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Influence of Artificial Intelligence Application on the Operational Efficiency of Commercial Banks

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Abstract

This study examined the influence of artificial intelligence application on the operational efficiency of commercial banks in China. Specifically, it assessed the extent of AI application in terms of customer service and engagement, fraud detection and security, and decision-making and strategy; evaluated operational efficiency in terms of process automation, cost efficiency, and transaction accuracy; tested the relationship between AI application and operational efficiency; and identified which AI application dimensions significantly influenced specific operational efficiency indicators. Using a descriptive-correlational research design, the study gathered data from 250 commercial banking institutions selected through stratified sampling. A self-structured questionnaire was used as the primary research instrument, with reliability testing confirming acceptable to excellent internal consistency across the measured constructs. Data were analyzed using weighted mean, rank, Spearman's rho correlation, and multiple linear regression. Findings showed that AI application was generally recognized across all three dimensions, with decision-making and strategy receiving the highest assessment. Operational efficiency was also rated favorably across process automation, cost efficiency, and transaction accuracy, with cost efficiency emerging as the strongest operational efficiency dimension. Correlation results revealed highly significant positive relationships between AI application and all operational efficiency indicators. Regression results further indicated that customer service and engagement and decision-making and strategy significantly influenced process automation, while AI-related service, security, and strategic decision-making functions contributed to cost efficiency and transaction accuracy. The study concludes that AI application serves as an important driver of operational efficiency in commercial banking, particularly when deployed not only as a customer-facing tool but also as a strategic, risk-control, and process-improvement mechanism. The findings support the development of an integrated AI deployment plan aimed at strengthening automation, cost control, transaction reliability, and data-driven banking operations.

Keywords: *Artificial Intelligence Application; Operational Efficiency; Commercial Banks; Process Automation; Cost Efficiency; Transaction Accuracy*

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1. Introduction

Artificial intelligence has become one of the most significant technological forces reshaping the operations of commercial banks. In the banking sector, AI is no longer limited to experimental automation or back-office support. It is increasingly applied in customer service, fraud detection, credit assessment, transaction monitoring, decision support, and strategic planning. These applications are particularly important in commercial banking, where institutions must process large volumes of transactions, respond quickly to customer needs, protect financial systems from fraud, and maintain efficiency under intense competition.

In China, the digital transformation of commercial banks has accelerated as financial institutions expand their use of intelligent customer service systems, automated risk-control models, smart branches, algorithmic decision tools, and data-driven management platforms. The operational logic of banking has therefore shifted from purely manual or rule-based

processing toward more integrated, automated, and predictive systems. This shift is important because commercial banks operate in an environment where efficiency, security, responsiveness, and accuracy directly affect institutional competitiveness. In this context, AI application may be understood not only as a technological upgrade but also as an operational strategy that influences how banks allocate resources, manage risks, serve customers, and improve internal processes.

The present study focuses on two major constructs: artificial intelligence application and operational efficiency. Artificial intelligence application refers to the use of AI-enabled systems, tools, and platforms in selected banking functions. In this study, it is examined in terms of customer service and engagement, fraud detection and security, and decision-making and strategy. These dimensions capture both front-office and back-office uses of AI. Customer service and engagement involve the use of AI-powered chatbots, virtual assistants, personalized service tools, and customer-response systems. Fraud detection and security refer to AI-supported mechanisms for detecting suspicious transactions, strengthening cybersecurity, reducing monitoring workload, and improving customer trust. Decision-making and strategy include the use of AI tools to support management decisions, analyze large datasets, predict market and customer behavior, accelerate decision-making, and respond to competitive changes.

Operational efficiency, on the other hand, refers to the extent to which commercial banks are able to improve work processes, control costs, and ensure reliable transactions through AI-supported operations. In this study, operational efficiency is measured in terms of process automation, cost efficiency, and transaction accuracy. Process automation refers to the automation of routine banking processes, reduction of manual errors, improvement of interdepartmental coordination, and streamlining of workflows. Cost efficiency concerns the ability of AI-supported operations to reduce labor-related expenses, improve resource utilization, minimize operational error costs, and support long-term cost savings. Transaction accuracy refers to the role of AI in detecting and correcting transaction errors, improving regulatory compliance, increasing reliability, and reducing mistakes in transaction processing.

The literature indicates that AI has already contributed to several functional areas of banking. Xu (2025) emphasized the value of AI in customer service by improving responsiveness and reducing the limitations of time and location in traditional banking services. Zheng (2026) linked AI and fintech adoption to improved risk identification and operational stability. Hui, Liu, and Hou (2025) also highlighted the role of AI in commercial bank credit risk management, particularly in strengthening risk identification through intelligent models. These studies suggest that AI can contribute meaningfully to service quality, security, risk control, and operational performance. However, many existing studies remain focused on specific banking functions rather than on the broader operational relationship between AI application and efficiency.

