

RPA in Commercial Banks: Optimization Mechanisms and Tool Selection

Yingxi Chen¹, Xinyao Du^{2,*}, Peiyin Shi³, Guangsheng Zhang⁴

¹ East China University of Science and Technology, Shanghai, China

² School of Management, University of Shanghai for Science and Technology, Shanghai, China

³ Department of finance, University of Yunnan for Finance and Economics, Yunnan, China

⁴ Department of Agricultural Consumer Economics, University of Illinois Urbana-Champaign, Urbana, IL, United states

* Corresponding Author Email: bockeyz2@illinois.edu

Abstract. Against the backdrop of the transformation of the banking business model propelled by the rapid development of fintech, this study delves into the optimization effect of Robotic Process Automation (RPA) on the commercial bank ecosystem and the prudent selection of tools. By leveraging case analysis, secondary data calculation, and in-depth expert interviews, a comprehensive case study of China Merchants Bank is meticulously conducted. The findings vividly demonstrate that RPA significantly optimizes the ecosystem of China Merchants Bank. It not only enhances business efficiency and reduces operational costs but also fortifies risk management and enriches customer experience. The Conch RPA platform showcases unique advantages, with its implementation strategies and safeguard measures proving highly effective. Looking ahead, RPA holds vast research potential in areas such as integration with artificial intelligence, exploration of novel scenarios, sustainability and risk management, and strategic collaboration. This research serves as a valuable reference for the digital upgrading endeavors of financial institutions.

Keywords: Robotic Process Automation, Commercial Banks, Conch RPA Platform, Digital Transformation.

1. Introduction

The rapid convergence of big data, cloud computing and artificial-intelligence technologies is compelling commercial banks to replace labor-intensive, error-prone workflows with digital processes that can satisfy regulators' real-time audit demands and customers' expectations for anytime-anywhere service. Robotic Process Automation (RPA), software robots that mimic clicks, keystrokes and data checks at the user-interface level, has therefore become the first pragmatic step in banks' digital-transformation roadmaps [1]. Early pilots worldwide report that RPA can compress processing time by 30 %–80 % and cut error rates to below 10 %, while generating fully traceable audit trails [2].

Despite these benefits, most deployments remain task-specific and vendor-driven, leaving three key issues unresolved. First, how can an RPA platform be securely integrated with legacy core systems, hybrid-cloud architectures and stringent data-encryption standards? Second, what is the true total cost of ownership (TCO) and governance burden of an in-house platform compared with mainstream commercial tools? Third, how does the shift from manual processing to bot supervision affect organizational roles, skills and culture?

China Merchants Bank (CMB) offers a unique testbed. Since 2017 it has embedded RPA at the heart of its "Smart Banking" strategy and developed its own Conch RPA platform. Conch combines a low-code studio, distributed architecture and native hybrid-cloud integration, aiming to reduce licence fees and tighten data security. By May 2022 the platform covered more than 5 000 scenarios and 10 000 robots, replacing nearly 100 million manual actions every day, shortening average processing time across 27 high-volume processes by 37 % and saving over 800 FTEs.

To benchmark these advantages against third-party solutions and illuminate the associated integration and governance challenges, this study undertakes a mixed-methods case analysis of Conch RPA's rollout at CMB. Drawing on process-mining logs, secondary performance metrics and expert interviews, we (i) quantify Conch's impact on efficiency, cost, risk control and customer experience; (ii) contrast its architecture and TCO with commercial vendor platforms adopted by peer banks; and (iii) propose a three-phase implementation blueprint, planning, pilot and scale-up, supported by a Centre of Excellence and scenario owners. By linking tool-selection criteria with ecosystem-level outcomes, the paper delivers a replicable evaluation framework and actionable guidance for secure, large-scale RPA deployment in commercial banking.

2. Literature Review

In recent years, robotic process automation (RPA) technology has received extensive attention from academia and the industry due to its low cost, rapid deployability, and high controllability. Willcocks, Lacity, and Craig summarized the three core modules of RPA, process capture, rule engine, and API integration, and pointed out that the technology can simulate repetitive work such as clicking, inputting, and checking on the manual interface, thus liberating manpower and reducing the error rate. Lacity, Willcocks, and Craig further proposed that RPA needs to be synergized with business process reengineering, technology platform selection, and operation and maintenance management in a large-scale rollout; otherwise, it is difficult to achieve sustained efficacy. In addition, some scholars have also emphasized the combination of RPA with process mining and low-code technology, which effectively lowers the participation threshold of non-technical personnel and makes automation rollout more efficient and widespread [3]. Asatiani and Penttinen further propose the automation-depth continuum, which provides a theoretical framework for measuring RPA maturity [4].

