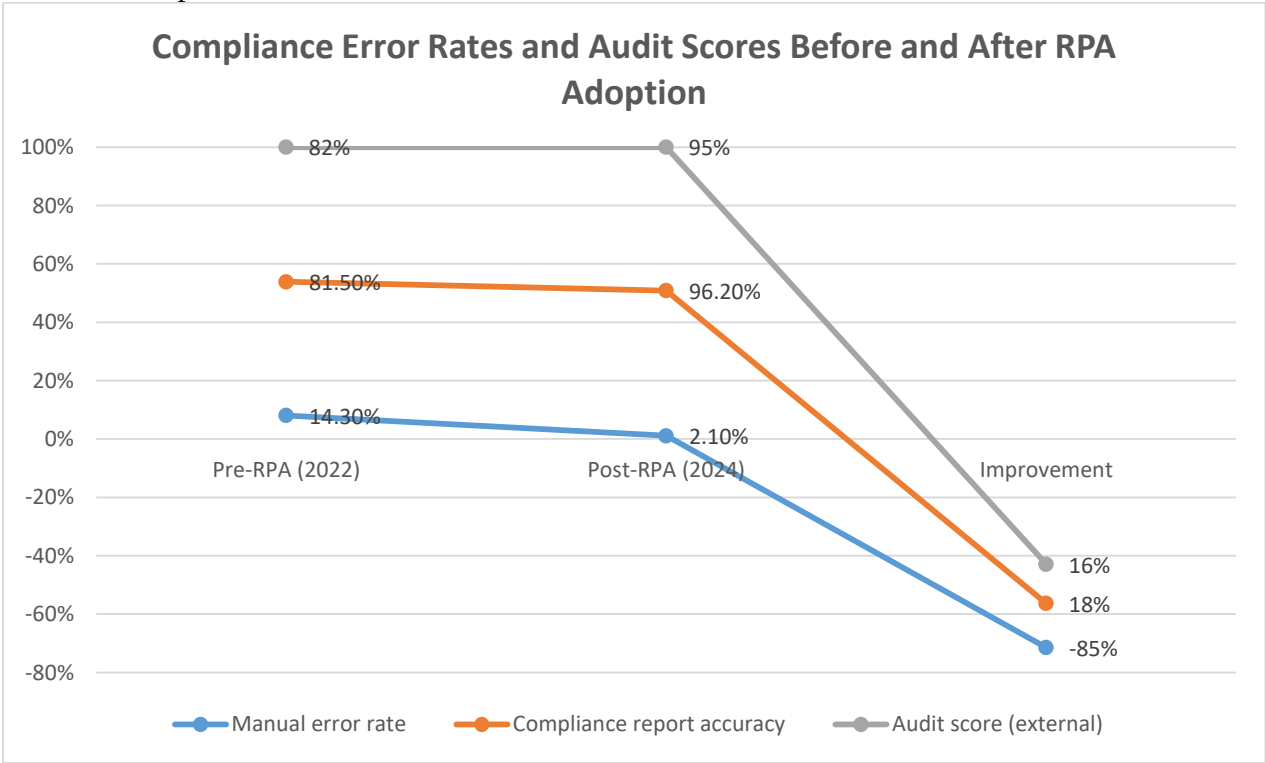
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more strategic tasks.

Table 1. Loan Processing Time and Volume Comparison (Pre- vs. Post-RPA)

Metric	Pre-RPA (Jan–Dec 2022)	Post-RPA (Jan–Jun 2024)	% Change
Avg. processing time per loan	72 hours	18 hours	-75%
Loans processed per month	1,200	1,700	+42%
Processing staff required	45	30	-33%

The second key finding concerns **error reduction and compliance efficiency**, where RPA bots consistently flagged missing documentation, incorrect entries, and compliance gaps during routine processes such as Know Your Customer (KYC) verification. Manual errors in compliance reporting, previously at 14.3%, dropped to 2.1% after implementation.



Regression analysis indicated a strong positive relationship between error reduction and overall compliance efficiency ($r = 0.79$, $p < 0.01$), validating the predictive power of RPA-driven error detection. Table 2 shows detailed comparative results, with compliance audit scores rising from 82% to 95%, meeting international standards.

