

# The Development of Commercial Banks under the Internet of Things

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## ABSTRACT

The Internet of Things (IoT) is a new paradigm that combines aspects and technologies from different approaches to form a system where the real and digital worlds meet and continuously interact in symbiosis. Using IoT in commercial banks can visualize and integrate financial information flow, capital flow, and logistics, effectively solving traditional financial problems and having a significant impact on the development of banks. This article will analyze the following aspects: First, the reconstruction effect of the Internet of Things on the credit and cost of commercial banks. Second, how the use of IoT allows regulators to establish better information sharing with commercial banks. Third, how the Internet of Things overcomes the problem that commercial banks serve the core service objects of small and medium-sized enterprises. Finally, this study also presents the challenges faced by commercial banks using IoT. The results show that IoT could provide robustness and resilience to the credit system, cost structure, and regulation of commercial banks, and create a leap in value for the commercial company while unlocking new demand of small and medium-sized enterprises.

**Keywords:** *IoT; commercial banks; inclusive finance; SEMs*

## 1. INTRODUCTION

The development of banking business and risk control are inseparable from a good credit environment, and the objective response of society and the accurate credit system are crucial for commercial banks to the pricing and financial risk assessment of products and services. The Internet of Things is an important driver for the development of commercial banks in that it not only improves the social credit system but also expands the boundaries of financial services.

Affected by customer sentiment and market noise, it is difficult for traditional commercial banks to get an accurate picture of the needs of various types of customers. Besides, traditional commercial banks suffer from information dissipation, long decision-making chains, and the difficulty of sharing information resources posed a huge challenge for financial supervision. Moreover, there is a large amount of profit in the market that has not been activated and the needs of long-tail customers have not been met [1], that is, a large financial blue ocean could be opened up. Therefore, how commercial banks use the Internet of Things to solve these problems is extremely critical.

At present, the adoption of IoT in commercial banks can make the credit system of banks enter a virtuous cycle. IoT also has a profound impact on the internal management model of commercial banks. It drives streamlined changes in their organizational structure, management models, and internal processes, and significantly improves the efficiency of their internal operations and services. Furthermore, the utilization of IoT helps relevant departments to integrate shareable information, which breaks down the isolation of information in the previous social credit system, known as "information silos"[2].

To further analyze the benefits that IoT can bring to commercial banks, the following issues need to be addressed: first, the previous subjective lending of commercial banks needs to be transferred into a lending mechanism that takes into account more objective factors. Second, credit systems are affected by the diversity of credit needs and information asymmetries, which pose potential risks to commercial banks and limit the expansion of their products and services [3]. Third, the buffering, filtering, and blocking effects of information silos can make financial regulation impossible, and the resulting adverse selection and moral hazard problems cannot be solved properly [4]. Finally, long-tail

customers such as small and medium-sized enterprises often find it difficult to borrow from commercial banks. There is no doubt that solving these problems is significant as it eliminates the real source of fraud, brings huge benefits to banks, and opens up a large financial blue ocean while greatly reducing systemic risk.

## 2. RECONFIGURATION OF THE ORIGINAL SYSTEM

### 2.1 Reconfiguration of credit mechanisms

The static historical data collected through the Internet of Things is stored in the cloud computing database, and the visualized valuable information filtered through AI integration will radiate the psychological and behavioral characteristics of individuals and enterprises at multiple levels [5]. The large-scale storage of these two types of data is conducive to analyzing customer sentiment and the interference degree of the external environment and market noise on customers, better judging the limited rational reality of customers, and satisfying diversified credit needs. In addition, it transforms the credit system from subjectivity to objectivity and potentially eliminates the real source of fraud.

Commercial banks, relying on the organic integration of IoT with other FinTech, can access a more panoramic view of the market, detect and anticipate possible risks for customers, and take risks out of the credit system with little or no human intervention, allowing social credit system enters a virtuous circle and works better, giving the credit mechanism a resilience function. A multi-layered application platform can reflect the objective status of the physical world in real-time, ensure information is timely and play a better monitoring role. On the basis that the time lag of 5G is only one percent of that of 4G [6]. IoT technology genuinely combines sensing technology to capture dynamic big data in the market in real-time, allowing commercial banks to swiftly scale and progress their work in data summarization models. Commercial banks will be able to analyze condition estimates and contingencies at the second level, as well as determine and identify solutions to existing and potential problems, thanks to sophisticated computer processing capability. The Internet of Things also allows commercial banks to employ summary models of investor behavioral decisions, transforming data into information that can be used to make quick decisions and properly price behavioral assets, lowering credit risk dramatically.