Several empirical studies in banking scenarios have validated the effectiveness of RPA. Li and Chen conducted a comparative study of the credit approval process of several commercial banks and found that the introduction of RPA reduces the average approval time by nearly 50%, decreases the manual error rate by about 70%, and significantly reduces operational costs [5]. Wang and Liu argued that RPA is highly replicable in back-office operation centers by comparing cases of book processing and accounting and scalability, and that different banks focus on implementation paths, platform selection, and organizational support [6]. Internationally, case studies from organizations such as HSBC and JPMorgan have also validated the effectiveness of RPA in the areas of customer due diligence (KYC) and contract review [7].

With the escalating regulatory requirements for risk management and compliance auditing, the application of RPA in risk control has gradually increased. Zhou showed that the RPA platform can monitor abnormal transaction patterns in real time and automatically generate compliance reports, significantly improving internal control efficiency and auditing transparency [8]. Davenport and Ronanki emphasized that the combination of RPA with artificial intelligence technologies, such as machine learning, natural language processing, etc. It can achieve smarter early warning and decision-making support, while at the same time reminding of the need for a sound feedback-closure and governance mechanism to prevent model bias and risk of misuse [9].

Although there are abundant "point" application studies, there is still a relative lack of systematic discussions on end-to-end automation of the whole process, system integration challenges, and continuous operation and control. Academics generally agree that interfaces between core systems and RPA platforms, middleware compatibility, data encryption, access control, and the transition of employees from operational roles to automation roles are key issues that need to be addressed. In addition, changes in organizational culture and adaptive adjustments in employee psychology and roles are gradually becoming key factors in the success of automation transformation. Future research should focus on the best practices of the deep integration of intelligent RPA with big data and artificial intelligence, the design of a closed-loop optimization mechanism for supervised learning, and replicable landing models for the banking industry. Meanwhile, in-depth research on the training

system, incentive mechanism, and career-path planning for employees is also an important guarantee to ensure the effectiveness of automation transformation. The in-depth exploration of these research directions will provide more forward-looking and practical theoretical and methodological support for the industry to promote digital transformation comprehensively.

3. Research results and analyses

3.1. Operation and Technical Mechanism of RPA in China Merchants Bank

3.1.1. System architecture and process design

The Conch RPA platform of China Merchants Bank has obvious advantages in the structural framework and workflow design. The underlying layer of the platform adopts cloud technology. This technology choice enables the bank to realise flexible resource allocation, thus adapting to the real-time demands of diverse business operations.

In real-world business scenarios, RPA also demonstrates exceptional automation capabilities. For example, in the credit card approval process, after RPA collects customer-related data, it performs an initial risk assessment, providing significant support to manual reviewers. As a result, approval times are significantly reduced. In retail lending, for example, RPA is able to retrieve information from multiple sources. It can review this information using criteria set in advance. Another example is in cash settlement, where transaction data can be collated and uploaded very comprehensively by RPA. Immediately after that, the data is processed quickly to ensure that the transaction data is settled accurately and in time. These applications of RPA make the business operation easy and reduce the errors caused by human labour, that is to say, both speed and accuracy are guaranteed.

3.1.2. Core Technical Mechanisms

The implementation of RPA technology in China Merchants Bank focuses on three main areas. The first is to help automate processes; RPA can generate scripts that mimic manual operations, and these scripts can help rationalize work. For example, during the annual review of public sector accounts, repetitive tasks can be delegated to RPA, even in complex environments, where the benefits are even more pronounced.

The second aspect relates to data collection and conversion. RPA extracts information from various sources. This information is then standardized directly on the platform. Afterwards, RPA also analyses the information in depth to support the decision-making process. Whether in customer relationship management or financial billing operations, RPA helps to develop targeted marketing strategies. At the same time, there is no need to worry about the integrity and security of the data.

The third area is the integration of RPA with AI, which enables intelligent decision-making and the resolution of anomalies. For example, machine learning algorithms can be used to assess risk during the credit card approval process. It is worth noting that these algorithms can be adjusted in real time. In addition, RPA continuously monitors the workflow. It triggers alerts and even auto-corrects when there are anomalies, which greatly ensures the smooth running of business processes.

3.2. Innovation, Efficiency and Competitive Advantage

3.2.1. Technological Advancement and Functionality Enhancement

China Merchants Bank was one of the first platforms to put RPA innovation into practice. It achieved autonomy by developing its own RPA platform, overcoming its dependence on third-party vendors and bypassing licensing restrictions. The platform uses distributed computing technology and advanced bot management development tools. As a result, the operational efficiency has increased substantially compared to the previous one. In addition, it fostered an environment of innovation within the bank, reducing technology-related costs and accelerating the process of workflow improvement.