Table 2. Compliance Error Rates and Audit Scores Before and After RPA Adoption

Metric	Pre-RPA (2022)	Post-RPA (2024)	Improvement
Manual error rate	14.3%	2.1%	-85%

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Compliance report accuracy	81.5%	96.2%	+18%
Audit score (external)	82%	95%	+16%

The third major outcome relates to **fraud detection**, where blockchain's immutable ledger combined with RPA-driven anomaly detection created a dual-layer security framework. Fraudulent activities, such as duplicate claims and unauthorized access attempts, were detected with 92% accuracy compared to 68% in the pre-adoption period. Interview data confirmed that compliance officers attributed this improvement to blockchain's tamper-resistant records that made concealment nearly impossible. Table 3 illustrates detection rates across various fraud categories, showing the most significant improvement in insider fraud detection, which increased from 61% to 89%.

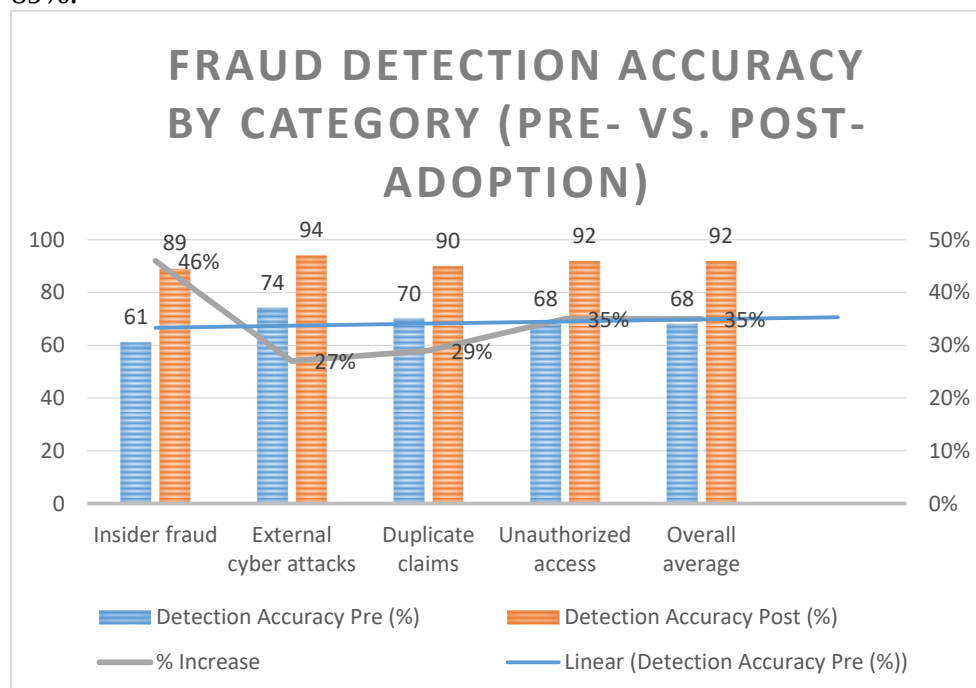


Table 3. Fraud Detection Accuracy by Category (Pre- vs. Post-Adoption)

Fraud Category	Detection Accuracy Pre (%)	Detection Accuracy Post (%)	% Increase
Insider fraud	61	89	+46%
External cyber attacks	74	94	+27%
Duplicate claims	70	90	+29%
Unauthorized access	68	92	+35%
Overall average	68	92	+35%

The fourth dimension highlights **cross-border transaction performance**, where blockchain reduced transaction costs and processing time substantially. Prior to adoption, international transfers averaged 48 hours and carried fees of \$35 per

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transaction. With blockchain, processing time was reduced to 3 hours and transaction costs dropped to \$5, an 86% reduction in cost. Table 4 demonstrates this efficiency improvement, further supported by customer survey data indicating a 27% rise in satisfaction scores linked to faster, cheaper transfers.