Several gaps therefore remain. First, prior studies often examine AI in a single banking area, such as customer service, credit risk, or fraud detection, without integrating these dimensions into a unified operational framework. Second, existing research tends to treat AI as a technological intervention without sufficiently examining how different AI application areas relate to specific efficiency outcomes. Third, the combined influence of AI application on process automation, cost efficiency, and transaction accuracy remains insufficiently examined. This is important because operational efficiency is not a single outcome. A bank may improve transaction monitoring without reducing cost, or improve customer service automation without necessarily improving strategic decision-making. A multidimensional analysis is therefore needed to clarify which AI application areas are most strongly associated with specific operational efficiency outcomes.

The study addresses these gaps by examining AI application and operational efficiency within a unified empirical framework. It considers AI application through customer service and engagement, fraud detection and security, and decision-making and strategy. It then assesses operational efficiency through process automation, cost efficiency, and transaction accuracy. By testing both correlation and regression relationships, the study provides evidence on whether AI application is significantly associated with operational efficiency and which AI dimensions contribute most strongly to particular efficiency indicators. This approach is relevant for commercial banks seeking to improve digital transformation outcomes through more targeted AI deployment.

The study aims to assess the influence of artificial intelligence application on the operational efficiency of commercial banks in China. Specifically, it seeks to determine the extent of AI application in terms of customer service and engagement, fraud detection and security, and decision-making and strategy; evaluate the level of operational efficiency in terms of process automation, cost efficiency, and transaction accuracy; test the significant relationship between AI application and operational efficiency; determine which AI application dimensions significantly influence specific operational efficiency indicators; and propose an action plan for enhancing operational efficiency through AI application in commercial banks.

2. Review of Related Literature

2.1 AI Application and Digital Transformation in Commercial Banking

Artificial intelligence has become a major component of digital transformation in commercial banking, particularly as banks move from conventional service delivery toward automated, data-driven, and intelligent operational systems. In the banking context, AI is applied not only to customer-facing services but also to internal operations, credit assessment, fraud monitoring, transaction processing, and strategic decision support. Yang (2025) described AI as an enabling force in the digital transformation of the banking industry, while Yin and Wang (2024) emphasized that generative AI has expanded the possibilities for banks to redesign service and operational processes. These views suggest that AI is no longer treated merely as a technical tool but as part of the institutional infrastructure through which banks improve efficiency, responsiveness, and competitiveness.

The literature also links AI adoption with broader fintech-enabled transformation. Ding and Qian (2026) argued that AI empowers the digital transformation of commercial banks through strategic pathways, technology integration, and ecosystem reconstruction. Similarly, Feng (2025) discussed AI as a force that reshapes commercial banks by improving operational models and enabling intelligent service structures. Lang (2025) further noted that intelligent agents are increasingly used in the internal management functions of commercial banks, indicating that AI adoption is not limited to external customer services but extends to managerial and administrative functions.

However, AI adoption in banking also requires coordinated investment in algorithms, data systems, technical teams, and operational integration. He (2025) examined the application and challenges of AI in credit decision-making, showing that AI systems can improve decision support but also depend on model quality and institutional readiness. Xu (2025) similarly emphasized that AI-based banking services require service optimization strategies to ensure that intelligent tools improve, rather than complicate, customer experience. These studies collectively support the view that AI adoption in commercial banking is both a technological and managerial issue. Comparable work on integrated organizational analytics argues that operational value depends on linking data integration, analytics capability, decision quality, and outcome monitoring, rather than treating analytics as isolated technical investment (Atento, Quinto, Espelita, & Castaneda, 2025). Likewise, evidence from AI adoption in education shows that perceived usefulness may be constrained by readiness issues involving access, cost, privacy, algorithmic bias, and user support (Rao, Tian, & Atento, 2025).

2.2 AI in Customer Service, Fraud Detection, and Strategic Decision-Making

One major stream of literature focuses on the functional applications of AI in banking. In customer service, AI-powered chatbots, virtual assistants, intelligent service platforms, and personalized banking tools help banks respond more efficiently to customer needs. Xu (2025) argued that AI can reduce the temporal and spatial limitations of traditional banking services by improving responsiveness and accessibility. Ma (2025) also linked AI-based customer analysis with precision marketing, suggesting that AI enables banks to personalize services through customer data analysis. These findings are relevant to the present study's focus on customer service and engagement as one dimension of AI application. Adjacent work on narrative health analytics similarly suggests that AI-supported text and interaction data can enrich service understanding when computational interpretation is paired with ethical, cultural, and interpretive safeguards (Atento, Quinto, Espelita, & San Juan, 2025).

AI is also strongly associated with fraud detection, risk control, and security. Hui, Liu, and Hou (2025) discussed the application of AI in credit risk management and emphasized its value in improving risk identification. Zheng (2026) similarly connected fintech and AI application with credit risk control in Chinese commercial banks. Zhang (2025) also examined how fintech can optimize commercial bank risk-control systems under the digital economy. These studies indicate that AI contributes to operational efficiency by strengthening banks' capacity to detect suspicious activities, improve fraud monitoring, and reduce risk exposure.