The bank also combined AI with RPA for extending its other capabilities. In customer service, natural language processing (NLP) technology is used to translate and respond to customer queries

in real time. In risk management, machine learning algorithms can analyse huge amounts of data, identify potential threats and issue timely warnings. It plays an important role in avoiding telecom fraud.

3.2.2. Quantifiable efficiency gains and benefits

In terms of efficiency, RPA has reinvigorated banks. Approval times for credit cards and retail loans have been significantly reduced. Funds settlement times are also much higher than before, further enabling banks to respond more quickly to customer needs.

From a cost perspective, RPA has allowed the bank to shrink its labour costs considerably. At the same time, financial risks that may be brought about by human operation are also avoided. Cost-benefit analyses show that banks can control costs effectively. The increased return on investment improves the profitability of the bank.

3.2.3. Difference with traditional industry models

On the newly opened road of RPA application, China Merchants Bank is significantly ahead of its competitors. In terms of technology, the bank's RPA is fully applied to core business workflows and provides customized solutions for specific business needs. In contrast, many competitors apply RPA only to basic tasks and rely on external support. In terms of customer service, the bank's AI-RPA system provides personalized assistance around the clock.

4. Analysis

4.1. Technological Innovation and Optimisation of Choices

China Merchants Bank launched the RPA pilot around 2017, entered the full application stage in 2018, and continued to iterate and upgrade, becoming an early benchmark case in the domestic banking industry to realise the large-scale application of RPA. This initiative is highly in line with its "financial technology bank" strategy, and has significantly improved business processing efficiency and customer experience.

In terms of technological innovation, China Merchants Bank has integrated RPA with artificial intelligence and big data technologies, and demonstrated a number of innovative cases covering finance, operations, data governance and intelligent services. For example, China Merchants Bank, in conjunction with Aloudata, constructed a data governance system based on column arithmetic lineage, which realises the automated tracking of the whole-link data lineage mapping through RPA technology. The solution uses RPA to automatically monitor upstream data changes, assess field-level impacts, and assist in model reconstruction and risk prevention, resulting in a 40% drop in the number of assets in the count warehouse and a 50% increase in link efficiency. In addition, China Merchants Bank has built an agile data service platform (Aloudata AIR) through Data Fabric architecture and RPA technology to support logical integration and real-time querying of heterogeneous data. rPA undertakes cross-system data migration and automated acceleration tasks in the process, and combines with AI algorithms to achieve adaptive physical acceleration, which reduces the cost of storage and computation by more than 50 per cent.

In terms of selection and optimization, in order to solve the adaptability problem of relying on foreign RPA tools (such as UiPath) in the early stage, China Merchants Bank initiated the research and development of an independently controllable RPA platform in 2019, and ultimately launched the "Conch RPA", which is aimed at lowering the technological threshold and improving the efficiency of scenario development. Through nearly five years of exploration, construction and practice, China Merchants Bank has redefined the RPA technology application model and precipitated many high-value application scenarios, including annual inspection of public accounts, fund clearing, and intelligent invoicing assistance for financial e-bills. As of May 2022, the number of online scenarios of Conch RPA of China Merchants Bank is close to 5,000, and the total number

of robots exceeds 10,000; the platform has saved more than 800 FTE (full working hours human resources), and the average number of daily replacement manual actions is nearly 100 million times.

Overall, through technological innovation and tool optimisation and upgrading, China Merchants Bank has improved the performance and adaptability of its RPA tools while bringing significant competitive advantages. This innovation-driven development strategy has enabled China Merchants Bank to maintain its leading position in the field of fintech, while also laying the foundation for its future digital transformation.

4.2. Quantitative Validation of Industry Comparison

This paper quantitatively validates the performance improvement of China Merchants Bank after the introduction of RPA tools in the bank. This validation process involves not only comparative analyses of the bank's internal financial data, but also a detailed examination of external customer feedback to ensure the objectivity and accuracy of the assessment results.

In terms of internal operations, China Merchants Bank focused on two core indicators: business process processing time and labour cost. Through a timing system that is accurate to the second, the bank kept a detailed record of business process processing time before and after the application of the RPA tool. The data showed that with the help of the RPA tool, the originally cumbersome and time-consuming business processes were greatly simplified, and the processing time was generally shortened by more than 30%. This means that customers are able to enjoy faster service when doing business, and bank employees are freed from repetitive labour to devote themselves to more valuable work.

Reduced labour costs are also one of the significant benefits of RPA tools. By comparing the number of employees and workload before and after the application of the RPA tool, China Merchants Bank found that the number of employees required showed a steady decline, despite the fact that the volume of business continued to grow. This is due to the efficient replacement of simple and repetitive tasks by RPA tools, which enables the bank to easily cope with the growth in business volume without increasing manpower investment. According to statistics, the application of RPA tools has enabled China Merchants Bank to reduce its manpower costs by more than 20%.