### 2.2 Reconfiguration of cost mechanisms

Under the traditional credit business, high costs are always the biggest bottleneck in business development, which in turn has an impact on the overall cost of

financing for borrowers. The high cost of credit business is reflected in the following aspects: First, high cost of acquiring customers. In the past, commercial banks mainly used "casting a wide net" to acquire customer resources without scenarios analysis, with a large investment in human resources but little benefit. The second is the high cost of risk identification. Commercial banks mostly use offline methods to collect, sort, and analyze the credit situation of users, which is time-consuming and labor-intensive. Third, high operating costs. Banks have a large area of physical branches, a large number of staff involved in operations, and a large amount number of funds invested in operations management.

Through the real-time information feedback, comprehensive information collection, and intelligent customer management functions of IoT, the costs of commercial banks in information collection, credit rating, and transaction maintenance will be significantly reduced. The fact that the value of the commodity is greater than the cost of supplying it is a necessary but not sufficient condition for a transaction to take place, as there are other costs such as the buyer's perceived difficulties, trust issues, institutional costs, and so on. These "other costs" are referred to as "transaction costs" in microeconomics. For a transaction to take place, the transaction cost has to be small enough, on top of the fact that the buyer's evaluation of the goods is greater than the seller's cost of providing the goods. The application of IoT can recover and salvage this part of the transaction cost and redistribute it to commercial banks and their customers. This process achieves value creation, improves the efficiency of resource utilization, activates, and divides more of the total potential surplus, thus releasing more profits.

Besides, the adoption of IoT enables commercial banks to change their previous internal control mindset to a product service mindset based on customer needs, eliminates various financial risk problems caused by improper operations through the management of seals, invoices, and vouchers, promotes further market opening, and overcomes manual administration problems. IoT also drives the transformation of banking business processes from decentralization to centralization. Commercial banks will re-conceptualize and redesign their existing business processes based on IoT, reorganizing them in a way that is most conducive to customer value creation and significantly improving the efficiency of their business processes. The data collected by the IoT will be formatted through artificial intelligence screening, categorized by financial metrics such as time and attributes, and then the most critical data visualized and passed on to the bank's major departments for analysis and decision making. This decision support technology provides decision support analysis by identifying existing, evolving, and predicted problems and presenting the various scenarios, multiple options needed by system

operators, and the likelihood of success and failure for each option. Dynamic simulation exercises using decision support technology tools and certified software within the financial industry will significantly improve the skills and levels of staff. Finally, the IoT is driving a shift in the way banking services are delivered towards personalized services. Through the utilization of IoT, commercial banks can interact with customers in real-time and fluently, understand their basic needs, and provide differentiated pricing for exclusive financial products based on a comprehensive rating of the customer, significantly enhancing the customer experience.

### 2.3 Reconfiguration of regulatory mechanisms

The ability of IoT to dynamically update data enables financial regulation to develop a large-scale, multi-layered, and real-time systematic manner [7], breaking the original system oriented by regulatory content will make regulation horizontally capable of responding to disruption outbreaks; through the data collected by IoT to make evolutionary predictions, ensuring that the development trajectory of commercial banks is in a visible range, vertically releasing. For information that needs to be disclosed to the regulator, the data collected by the IoT will be loaded into the blockchain [8]. And the regulator and the banks can share information by entering into a suitable contract. This allows the regulator and the commercial banks to jointly analyze the development of the market, the regulator informs the commercial banks of some violations and the banks dispose of the violations according to the law, thus achieving an early warning effect in the industry. There is no doubt that IoT will greatly weaken the information asymmetry problem in the banking industry. Moreover, the information sharing via IoT makes the information symmetry observable and verifiable, and then the corresponding contract signed on the blockchain greatly weakens the problem of different behaviors after the agreement beforehand and can also weaken the relationship-specific investment and hold-up behavior among banks. This makes investment behavior in the right direction towards improving social welfare and thus contributes to the prosperity of the economy as a whole. The regulation enabled by IoT also provides some restraint on the excessive leverage of large corporations through ABS (Asset-Backed Securitization), reducing the potential for systemic risk in the market.