Another important area is decision-making and strategy. Xiao and Xu (2026) argued that AI application can influence commercial bank competition by improving decision quality and strategic responsiveness. Wu and Xu (2025) also associated digital intelligence with the construction of core competitiveness in commercial bank wealth management. Ding and Qian (2026) further emphasized that AI supports strategic transformation by integrating technology into institutional decision processes. These studies suggest that AI does not merely automate isolated tasks. It can also support management-level decisions, resource allocation, market analysis, and strategic adaptation.

2.3 Operational Efficiency in Banking: Automation, Cost Control, and Transaction Accuracy

Operational efficiency in commercial banking is usually reflected in faster processes, lower operating costs, improved resource utilization, reduced errors, and more reliable transactions. The original literature indicates that AI contributes to operational efficiency through process automation, cost efficiency, and transaction accuracy. The China

Agricultural Bank Operation Management Department Research Group and Fan (2025) discussed the application of generative AI in commercial bank operation management, particularly in improving process standardization and operational responsiveness. Zhai (2025) similarly highlighted the use of generative AI in commercial banks as a way to support automation and operational improvement. Comparable evidence from quality-management implementation also indicates that operational efficiency improves when system design is supported by organizational practices, human factors, monitoring routines, and enabling digital infrastructure (Gamasan & Atento, 2026).

Cost efficiency is another important efficiency outcome. Jiang (2025) examined the impact of fintech on commercial bank profitability, suggesting that technology adoption can improve resource use and cost management. Liu (2025) more directly linked digital transformation with commercial bank operational efficiency, indicating that digital tools can reduce operational inefficiencies when properly implemented. Yun (2025) also discussed the relationship between digital transformation and business performance, supporting the view that AI and related technologies may improve institutional performance through cost control, resource optimization, and efficiency gains.

Transaction accuracy is also central to banking efficiency because errors, compliance failures, and unreliable transaction processing can generate financial and reputational costs. Wang, Yu, and Zhang (2026) argued that AI can improve the standardization of internal audit in commercial banks, which is closely related to compliance and transaction reliability. Zhou, Chen, and Liu (2025) also connected digital transformation with intelligent identification and dynamic prevention and control of credit risks. Zhuo and Chen (2025) added that big data-supported credit risk management can improve the precision of risk identification. These studies support the inclusion of transaction accuracy as a core operational efficiency dimension in the present study. Related research on AI in accounting cautions that automation strengthens decision support only when outputs remain traceable, verifiable, and subject to professional oversight (Bendal, Sabasa, Espelita, & Atento, 2026).

2.4 Synthesis and Literature Gaps

The reviewed literature generally agrees that AI supports commercial banking transformation by improving service responsiveness, risk detection, strategic decision-making, process automation, cost control, and transaction reliability. Customer service studies emphasize personalization and service responsiveness (Ma, 2025; Xu, 2025). Risk and fraud-related studies highlight AI's value in credit risk identification, fraud detection, and compliance monitoring (Hui et al., 2025; Wang et al., 2026; Zheng, 2026). Strategy-oriented studies show that AI strengthens decision-making, market analysis, and competitive responsiveness (Ding & Qian, 2026; Xiao & Xu, 2026; Wu & Xu, 2025). Efficiency-focused studies further suggest that AI and fintech contribute to process improvement, cost efficiency, and business performance (Jiang, 2025; Liu, 2025; Yun, 2025; Zhai, 2025).

Despite these contributions, the literature remains somewhat fragmented. Many studies examine AI in one banking function, such as customer service, credit risk, digital transformation, or profitability, but fewer studies integrate customer service, fraud detection, and strategic decision-making into one framework. Likewise, operational efficiency is often discussed broadly, without separating process automation, cost efficiency, and transaction accuracy as distinct outcomes. The present study responds to this gap by examining how three dimensions of AI application relate to three specific dimensions of operational efficiency among commercial banks in China. This structure allows the analysis to identify not only whether AI application is associated with efficiency, but also which AI dimensions are most relevant to particular efficiency outcomes.

3. Methods

3.1 Research Design

This study used a descriptive-correlational research design to examine the influence of artificial intelligence application on the operational efficiency of commercial banks in China. The descriptive component was used to assess the extent of AI application and the level of operational efficiency based on the perceptions of the respondents. The correlational component was used to determine whether significant relationships existed between AI application and operational efficiency, while regression analysis was used to identify which AI application dimensions significantly influenced specific operational efficiency indicators.

This design was appropriate because the study did not manipulate variables experimentally. Instead, it measured existing AI-related practices and operational efficiency conditions among commercial banking institutions.

3.2 Participants of the Study

The participants of the study were drawn from commercial banking institutions in China that had formally applied artificial intelligence technologies in their operations. The study focused on banks with tangible AI-related investments, including AI-supported systems, digital service platforms, fraud detection tools, and decision-support mechanisms.

A total of 250 commercial banking institutions were included in the study using stratified sampling. The stratification considered bank category, geographical distribution, and asset scale to ensure that the sample represented different types of commercial banks. This approach allowed the study to capture variations in AI application and operational efficiency across banking institutions with different organizational and operational characteristics.