In terms of external customer feedback, China Merchants Bank has also achieved satisfactory results. Through regular customer satisfaction surveys, the bank has found that the application of RPA tools has significantly improved customers' overall evaluation of the bank's services. Customers generally reflected that after using the RPA tool, they were not only able to complete their business transactions more quickly, but also enjoyed a more precise and personalized service experience. This positive feedback was further translated into a steady increase in China Merchants Bank's business growth rate.

In terms of financial data, this paper analyses the operational financial data of China Merchants Bank after it started applying RPA tools with its peers in an in-depth comparison from four perspectives: profitability, solvency, operating capacity and growth capacity. Taking Pudong Development Bank and Industrial Bank, which are also joint-stock banks and market leaders, as examples, this paper can clearly reveal China Merchants Bank's unique strengths and leading position in the industry.

1. Profitability: ROE and Net Sales Margin Leadership.

Table 1 and Table 2 show the relevant indicators of CMB and its comparable companies' profitability from 2017 to 2024 (See Table 1 and Table 2).

Table 1. Return on Equity (%)

Return on Equity (%)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	14.61	14.92	15.19	13.45	13.96	14.60	13.62	12.10
SPDB	13.28	12.27	11.58	10.46	8.51	7.79	5.10	6.08
CIB	13.72	13.01	12.17	10.82	12.09	12.25	9.69	8.75

Table 2. Net Profit Margin on Sales (%)

Net Profit Margin on Sales (%)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	31.98	32.52	34.64	33.72	36.48	40.40	43.64	44.32
SPDB	32.62	32.95	31.21	30.04	28.15	27.57	21.58	26.84
CIB	41.25	38.69	36.79	33.32	37.89	41.56	36.83	36.51

The ROE trend from 2017 to 2024 is shown in Fig. 1, and the Net profit margin trend from 2017 to 2024 is shown in Fig. 2. Based on the results, China Merchants Bank's ROE has been stabling in the 12%-15% zone for a long time, reaching 14.60% in 2022, significantly higher than Pudong Development Bank's 7.79% and Societe Generale's 12.25%. Its net sales margin has continued to climb from 31.98% in 2017 to 44.32% in 2024, well above the peer average. This advantage stems from RPA technology's compression of manpower costs (saving over 800 FTEs and reducing manpower costs by 20%) and business process optimisation (reducing processing time by 30%), which has directly contributed to the net profit margin (See Figure1 and Figure 2).

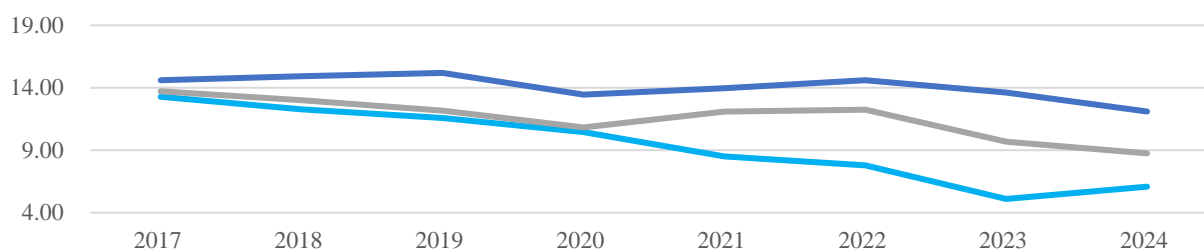


Figure 1. ROE trend from 2017 to 2024.

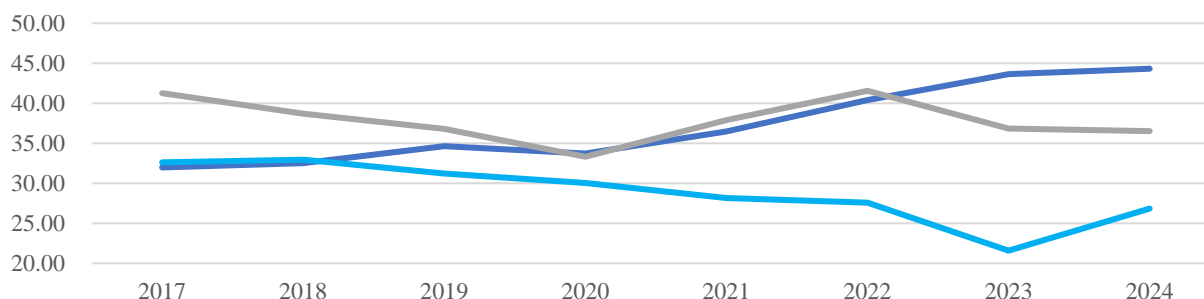


Figure 2. Net profit margin trend from 2017 to 2024.