## 3. THE IMPACT OF IOT TECHNOLOGY ON INCLUSIVE FINANCE

IoT helps commercial banks to extend their services to the long-tail segment. Commercial banks can apply "IoT + Big Data + Predictive Algorithm + Automated System" to achieve real-time collection of information on "long-tail customers" and collect information on long-tail customers' enterprises at almost zero marginal cost,

making it possible for commercial banks to provide more comprehensive financial services to long-tail clients.

Compared to Internet finance, which only has information and capital flow, and lacks effective mastery of the real economy, IoT finance unites capital flow, information flow, and physical flow, assisting commercial banks to have three-dimensional supervision of small and micro enterprises and their upstream and downstream supply chains, effectively solving the problem of information asymmetry. Take small and medium-sized enterprises (SMEs) as an example, the problem of difficult and expensive financing faced by SMEs in the past has been a major issue for commercial banks in developing the real economy and inclusive finance. There are two main reasons for the difficulty of financing for SMEs: first, the lack of credit assets available for collateral, SMEs due to the size limit, the total amount of effective collateral is small, at the same time, assets (such as patents, equity, inventory, trademarks, professional production equipment, etc.) are difficult to meet the existing risk control requirements of commercial banks; second, there is a more prominent information asymmetry problem between SMEs and commercial banks, on the one hand, SMEs lack scientific decision-making and incentive and restraint mechanisms, and their management style need to need to be further standardized, which restricts their financing behavior; on the other hand, SMEs' financial systems are generally not sound, which limits commercial banks' scientific credit assessment and leads to commercial banks' hesitation to lend. Through the use of IoT technology, the digital transformation of information flow, logistics, and capital flow of micro and small enterprises can be realized, and commercial banks can grasp the production and operation status of enterprises in real-time. The multi-dimensional IoT data provides commercial banks with new risk mitigation tools, effectively avoiding problems such as the insufficient value of collateral for SME financing, difficulty in quantifying collateral, and information asymmetry while providing commercial banks with the possibility of granting credit to more SMEs.

Three ways in which IoT can facilitate financing for SMEs: Firstly, inventory, which was previously regarded as a movable asset in accounting, can be "immobilized". On the one hand, through IoT, the inventory of semi-finished and finished products has been transformed into "real estate", with the relevant attributes and quantities of inventory being captured by thin-film sensor devices on the low cost, radio frequency identification, and other technologies, and the integrated real-time data being placed into a cloud computing database for commercial banks to assess the current value of the inventory, thus enabling SMEs to obtain more credit from commercial banks. commercial banks to obtain more credit lines; secondly, the logistics link of micro and small enterprises can be monitored by commercial banks through the Internet of Things promptly. For commercial banks,

logistics is an important means of understanding the information and technical status of SMEs. The company can reduce the information asymmetry between SMEs and commercial banks by establishing a logistics network in the logistics chain of the enterprise, technological transformation, and effective access to commercial information.

#### 4. LIMITATIONS AND SOLUTIONS

First and foremost, the cost of installing and popularizing a new IoT system is high. The development of IoT banking is predicated on IoT retrofitting of markets, but the cost of installing the agile sensors required for an entire IoT is a significant cost and the input-output ratio is still low especially for SMEs and agribusinesses. In addition, if the transformation is outsourced, there is a risk of "relationship-specific investment", which is resulting in "hold-up problems" (Outsourcers can either take advantage of the loopholes left by an incomplete contract to reduce earmarked investments, or they can take advantage of the "bundling effect" during contract renegotiation by threatening to terminate the renegotiated contract and requesting commercial banks to increase contract benefits.), by either large enterprises or commercial banks before the IoT transformation is carried out. The application of IoT can only be better implemented after the completion of the industrial chain, which is formed by hundreds or even thousands of SEMs, with a platform dedicated to them, not for finance but the development of enterprise automation and logistics automation, and still, there is no reason for commercial banks to help the industrial chain pay for automation. Nevertheless, these problems will be solved to some extent if the government promotes the process of FinTech under the background of 5G to help enterprises to strengthen each other in intelligence, to sign complete contracts using FinTech, and to guarantee the spread of IoT.