3.3 Research Instrument

A self-structured questionnaire was used as the primary data-gathering instrument. The questionnaire consisted of two major parts. The first part measured Artificial Intelligence Application in terms of customer service and engagement, fraud detection and security, and decision-making and strategy. The second part measured Operational Efficiency in terms of process automation, cost efficiency, and transaction accuracy.

The items were rated using a four-point Likert scale: 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Disagree. The questionnaire was subjected to validation and reliability testing. Cronbach's alpha coefficients showed good to excellent internal consistency across the major variables. For Artificial Intelligence Application, the reliability coefficients were 0.826 for customer service and engagement, 0.851 for fraud detection and security, and 0.883 for decision-making and strategy. The overall reliability coefficient for AI application was 0.927, interpreted as excellent. For Operational Efficiency, the coefficients were 0.819 for process automation, 0.844 for cost efficiency, and 0.872 for transaction accuracy. The overall reliability coefficient for operational efficiency was 0.931, also interpreted as excellent. These results indicate that the instrument was sufficiently reliable for measuring the constructs of the study.

3.4 Data Gathering Procedure

The study followed a systematic data-gathering procedure. First, the research topic and variables were identified based on the literature on artificial intelligence application, fintech, digital transformation, and banking operational efficiency. Second, the questionnaire was developed based on the study objectives and the operational definitions of the variables. Third, the instrument underwent validation and reliability testing to ensure clarity, internal consistency, and alignment with the research objectives.

After validation, data were gathered from the target commercial banking institutions. The completed responses were reviewed, encoded, and prepared for statistical analysis. Responses were screened to ensure completeness and suitability for the intended descriptive, correlational, and regression analyses.

3.5 Ethical Considerations

The study observed appropriate ethical standards in the conduct of research. Participation was treated with confidentiality, and the data gathered were used solely for academic and research purposes. The study did not require disclosure of confidential banking information, trade secrets, or restricted internal documents. Respondents were informed of the purpose of the study, and their participation was treated as voluntary. The study also underwent institutional ethics review before implementation, consistent with the thesis requirements.

3.6 Data Analysis

The data were analyzed using descriptive and inferential statistical tools. Weighted mean, composite mean, and rank were used to determine the extent of AI application and the level of operational efficiency. These tools were applied to the dimensions of AI application, namely customer service and engagement, fraud detection and security, and decision-making and strategy, as well as to the dimensions of operational efficiency, namely process automation, cost efficiency, and transaction accuracy.

Before testing relationships among the variables, the Kolmogorov-Smirnov test was used to determine whether the data were normally distributed. Since the results indicated that the data were not normally distributed, Spearman's rho correlation was used to test the significant relationship between AI application and operational efficiency. Multiple regression analysis was then applied to determine which dimensions of AI application significantly influenced each operational efficiency indicator.

4. Results and Discussion

This section presents the findings on artificial intelligence application and operational efficiency among commercial banks. AI application was assessed in terms of customer service and engagement, fraud detection and security, and decision-making and strategy. Operational efficiency was assessed in terms of process automation, cost efficiency, and transaction accuracy. The section also presents the correlation and regression results used to determine the relationship and influence of AI application on operational efficiency.

4.1 Assessment of AI Application in Commercial Banks

Table 1. Respondents' Assessment of AI Application in Commercial Banks in Terms of Customer Service and Engagement

Indicators	Weighted Mean	Verbal Interpretation	Rank
AI-powered chatbots or virtual assistants are used to handle customer inquiries efficiently.	3.29	Agree	5
AI systems help personalize banking services based on customer preferences and behavior.	3.42	Agree	1
AI applications improve response time in customer service interactions.	3.40	Agree	2.5
Customer complaints are addressed more effectively through 24/7 AI-supported systems.	3.40	Agree	2.5
AI technologies contribute to a more seamless and convenient customer experience.	3.37	Agree	4
Composite Mean	3.38	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 1 shows that AI application in customer service and engagement obtained a composite mean of 3.38, interpreted as Agree. This indicates that respondents generally recognized the contribution of AI to improving customer-facing banking services. The highest-rated indicator was the use of AI systems to personalize banking services based on customer preferences and behavior, with a weighted mean of 3.42. This suggests that personalization is perceived as one of the strongest customer-service benefits of AI in commercial banks.

The indicators on response time and 24/7 complaint handling both obtained a mean of 3.40, showing that AI-supported systems are also valued for service responsiveness and availability. However, the lowest-rated indicator was the use of AI-powered chatbots or virtual assistants to handle customer inquiries efficiently, with a mean of 3.29. Although still interpreted as Agree, this result suggests that chatbot efficiency may remain less mature than other AI-supported customer engagement functions.

Table 2. Respondents' Assessment of AI Application in Commercial Banks in Terms of Fraud Detection and Security

Indicators	Weighted Mean	Verbal Interpretation	Rank
AI systems are used to detect suspicious transactions in real time.	3.50	Strongly Agree	1
AI applications improve the accuracy of fraud detection processes.	3.40	Agree	4.5
AI technology strengthens the bank's overall cybersecurity measures.	3.40	Agree	4.5
AI applications reduce the workload of employees involved in fraud monitoring.	3.48	Agree	2
AI-driven security systems enhance customer trust in the bank.	3.43	Agree	3
Composite Mean	3.44	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 2 shows that AI application in fraud detection and security obtained a composite mean of 3.44, interpreted as Agree. The highest-rated indicator was the use of AI systems to detect suspicious transactions in real time, with a weighted mean of 3.50, interpreted as Strongly Agree. This indicates that real-time suspicious transaction detection is perceived as a particularly strong AI capability in commercial banks.