2. Debt-paying Ability:

Table 3 and Table 4 show the relevant indicators of CMB and its comparable companies' debt-paying ability from 2017 to 2024 (See Table 3 and Table 4).

Table 3. Debt - to - Asset Ratio (%)

Debt-to-Asset Ratio (%)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	92.32	91.94	91.67	91.27	90.64	90.59	90.16	89.85
SPDB	92.98	92.39	91.99	91.88	91.66	91.88	91.86	92.13
CIB	93.41	92.96	92.31	92.09	91.93	91.83	92.05	91.50

Table 4. Equity Ratio

Equity Ratio	2017	2018	2019	2020	2021	2022	2023	2024
CMB	12.11	11.48	11.12	10.54	9.76	9.71	9.24	8.91
SPDB	13.41	12.32	11.64	11.45	11.13	11.46	11.42	11.84
CIB	14.38	13.39	12.18	11.81	11.56	11.40	11.74	10.90

The trend of debt-to-asset ratio from 2017 to 2024 is shown in Fig. 3, and the trend of equity ratio from 2017 to 2024 can be seen in Fig. 4. Based on the results, all three banks' gearing ratios exceed 89%, in line with the high leverage characteristics of the banking industry. China Merchants Bank's gearing ratio gradually decreases from 92.32% in 2017 to 89.85% in 2024, with better risk control than Pu's 92.13% and Societe Generale's 91.50% (See Figure 3 and Figure 4).

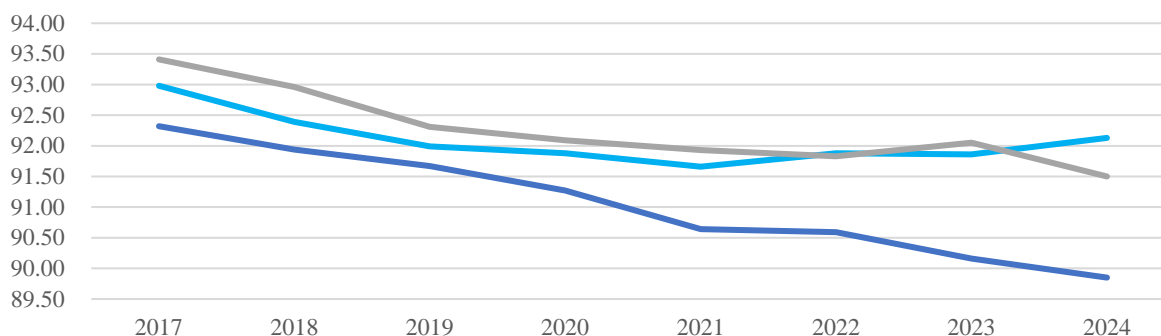


Figure 3. Trend of debt - to - asset ratio from 2017 to 2024.

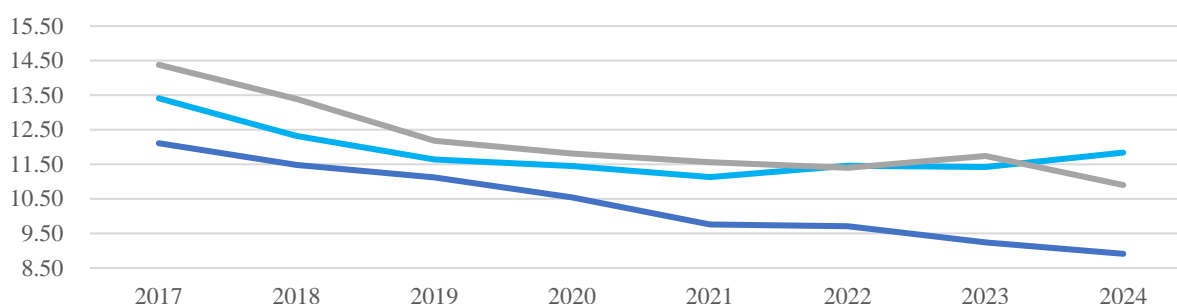


Figure 4. Trend of equity ratio from 2017 to 2024.

3. operating capacity:

Table 5 shows the relevant indicators of CMB and its comparable companies' operating capacity from 2017 to 2024 (See Table 5).