Furthermore, there are three systemic risks in the IoT. Firstly, the risk of the IoT perception layer, where risks are not collected comprehensively enough as well as not tracked promptly due to the failure or malfunction of terminal equipment and the inefficient operation of various information sources. However, the risk of the perception layer is not high because the maintenance cost of a single node sensor is relatively low and there is no risk contagion. The problem of sensor failure can be effectively addressed by increasing sensor density. But for commercial banks, the occurrence of transmitting wrong data due to sensor destruction is more worthy of attention and solution. Furthermore, the network transmission layer risk, due to the lack of complete technology and standards, which may bring operational risks, such as leakage of information, malicious interference with the network transmission process, etc. Therefore, a better IoT system and the standards to judge

the fairness of IoT in the banking field need to be established. Lastly, the application layer risk, the application layer risk comes from the superposition of other layers of risk, the specific operational risks faced are mainly intellectual property protection risk, the cooperation risk of each participant, data mining efficiency risk, IoT management risk, etc. So commercial banks need to have solutions for all levels of application risk: patents for data users need to be filed, proxy risk needs to be avoided with appropriate contracts, the CPU that handles the data mined by the nodes needs to be more sophisticated, and there needs to be an alternative solution to a more serious CPU failure problem.

#### 5. CONCLUSION

The implementation of IoT will be able to reconstruct the systems and provide a new way to solve the problems of commercial banks. In this paper, the IoT stores and processes information to analyze customer sentiment to get a more comprehensive view of credit needs and to broaden the scope and efficiency of services. Because of the subjective nature of IoT and the combination with the sharing nature of blockchain, a more stable regulatory system is obtained. Using the real-time and low-cost characteristics of the IoT for data collection and taking into account the monitoring of the physical flow, the results of commercial banks to explore the blue ocean of financial inclusion are obtained. Improvements that need attention are given to the IoT system itself, and the problems that commercial banks will encounter when using IoT are addressed. It should be noted that this article is an analysis from a financial analysis perspective, but most of the technical aspects of the IoT system itself are not considered. How to build a faultless, ultra-low latency and energy-efficient IoT system (e.g., single-node data reliability, robustness and resilience of IoT systems, soft vs. hard failures, etc.) is becoming an essential and challenging issue for commercial banks to apply IoT.

#### REFERENCES

- [1] Elberse, A. Should You Invest in the Long Tail? 2008. <http://www.geminis.ufscar.br/wp-content/uploads/2009/05/shouldyouinvestinthelongtail.pdf>
- [2] Côté, M. A matter of trust and respect | CAmagazine.com. Retrieved May 2012. <https://web.archive.org/web/20120601005717/http://www.camagazine.com/archives/print-edition/2002/march/columns/camagazine23400.aspx>
- [3] Andrew Leyshon, Nigel Thrift. Lists come alive: electronic systems of knowledge and the rise of credit-scoring in retail banking, *Economy and*

Society, 28:3, 434-466, 1999.

DOI: 10.1080/03085149900000013

- [4] J. A. Vayghan, S. M. Garfinkle, C. Walenta, D. C. Healy, and Z. Valentin, "The internal information transformation of IBM," in *IBM Systems Journal*, vol. 46, no. 4, pp. 669-683, 2007.  
DOI: 10.1147/sj.464.0669.
- [5] Belanche, D., Casaló, L.V., and Flavián, C.(2019)"Artificial Intelligence in FinTech: understanding Robo-advisors adoption among customers", *Industrial Management & Data Systems*, Vol. 119 No. 7, pp. 1411-1430.  
<https://doi.org/10.1108/IMDS-08-2018-0368>
- [6] M. Shafi et al., "5G: A Tutorial Overview of Standards, Trials, Challenges, Deployment, and Practice," in *IEEE Journal on Selected Areas in Communications*, vol. 35, no. 6, pp. 1201-1221, June 2017.  
DOI: 10.1109/JSAC.2017.2692307.
- [7] Y. Sun, H. Song, A. J. Jara and R. Bie, "Internet of Things and Big Data Analytics for Smart and Connected Communities," in *IEEE Access*, vol. 4, pp. 766-773, 2016.  
DOI: 10.1109/ACCESS.2016.2529723.
- [8] O. Novo, "Blockchain Meets IoT: An Architecture for Scalable Access Management in IoT," in *IEEE Internet of Things Journal*, vol. 5, no. 2, pp. 1184-1195, April 2018.  
DOI: 10.1109/JIOT.2018.2812239.