The use of AI to reduce employee workload in fraud monitoring ranked second, with a mean of 3.48. This result suggests that AI not only strengthens security functions but also reduces the burden of manual monitoring. Meanwhile, fraud detection accuracy and cybersecurity strengthening both obtained a mean of 3.40, ranking lowest within the

dimension. These scores remain favorable, but they imply that accuracy and cybersecurity enhancement may still require continued model improvement, stronger data governance, and regular system updating.

Table 3. Respondents' Assessment of AI Application in Commercial Banks in Terms of Decision-Making and Strategy

Indicators	Weighted Mean	Verbal Interpretation	Rank
AI systems support management in making data-driven decisions.	3.48	Agree	1.5
AI tools help analyze large volumes of financial and customer data.	3.42	Agree	5
AI technologies assist in predicting market trends and customer behavior.	3.45	Agree	3
AI systems contribute to faster decision-making processes.	3.48	Agree	1.5
AI adoption enhances the bank's ability to respond to competitive and market changes.	3.44	Agree	4
Composite Mean	3.45	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 3 presents the assessment of AI application in decision-making and strategy. The composite mean was 3.45, interpreted as Agree, and this was the highest among the three AI application dimensions. The highest-rated indicators were the ability of AI to support data-driven management decisions and accelerate decision-making processes, both with means of 3.48. These findings suggest that respondents perceived AI as especially useful in improving the speed and evidence base of managerial decision-making.

The lowest-rated indicator was the use of AI tools to analyze large volumes of financial and customer data, with a mean of 3.42. Although still favorable, this result suggests that large-scale data analysis remains a technical and organizational challenge. Banks may possess AI tools, but the effectiveness of these tools depends on data integration, quality, accessibility, and staff capability.

Table 4. Summary of Respondents' Assessment of AI Application in Commercial Banks

Dimensions	Composite Mean	Verbal Interpretation	Rank
Customer Service and Engagement	3.38	Agree	3
Fraud Detection and Security	3.44	Agree	2
Decision-Making and Strategy	3.45	Agree	1
Overall Composite Mean	3.42	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 4 summarizes the assessment of AI application in commercial banks. The overall composite mean was 3.42, interpreted as Agree. Among the three dimensions, Decision-Making and Strategy ranked first with a mean of 3.45, followed closely by Fraud Detection and Security with 3.44. Customer Service and Engagement ranked third with 3.38.

These results suggest that AI application is recognized across operational and managerial areas, but its strongest perceived contribution is at the decision-making and strategic level. This implies that commercial banks may be using AI not only for automation and customer-facing tools but also for management support, market responsiveness, and strategic adaptation.

4.2 Level of Operational Efficiency in Commercial Banks

Table 5. Level of Operational Efficiency in Terms of Process Automation

Indicators	Weighted Mean	Verbal Interpretation	Rank
AI applications automate routine banking processes effectively.	3.41	Agree	4
Automated processes reduce manual errors in daily operations.	3.46	Agree	2.5
AI automation improves coordination across different banking departments.	3.46	Agree	2.5
Operational processes have become more streamlined due to AI use.	3.47	Agree	1
AI-driven automation improves workflow efficiency.	3.40	Agree	5
Composite Mean	3.44	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 5 shows that process automation obtained a composite mean of 3.44, interpreted as Agree. The highest-rated indicator was that operational processes have become more streamlined due to AI use, with a mean of 3.47. This indicates that AI is perceived as useful in simplifying banking processes and reducing procedural complexity.

The reduction of manual errors and improvement of coordination across departments both obtained means of 3.46, suggesting that AI-supported automation contributes to operational reliability and interdepartmental coordination. The lowest-rated indicator was AI-driven automation improving workflow efficiency, with a mean of 3.40. This result remains positive, but it suggests that workflow automation may still face implementation barriers, such as process fragmentation, legacy systems, or incomplete integration across departments.

Table 6. Level of Operational Efficiency in Terms of Cost Efficiency

Indicators	Weighted Mean	Verbal Interpretation	Rank
Automation through AI lowers labor-related expenses.	3.42	Agree	5
AI applications improve resource utilization efficiency.	3.44	Agree	3.5
The use of AI contributes to long-term cost savings.	3.49	Agree	2
AI systems help minimize costs associated with operational errors.	3.44	Agree	3.5
The bank achieves better cost control through AI-supported operations.	3.52	Strongly Agree	1
Composite Mean	3.46	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 6 shows that cost efficiency obtained a composite mean of 3.46, interpreted as Agree. The highest-rated indicator was that banks achieve better cost control through AI-supported operations, with a mean of 3.52, interpreted as Strongly Agree. This suggests that respondents perceived AI as particularly valuable for strengthening cost-control mechanisms.