Table 5. Total Asset Turnover Ratio (times)

Total Asset Turnover Ratio (times)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03
SPDB	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
CIB	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02

The trend of total asset turnover ratio from 2017 to 2024 can be seen in Fig. 5. Based on the results, China Merchants Bank's total asset turnover ratio is stable at 0.03-0.04 times, slightly higher than its peers, reflecting the advantage of technology-enabled asset use efficiency. Meanwhile, its gearing ratio decreased from 92.32% in 2017 to 89.85% in 2024, and its equity ratio decreased from 12.11 to 8.91, optimizing the leverage level significantly. In contrast, Pudong Development and Societe Generale's gearing ratios are higher than 90%, with greater exposure to debt structure risks (See Figure 5).

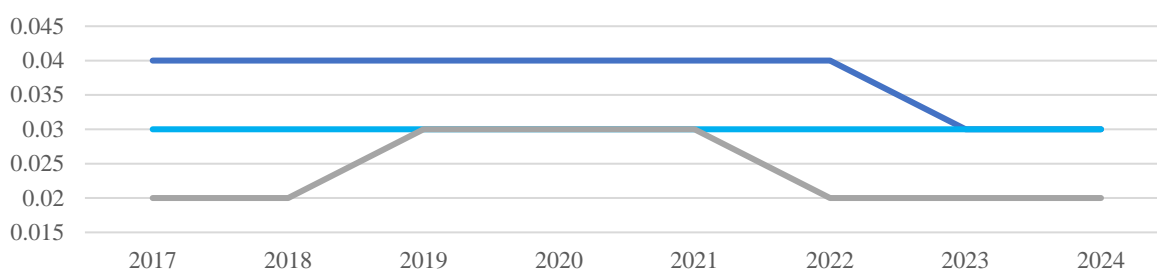


Figure 5. Trend of total asset turnover ratio from 2017 to 2024.

4. Growth capacity:

Table 6 and Table 7 show the relevant indicators of CMB and its comparable companies' growth capacity from 2017 to 2024 (See Table 6 and Table 7).

Table 6. Growth Rate of Operating Profit (%)

Growth Rate of Operating Profit (%)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	15.47	17.75	9.79	4.78	20.69	11.58	6.97	1.33
SPDB	0.90	-7.02	6.92	-4.48	-11.28	-4.95	-27.61	16.46
CIB	2.21	4.78	9.35	3.07	24.37	11.52	-20.74	3.63

Table 7. Operating Revenue (CNY bn)

Operating Revenue (CNY bn)	2017	2018	2019	2020	2021	2022	2023	2024
CMB	2208.97	2485.55	2697.03	2904.82	3312.53	3447.83	3391.23	3374.88
SPDB	1686.19	1715.42	1906.88	1963.84	1909.82	1886.22	1734.34	1707.48
CIB	1399.75	1582.87	1813.08	2031.37	2212.36	2223.74	2108.31	2122.26

The trend of growth rate of operating profit from 2017 to 2024 is shown in Fig. 6, and the trend of operating revenue from 2017 to 2024 can be seen in Fig. 7. Based on the results, China Merchants Bank's operating profit growth rate is less volatile, reaching a peak of 20.69% in 2021 and 1.33% in 2024, while Pudong Development Bank's growth rate plummeted to -27.61% in 2023, and Societe Generale also experienced negative growth of -20.74% in the same year. The difference shows that China Merchants Bank, through technology-driven efficiency improvements, effectively buffer the impact of macroeconomic fluctuations, while the peer profitability of the external environment by the impact of significant. In addition, China Merchants Bank continued to lead the scale of operating income, such as 344.783 billion yuan in 2022, Pudong Development, Industrial revenue for the same period is less than its 55% and 65%, the market share gap further expanded (See Figure 6 and Figure 7).

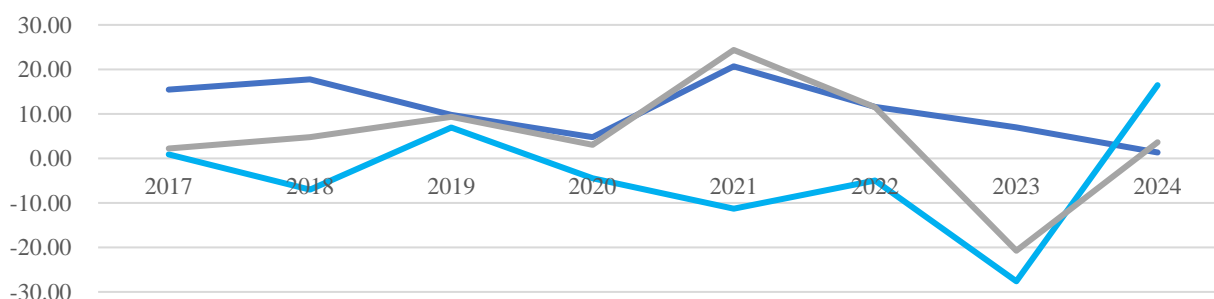


Figure 6. Trend of growth rate of operating profit from 2017 to 2024.