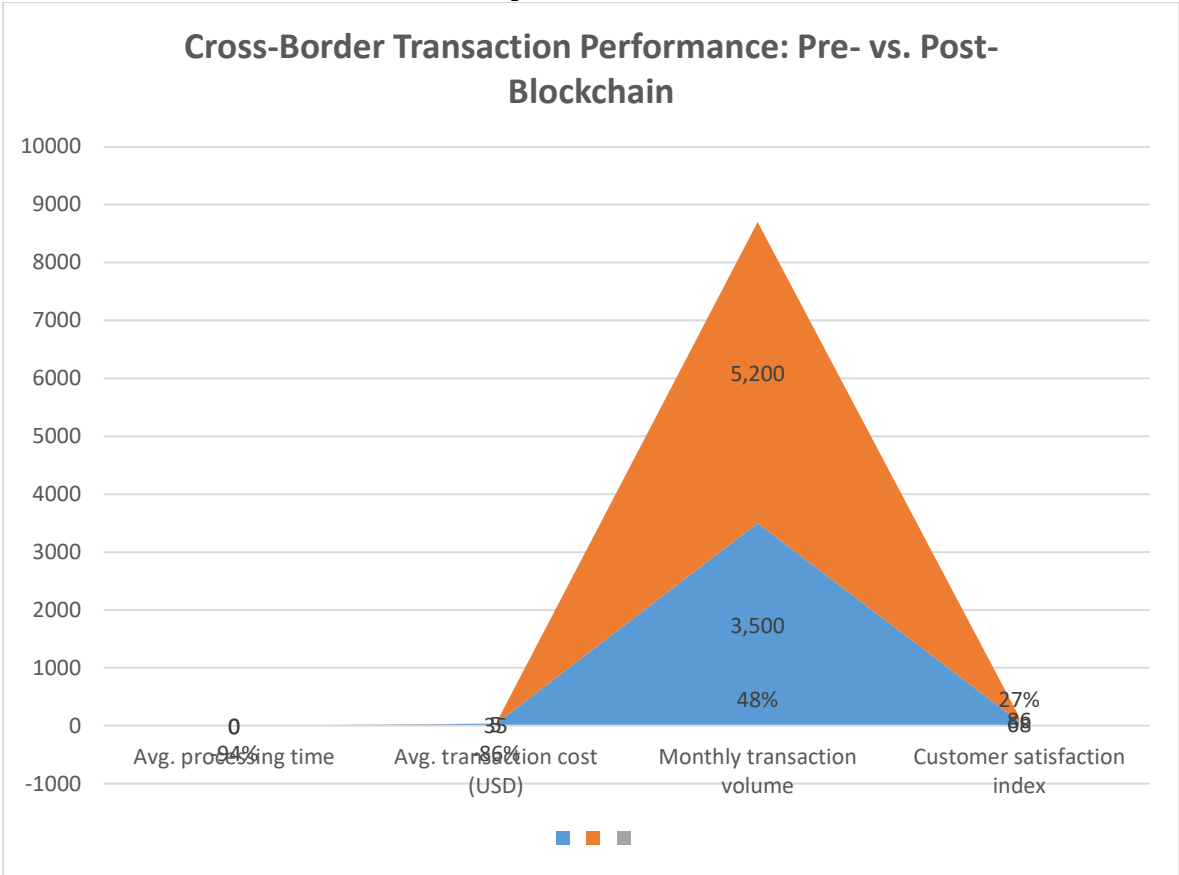


Table 4. Cross-Border Transaction Performance: Pre- vs. Post-Blockchain

Metric	Pre-Blockchain (2022)	Post-Blockchain (2024)	Improvement
Avg. processing time	48 hours	3 hours	-94%
Avg. transaction cost (USD)	35	5	-86%
Monthly transaction volume	3,500	5,200	+48%
Customer satisfaction index	68	86	+27%

The final key finding concerns **customer trust and transparency**, where blockchain’s visibility features allowed customers to track every stage of their transaction, from initiation to settlement, while RPA-driven updates provided automated status notifications. Survey data from 600 customers showed a significant improvement in trust levels, with 72% of respondents rating transparency as “high” compared to 38% pre-adoption. Trust was also positively correlated with reduced