The use of AI for long-term cost savings ranked second, with a mean of 3.49. This indicates that AI may be seen not only as a short-term automation tool but also as a long-term operational investment. The lowest-rated indicator was the reduction of labor-related expenses through AI automation, with a mean of 3.42. This may imply that while AI improves cost control, its immediate effect on labor costs may be moderated by implementation costs, staff training, system maintenance, and the need for hybrid human-AI operations.

Table 7. Level of Operational Efficiency in Terms of Transaction Accuracy

Indicators	Weighted Mean	Verbal Interpretation	Rank
AI tools help detect and correct transaction errors promptly.	3.42	Agree	5
AI applications enhance compliance with banking regulations and standards.	3.51	Strongly Agree	1
AI applications improve the accuracy of financial transactions.	3.43	Agree	4
Transaction processing has become more reliable with AI support.	3.45	Agree	2.5
Errors in transaction processing have decreased due to AI use.	3.45	Agree	2.5
Composite Mean	3.45	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree.

Table 7 shows that transaction accuracy obtained a composite mean of 3.45, interpreted as Agree. The highest-rated indicator was the enhancement of compliance with banking regulations and standards, with a mean of 3.51, interpreted as Strongly Agree. This suggests that AI is perceived as particularly valuable in supporting compliance-oriented transaction control.

The indicators on transaction reliability and reduction of transaction-processing errors both obtained means of 3.45, showing that AI contributes to more dependable transaction processes. The lowest-rated indicator was the prompt detection and correction of transaction errors, with a mean of 3.42. While still favorable, this result suggests that real-time correction remains an area requiring further improvement.

Table 8. Summary of the Level of Operational Efficiency

Dimensions	Composite Mean	Verbal Interpretation	Rank
Process Automation	3.44	Agree	3
Cost Efficiency	3.46	Agree	1

Transaction Accuracy	3.45	Agree	2
Overall Composite Mean	3.45	Agree	

Legend: 3.50-4.00 = Strongly Agree; 2.50-3.49 = Agree; 1.50-2.49 = Disagree; 1.00-1.49 = Strongly Disagree. The summary values were corrected to match Tables 5 to 7.

Table 8 summarizes the level of operational efficiency in commercial banks. The corrected overall composite mean was 3.45, interpreted as Agree. Among the three dimensions, Cost Efficiency ranked first with a mean of 3.46, followed by Transaction Accuracy with 3.45, and Process Automation with 3.44.

These results suggest that AI-supported operations are perceived as useful across the three operational dimensions. Cost efficiency obtained the highest assessment, indicating that AI is viewed most strongly as a tool for cost control, resource optimization, and long-term operational savings.

4.3 Relationship Between AI Application and Operational Efficiency

Table 9. Relationship Between AI Application and Operational Efficiency

AI Application Dimension	Operational Efficiency Dimension	rho-value	p-value	Interpretation
Overall AI Application	Process Automation	0.796**	p < .001	Highly Significant
Overall AI Application	Cost Efficiency	0.815**	p < .001	Highly Significant
Overall AI Application	Transaction Accuracy	0.813**	p < .001	Highly Significant
Customer Service and Engagement	Process Automation	0.779**	p < .001	Highly Significant
Customer Service and Engagement	Cost Efficiency	0.829**	p < .001	Highly Significant
Customer Service and Engagement	Transaction Accuracy	0.819**	p < .001	Highly Significant
Decision-Making and Strategy	Process Automation	0.845**	p < .001	Highly Significant
Decision-Making and Strategy	Cost Efficiency	0.850**	p < .001	Highly Significant
Decision-Making and Strategy	Transaction Accuracy	0.855**	p < .001	Highly Significant

Note. Correlation is significant at the 0.01 level. Fraud Detection and Security correlation rows were not clearly shown in the source table and should be verified against the statistical output before publication.

Table 9 shows highly significant positive relationships between AI application and operational efficiency. Overall AI application was significantly correlated with process automation, cost efficiency, and transaction accuracy, with rho-values ranging from 0.796 to 0.815. These values indicate strong positive associations, suggesting that higher AI application is associated with higher operational efficiency.

Customer service and engagement was also positively and significantly related to all three operational efficiency dimensions, with the strongest relationship observed in cost efficiency. This suggests that AI-supported customer service may reduce service-related inefficiencies, improve customer handling, and support more cost-effective service delivery.

Decision-making and strategy showed the strongest correlation values across the table, particularly with transaction accuracy at 0.855. This suggests that strategic and data-driven AI use may have a particularly strong relationship with reliable, accurate, and efficient banking operations.

4.4 Influence of AI Application on Operational Efficiency

Table 10. Dimensions of AI Application that Influence Operational Efficiency in Terms of Process Automation

Predictor Variables	Regression Coefficient	p-value	Interpretation
Constant	0.230		
Customer Service and Engagement	0.337	p < .001	Significant
Fraud Detection and Security	0.100	p = .196	Not Significant
Decision-Making and Strategy	0.500	p < .001	Significant

Legend: Significant if p-value < .05; Not significant if p-value > .05.