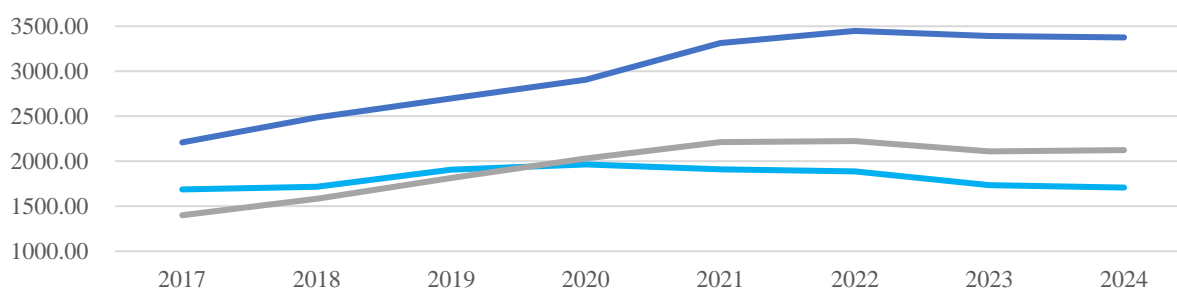


Figure 7. Trend of operating revenue from 2017 to 2024.

5. Discussion

Through in-depth analysis of the application of RPA technology in China Merchants Bank, this study comprehensively reveals the important role of RPA in optimizing the ecology of commercial banks, the mechanism of its role and the key elements of the selection of tools, and draws the following main conclusions.

RPA plays a significant role in optimizing the ecology of China Merchants Bank: the wide application of RPA technology in China Merchants Bank has had an all-around positive impact on its business processes, service quality, innovation capacity and overall ecology. In terms of business processes, RPA has realized the automated reshaping of key business processes such as the annual inspection of public accounts and fund clearing, greatly improving the efficiency and accuracy of business processing. Taking the annual inspection of public accounts as an example, the RPA robot can automatically complete the collection, comparison and declaration of account information, with the automated annual inspection rate reaching 87%, increasing the processing efficiency by several times and effectively solving the problems of duplicated labor and inefficiency that existed in the traditional annual inspection process. In the fund clearing business, the application of RPA has greatly improved the efficiency of fund clearing, shortening the time of fund arrival from an average of hours to less than a few hours, realizing real-time clearing of funds, and greatly enhancing the customer experience [10].

RPA optimizes the multiple mechanisms of the banking ecosystem: in terms of operational efficiency, RPA is able to simulate human operations and automatically perform repetitive and regular tasks in accordance with preset rules, thus significantly increasing the speed of business processing, reducing the number of manual operations, and realizing the rapid flow of business processes. In terms of cost control, the application of RPA effectively reduces labor costs and operating costs. By automating tasks, it reduces the reliance on a large number of manual labor, and at the same time reduces the cost of rework caused by human error. In terms of risk control, RPA strictly follows the preset rules to avoid the risks of human negligence and irregular operation, and it can monitor the risk indicators in the business process in real time and issue timely warnings. In terms of customer experience, RPA realizes rapid response and accurate provision of services, providing customers with more convenient and efficient financial services and enhancing customer stickiness. In terms of business innovation, the integration of RPA with big data, artificial intelligence and other technologies provides strong support for financial product innovation and business model innovation, promoting the development of a series of innovative and competitive financial products and services by China Merchants Bank, and enhancing market competitiveness.

Unique Advantages of Conch RPA Platform. China Merchants Bank's self-developed Conch RPA platform shows excellent performance and distinctive advantages in meeting the bank's complex business needs. In terms of technical architecture, it adopts an advanced distributed architecture with high stability and scalability. It can easily cope with massive business data and highly concurrent business requests. Regarding ease of use, it adopts a low-code/zero-code development model, which significantly reduces the use threshold and enables business personnel to quickly get started and participate in developing RPA scenarios. In terms of functionality, rich automation components are

provided, covering data collection, processing, file operation, process control, and other aspects, which can meet the diverse business needs of China Merchants Bank. In terms of integration capabilities, it realizes in-depth integration with advanced technologies such as AI, OCR, NLP, etc., further expanding the application boundaries and value [11]. Compared with other mainstream RPA tools, the Conch RPA platform has obvious advantages in terms of localized services, compatibility with the existing systems of China Merchants Bank, and cost-effectiveness, which can better fit the business characteristics and needs of China Merchants Bank and provide strong support for the digital transformation of China Merchants Bank. RPA project implementation strategy and safeguards are crucial: China Merchants Bank has formulated scientific and rigorous implementation steps and techniques during the RPA project implementation process, including the planning phase, pilot phase, and promotion phase. In the planning phase, a special team was set up to comprehensively sort out business processes, identify application scenarios and conduct detailed requirements analysis; in the pilot phase, the feasibility and effectiveness of the solution was verified through piloting in some branches or business departments, and optimized and adjusted promptly; in the rollout phase, a detailed rollout plan was formulated, comprehensive training and technical support were provided, and effective communication and project management mechanisms were established to ensure that the RPA technology was implemented throughout the bank. During the promotion phase, CMB formulates a detailed promotion plan, provides comprehensive training and technical support, and establishes an effective communication mechanism and project management mechanism to ensure the smooth promotion and application of RPA technology throughout the bank.