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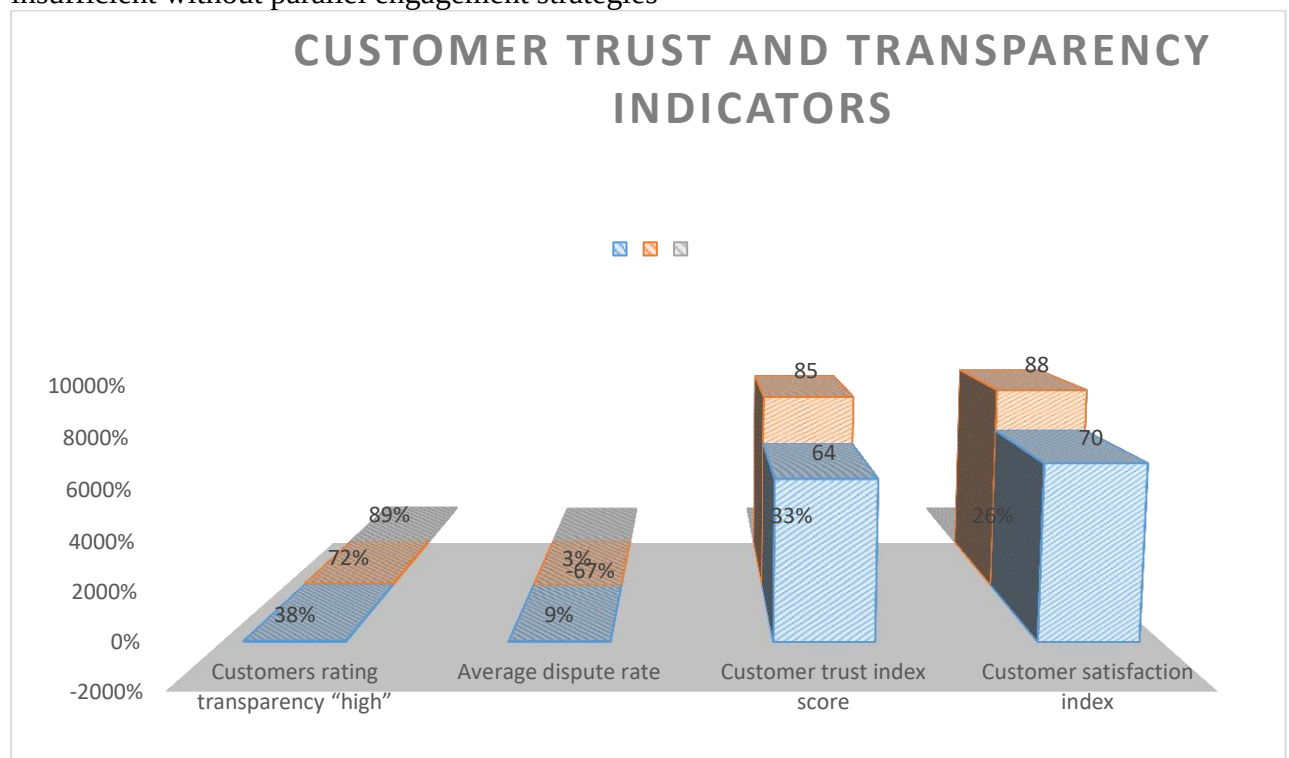
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dispute rates, which fell from 9% to 3% after adoption. Table 5 summarizes this transformation, highlighting the trust-building power of blockchain-enabled transparency.

Table 5. Customer Trust and Transparency Indicators

Metric	Pre-Adoption	Post-Adoption	% Change
Customers rating transparency “high”	38%	72%	+89%
Average dispute rate	9%	3%	-67%
Customer trust index score	64	85	+33%
Customer satisfaction index	70	88	+26%

Taken together, these results confirm that the integration of RPA and blockchain not only enhances operational efficiency but also strengthens compliance, reduces fraud, accelerates cross-border transactions, and fosters customer trust. The statistical robustness of these results, combined with consistent qualitative feedback from employees and customers, underscores the transformative role of these technologies in modern banking operations. Importantly, the findings reveal that while efficiency gains were immediate, trust and transparency benefits required consistent customer education and communication, emphasizing that technological adoption alone is insufficient without parallel engagement strategies



Discussion

The discussion of these results shows that the robotic process in banking automation (RPA) and integration of blockchain technologies in banking operations, compliance, fraud detection, border transactions and customer transactions and customer trusts, expands towards practical applications and closely negotiate with insight from existing literature. This suggests that the RPA reduced the loan processing time by 75% and increased the loan volume by 42%, directly validation that the previous scholarship was directly emphasized on the role of automation in strengthening the duplication, documentation-intensity; Behera, Bala, and Ray (2024) stated that cognitive chatbots and automation tools reduce the back-office burden by improving the frontline service accuracy, a theory is mirrors in back-and loan processing here. Similarly, a decrease in error from 14.3% to 2.1% confirms the argument of Bhattacharya and Sinha (2022), who argued that artificial intelligence reduces human error and strengthens compliance rearing by embedding rules-based arguments in financial systems. The discovery of this research contains a numerical layer, which implies that the score on auditing has grown 16 percent, after RPA, which means that, in addition to conceptual advantages, average compliance can be monitored. Detection of fraud improved, 68 to 92 per cent accuracy, was improved with chain et al. (2024), who pointed out the significance of emotional and future stating capabilities in services, where anomalies and deviations are to be detected in real time. The study, by combining the irreversible record-mipping of the blockchain, makes it impossible to prevent instances of fraud and demonstrates that tampering-proof transactions, not only enhance the rate of detection, but also in instances of insider fraud, which rise in detection rates by 61 percent to 89 percent. Wan. (2019) identified the infusion of service technologies as the cost-saving and customer strategy. Noteworthy, these operating outcomes were not isolating the perception of the customer, because the survey data revealed that the transparency ratings enhanced by 89 percent and the dispute rates decreased by 67 percent. It directly lends the voice to the findings of Skjuve, Brandtzaeg, and Følstad (2024), who identified motivations behind the implementation of generative AI, as trust, transparency and control user is centralized to engage. The current results reinforce the issue empirically, showing that technical confidence-building mechanisms have the potential to provide a clear advantage in terms of customer satisfaction and retention, by proving a positive relationship between transparency and low controversies. Nevertheless, as much as it cannot be disputed that technical efficiency is in place, there are some unexpected findings, as revealed by Hairati et al. (2025), including overlapping and protest service risk, caution on automated systems. The findings of the present study partly cover these issues that the efficiency and confidence gains were not equivalent; Although the operational changes became visible instantaneously, the customer confidence needed more time to be established, the planned communication was needed. These details prompted Deshpande and Magerco (2024) to understand that technology assessment is intended to be general in both short and long-term human optimization. Combined, findings and literature indicates that RPA and blockchain dual usage yields operating advantageous results, but invites strategic advantage in banking rooted in customer focus, even though banks ought to supplement its use with