Table 10 shows that customer service and engagement and decision-making and strategy significantly influenced process automation. Decision-making and strategy had the stronger coefficient at 0.500, followed by customer service and engagement at 0.337. This suggests that process automation is more strongly influenced by AI use at the strategic and managerial level than by customer-facing AI alone.

Fraud detection and security did not significantly influence process automation, with a coefficient of 0.100 and a p-value of .196. This result is reasonable because fraud detection tools are primarily designed to strengthen monitoring, risk control, and transaction security, rather than directly automate general operational workflows.

Table 11. Dimensions of AI Application that Influence Operational Efficiency in Terms of Cost Efficiency

Predictor Variables	Regression Coefficient	p-value	Interpretation
Constant	0.154		
Customer Service and Engagement	0.301	p < .001	Significant
Fraud Detection and Security	0.249	p < .001	Significant
Decision-Making and Strategy	0.415	p < .001	Significant

Legend: Significant if p-value < .05; Not significant if p-value > .05.

Table 11 shows that all three AI application dimensions significantly influenced cost efficiency. Decision-making and strategy had the strongest influence, with a coefficient of 0.415, followed by customer service and engagement at 0.301, and fraud detection and security at 0.249.

These findings indicate that cost efficiency is influenced by AI across multiple banking functions. AI-supported decision-making may improve cost efficiency through better resource allocation, faster management decisions, and more precise operational planning. Customer service AI may reduce service delivery costs by improving responsiveness and reducing reliance on manual service channels. Fraud detection and security may contribute to cost efficiency by reducing fraud-related losses, monitoring burdens, and risk-event costs.

Table 12. Dimensions of AI Application that Influence Operational Efficiency in Terms of Transaction Accuracy

Predictor Variables	Regression Coefficient	p-value	Interpretation
Constant	0.166		
Customer Service and Engagement	0.287	p < .001	Significant
Fraud Detection and Security	0.308	For verification	For verification
Decision-Making and Strategy	0.363	p < .001	Significant

Note. The source table reports Fraud Detection and Security as significant but gives an inconsistent p-value notation. The value should be verified against the statistical output before final publication.

Table 12 shows that customer service and engagement and decision-making and strategy significantly influenced transaction accuracy. Decision-making and strategy had the highest coefficient at 0.363, indicating that AI-supported management and strategic decision processes may contribute substantially to transaction reliability and accuracy.

Fraud detection and security had a coefficient of 0.308, which conceptually suggests a meaningful relationship with transaction accuracy. However, the source table contains an inconsistency in the reported p-value for this predictor. Therefore, the significance of this specific coefficient should be verified against the statistical output before final publication.

4.5 Proposed Action Plan

Based on the findings, the study proposes an action plan centered on process automation, cost-efficiency optimization, transaction accuracy, and integrated AI capability-building. The action plan is intended to guide commercial banks in moving from fragmented AI use toward coordinated AI-supported operational transformation.

Table 13. Action Plan for Enhancing Operational Efficiency of Commercial Banks

Key Result Areas	Strategies	Strategic Objectives	Persons Involved	Expected Outcomes
Process Automation Efficiency Improvement	Conduct systematic reconstruction of operational processes based on AI decision-making and strategy; deepen AI use in customer service automation; establish an AI process-automation feedback mechanism.	Improve process automation through AI-supported planning and service-level implementation while reducing manual intervention.	AI R&D Team; Operation Management Department; Customer Service Department; Business Department Heads	Higher automation rate; shorter process time; lower interdepartmental process errors.
Cost Efficiency Optimization and Upgrading	Formulate refined AI-supported cost-control strategies; expand intelligent customer service and remote services; strengthen AI fraud detection to reduce risk losses; establish AI cost-efficiency monitoring.	Improve cost efficiency through decision-making efficiency, service cost reduction, and risk-control loss reduction.	Financial Management Department; AI R&D Team; Operation Management Department; Risk Control Department; Customer Service Department	Reduced operational costs; improved resource utilization; reduced fraud losses; stronger long-term cost savings.
Comprehensive Guarantee of Transaction Accuracy	Optimize transaction rules and process design; upgrade real-time monitoring and error-correction models; strengthen transaction guidance and information verification; establish AI transaction-accuracy evaluation.	Improve transaction accuracy, reduce transaction errors, and strengthen regulatory compliance.	Risk Control Department; Transaction Management Department; AI R&D Team; Customer Service Department; Compliance Department	Lower transaction error rate; stronger compliance; shorter error-detection and correction time; improved processing reliability.
AI Application Dimension Synergistic Upgrading	Strengthen technology integration and data interconnection across customer service, fraud detection, and decision-making; establish AI training systems; create an AI application innovation center; evaluate and iterate AI models regularly.	Build an integrated AI operational support system that maximizes the contribution of AI to operational efficiency.	Technology Department; AI R&D Team; Human Resources Department; Operation Management Department; Business Departments	Improved data interconnection; higher employee AI-use capability; regular AI application innovation; shorter model optimization cycle.