Meanwhile, China Merchants Bank has built a perfect organizational structure and talent protection system, and set up the RPA Center of Excellence (CoE), which is responsible for strategic planning, technology research and development, project management, knowledge sharing, and training in the application of RPA technology. Regarding talent assurance, a team of high-quality RPA professionals has been created through a combination of internal training and external introduction, providing solid organizational and talent support for the implementation and continuous optimization of RPA projects. In addition, China Merchants Bank has fully identified and effectively responded to technical risks, data security risks, and personnel and organizational risks during the implementation of RPA, and established a perfect monitoring system, emergency response plan, authority management system, data encryption mechanism, as well as staff training and communication mechanisms to ensure the sound promotion of the RPA project and the security and stability of the bank's operations.

6. Conclusion

Looking ahead, with the rapid development of FinTech, the application of RPA in commercial banking will have a broader prospect, and related research will be expanded and deepened into multiple dimensions.

In terms of research on integrating RPA and artificial intelligence, although RPA has achieved significant results in many business scenarios for commercial banks, there is still a huge potential for deep integration with artificial intelligence. Future research can focus on further improving the intelligence of RPA robots to more accurately understand complex business logic and unstructured data. By introducing deep learning algorithms, RPA robots can automatically learn and optimize business processes, and dynamically adjust their operation strategies according to different business scenarios and customer needs, to achieve more efficient and intelligent business processing. Research how to deeply integrate natural language processing technology with RPA, so that the robot can directly understand customers' natural language commands and complete complex financial business operations, such as intelligent financial planning, loan application approval, etc., to enhance customer experience and service efficiency.

Exploring and expanding new application scenarios is also an important direction for future research. With the continuous innovation of the financial market and the increasing diversification of

customer needs, commercial banks need to continuously explore the application potential of RPA in emerging business areas. In the field of green finance, it is essential to study how to use RPA to automate the assessment, monitoring and management of green credit projects, so as to help banks better support the development of environmental protection industry; in the field of supply chain finance, it is essential to explore the application of RPA in the integration of capital flow, information flow and logistics of upstream and downstream enterprises in the supply chain, so as to realize the automation of the whole process of supply chain finance business, and to improve the efficiency and security of supply chain finance; in the field of cross-border In the field of cross-border finance, research on how RPA can cope with complex international financial regulations and business processes, realize automated processing of cross-border payment, foreign exchange transactions and other businesses, and reduce the operational risks and costs of cross-border financial business.

Research on the sustainability and risk management of RPA application should not be neglected. As the application of RPA in commercial banks continues to deepen, how to ensure its long-term stable operation and realize sustainable development has become a key issue. Future research can focus on performance optimization, reliability improvement, cost-benefit analysis, and other aspects of RPA systems, establish a scientific RPA application evaluation system, regularly evaluate and provide feedback on the implementation effect of RPA projects, timely adjust and optimize the application strategy, and ensure that RPA technology can continue to create value for commercial banks. Meanwhile, as the scope of RPA application expands, the difficulty of risk management also increases. Future research needs to explore further how to strengthen risk management in the process of RPA application and improve the risk identification, assessment, and control mechanism. Research on how to use big data analysis, artificial intelligence, and other technical means to monitor the operational status and potential risks of the RPA system in real time, establish risk early warning models, detect and resolve risks in advance, and safeguard the sound operation of banks.

Research on the strategic position and synergistic development of RPA technology in the digital transformation of commercial banks is also an important research direction in the future. Commercial banks should examine the application of RPA technology from a strategic perspective, study how to organically combine RPA with the bank's overall digitalization strategy, business development strategy and risk management strategy, and realize the synergistic development of RPA technology and other financial technologies (e.g., blockchain, cloud computing, etc.), to form a synergistic force that can jointly promote the digital transformation and innovative development of commercial banks. Research how to promote the optimization and restructuring of the bank's internal organizational structure and business processes through the application of RPA technology, enhance the bank's operational efficiency and market competitiveness, and achieve the bank's sustainable development.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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