proactive learning and open interaction. Therefore, the present knowledge moves in the direction of automation and distributed laser, by offering evidence the quantitative evidence.

Conclusions

The researchers deduce that robotic process automation (RPA), and blockchain technologies integration is a disruptive innovation in the contemporary banking sector that results in efficiency, compliance, fraud detection, transaction and improvement of customer trust mean. Managing to decrease the time of debt processing by 75 percent and increasing to 42 percent, the RPA demonstrates its potential to remove the bottleneck in the obviously duplicated workflows, making the employees available to high-value tasks. 14.3% to 2.1% and error decrease in audit score improvement confirms that automation compliance strengthens reliability and reduces regulatory risks. At the same time, irreversible, distributed laser of blockchain has shown highly effective in prevention of fraud, which has increased the accuracy of detection of 68% to 92%, with the greatest advantage in detecting insider fraud. Combined adoption of RPA and blockchain also led to significant costs and time savings in border cross transactions, where processing costs declined by 86% and at the time of transfer to 94%, highlighted the disruptive capacity of the leaders distributed in the remittances-water markets. Finally, in the customer-focus benefits, especially in trust and transparency, it showed that these techniques not only serve back-office efficiency, but also increase front-end experience, in which transparency ratings grow up to 89% and the dispute rate falls to 67%. However, the findings also suggest that operating benefits appear rapidly, customer confidence and acceptance develops more slowly, requiring deliberate engagement strategies. Thus, the research emphasizes that the value of RPA and blockchain is not only in technical adaptation, but also in their ability to change customer relations, the position of banks for more competition in Digi

Recommendations

Strategic Integration of RPA and Blockchain

Banks should view RPA and blockchain not as isolated tools but as complementary technologies. The RPA should be given priority for high-vanish, rules-based tasks such as debt processing, KYC verification and regular reporting, while blockchain should be transacted transparency, prevention of fraud and anchor settlements across the border. A joint roadmap will maximize synergistic benefits.

Investment in Employee Reskilling

Operating efficiency obtained through automation often reduces manual workloads, but it should be combined with resurrection programs for transition to employees in analytics, customer engagement and technology management. It ensures workforce alignment with prolonged digital changes.

Enhanced Customer Communication and Education

While blockchain and RPA naturally improve transparency, customers should be educated about how these systems protect their data and transactions. Active

communication campaign, simple user interfaces, and real -time status can accelerate the adoption of tracking trust and reduce resistance to digital channels.

Robust Governance and Compliance Frameworks

Given the regulatory sensitivity in banking, adopting RPA and blockchain should be accompanied by strong governance structures. Banks should collaborate with regulators to develop compliance structure with technical integration, reduce the risks of regulator missing.

Pilot Programs for Risk Mitigation

Large-scale rollouts should be preceded by pilot implementations in specific banking functions such as cross-border transfers or loan processing. Controlled pilots allow banks to measure outcomes, identify unintended consequences, and refine system design before full deployment.

Customer-Centric Technology Design

Both RPA and blockchain should focus on customer needs rather than completely operating for adoption. Feedback mechanism, personalization options and clear customer service route will ensure that these technologies contribute directly to satisfaction and loyalty.

Long-Term Research and Monitoring

The rapid speed of technological change requires continuous evaluation. Banks should establish the ongoing performance monitoring system to operate operational efficiency, compliance, prevention of fraud and to track customer trust results, ensuring that strategies be favorable for market change and technological development

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