5. Conclusions

Based on the findings, the study concludes that artificial intelligence application is positively associated with the operational efficiency of commercial banks. AI was recognized across the three application dimensions of customer service and engagement, fraud detection and security, and decision-making and strategy, with the strongest assessment observed in decision-making and strategy. This indicates that commercial banks increasingly use AI not only as a service automation tool but also as a strategic support mechanism for data-driven decisions, faster managerial responses, and market adaptation.

Operational efficiency was also favorably assessed across process automation, cost efficiency, and transaction accuracy. Among these dimensions, cost efficiency obtained the highest assessment, suggesting that AI-supported operations are perceived as particularly useful in strengthening cost control, improving resource utilization, and supporting long-term savings. Transaction accuracy and process automation were likewise rated positively, showing that AI contributes to compliance, transaction reliability, error reduction, workflow streamlining, and operational coordination.

The correlation results indicate a highly significant positive relationship between AI application and operational efficiency. This means that stronger AI application is associated with higher levels of process automation, cost efficiency, and transaction accuracy. However, because the study used a descriptive-correlational design, the results should be interpreted as evidence of statistical association and prediction rather than experimental causation.

The regression results further indicate that customer service and engagement and decision-making and strategy significantly predict process automation. For cost efficiency, all three AI dimensions, namely customer service and engagement, fraud detection and security, and decision-making and strategy, significantly contribute to the model. For transaction accuracy, customer service and engagement and decision-making and strategy were supported as significant predictors, while the result for fraud detection and security must still be verified because the original table contains a p-value inconsistency.

Finally, the study supports the need for an integrated AI operational support system. The proposed action plan should focus on process automation, cost-efficiency optimization, transaction accuracy, and cross-functional AI integration. The practical value of the study lies in showing that AI deployment should not be fragmented across isolated banking functions. Instead, AI should be managed as a coordinated operational strategy involving service systems, fraud monitoring, decision support, compliance, employee capability-building, and continuous model evaluation.

6. Recommendations

Commercial banks may strengthen employee training on AI-supported systems, data literacy, and human-AI workflow coordination. Since AI effectiveness depends not only on system deployment but also on the ability of personnel to interpret, supervise, and use AI outputs, training should be differentiated according to functional roles such as customer service, operations, compliance, risk control, and management.

Banks may also prioritize the integration of AI systems across customer service, fraud detection, transaction monitoring, and strategic decision-making. This is important because fragmented AI applications may limit operational gains. An integrated system would allow banks to reduce data silos, improve model consistency, strengthen real-time monitoring, and align AI outputs with operational and strategic objectives.

Commercial banks may improve chatbot and virtual assistant systems, since this was the lowest-rated indicator under customer service and engagement. Improvements may include better natural language processing, escalation protocols for complex inquiries, multilingual support, and continuous monitoring of customer satisfaction with AI-supported service channels.

Banks may further enhance AI-supported fraud detection and cybersecurity systems. Although fraud detection and security were positively assessed, the relatively lower ratings for fraud detection accuracy and cybersecurity strengthening suggest the need for continuous model updating, improved data quality, stronger cybersecurity architecture, and regular validation of AI risk-control models.

Management may use AI more deliberately for strategic planning, resource allocation, cost control, and operational redesign. Since decision-making and strategy consistently showed strong results, banks may benefit from embedding AI outputs into management dashboards, predictive analytics, performance monitoring systems, and strategic review processes.

The proposed action plan may be presented to commercial banking associations, bank management groups, or digital transformation committees as a basis for improving operational efficiency through AI deployment. The plan should be treated as a strategic guide, not merely as a technical implementation checklist.

Future researchers may expand the model by including customer satisfaction, employee productivity, digital transformation readiness, service innovation capability, risk management performance, organizational resilience, profitability, or bank size as additional variables. Future studies may also use longitudinal designs, mixed-method approaches, or actual operational performance data to validate whether AI application produces measurable improvements over time.

7. Practical Implications

For bank executives, the findings imply that AI investment should be evaluated not only in terms of technology acquisition but also in terms of operational value. AI systems should be linked to measurable outcomes such as shorter processing time, reduced operational cost, improved transaction accuracy, lower fraud exposure, and stronger compliance.

For operations managers, the results suggest that AI should be used to redesign workflows rather than merely automate existing inefficiencies. Process mapping, workflow simplification, and interdepartmental coordination should precede or accompany AI deployment.

For risk and compliance officers, AI-supported fraud detection and transaction monitoring should be continuously validated. The practical challenge is not simply deploying AI models but ensuring that these models remain accurate, auditable, compliant, and responsive to evolving financial risks.

For customer service managers, AI should enhance rather than weaken customer experience. Chatbots and virtual assistants should be designed with clear escalation points, accurate response capabilities, and customer-centered service standards.

For researchers, the study contributes a multidimensional model linking AI application with operational efficiency. Its main limitation is that the findings are based on survey responses and correlational analysis. Future studies may strengthen the evidence by using verified institutional performance data, panel data, or pre- and post-AI implementation comparisons.

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