

Big Data Applications in Banking Sector in Vietnam Today

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ABSTRACT: In the context of the Industrial Revolution 4.0, Big Data has become a strategic resource to help improve efficiency and competitiveness for the banking industry. The study uses qualitative methods to systematize theories, evaluate the current application status at Vietnamese commercial banks and propose solutions for improvement. Big Data has been applied in many activities such as credit scoring, fraud detection, service personalization, etc., but still faces challenges in terms of infrastructure, human resources, security and legality. From there, the study proposes comprehensive recommendations for both banks and management agencies to promote more effective application in the future.

KEYWORDS: Big Data, commercial banking, information technology, digital banking, personalizing customer experience

1. INTRODUCTION

The Industrial Revolution 4.0 with the combination of AI, IoT and cloud computing has created a huge amount of data, making Big Data a strategic resource in the digital economy. For commercial banks, Big Data contributes to improving competitiveness, optimizing operations, managing risks and personalizing services. However, the implementation process at Vietnamese commercial banks still faces many challenges such as investment costs, poor infrastructure, lack of specialized human resources and legal barriers.

This study aims to: (1) Systematize the theoretical basis of Big Data in the banking sector; (2) Analyze the current application status at Vietnamese commercial banks, clearly stating the results achieved and limitations; (3) Propose recommendations to promote more effective and sustainable application. The study focuses on commercial banks in Vietnam, using qualitative methods through secondary document analysis.

2. THEORY OF BIG DATA

2.1. Big Data Concept

Big Data is a large, high-velocity, and diverse data set that exceeds the processing capabilities of traditional tools. Big Data not only changes the way data is stored, but also creates opportunities to mine knowledge, predict trends, and support decision making. In the banking industry, effectively utilizing Big Data requires new management thinking and investment in modern analytics; focusing only on storage and ignoring analytics will waste potential. Big Data is classified into three groups: structured, unstructured, and semi-structured, depending on the level of organization of the data.

2.2. Big data characteristics

Doug Laney (2011) identified three main characteristics of Big Data: Volume, Velocity, and Variety. The model was later expanded into 7Vs to better reflect the complexity of data, including: Veracity, Visualization, Variability, and Value. These characteristics help to better understand the challenges and potential of Big Data in effectively managing, analyzing, and exploiting data in the digital environment.

2.3. Benefits of Big Data for Banking

Globally, banks have applied Big Data to many core activities such as: customer segmentation, personalization of experience, credit risk assessment, fraud detection, operational optimization, compliance management, security, feedback analysis and algorithmic trading. These applications help improve operational efficiency and create competitive advantages. Understanding these global trends is an important basis for comparing, evaluating and orienting Big Data development in accordance with the context of the Vietnamese banking industry.

3. CURRENT STATUS OF BIG DATA APPLICATION IN BANKING SECTOR IN VIETNAM

Vietnam's banking industry is at the forefront of digital transformation with support from the Government and the State Bank of Vietnam's policies, such as Decision 810/QĐ-NHNN. By the end of 2022, investment in digital technology reached more than VND 15,000 billion, with a high proportion of banks having deployed digital banking. However, the application of Big Data is uneven: large banks have advantages in infrastructure and human resources, while small banks face many difficulties. Integrating Big Data into core processes and exploiting value from data is still limited, which is a long-term challenge in the digital transformation process.

“Big Data Applications in Banking Sector in Vietnam Today”

In the context of strong digital transformation, Vietnamese commercial banks are actively exploiting Big Data not only to optimize operations but also to enhance competitiveness, improve customer experience and develop innovative financial services. Below are some typical applications and results achieved at pioneering banks:

Techcombank is one of the pioneers in deploying Big Data, focusing on credit analysis, fraud detection and service personalization. The bank has completed the transfer of all data to the cloud platform, applying tools such as Databricks, Apache Spark and machine learning models to analyze real-time data. At the same time, Techcombank deployed the GeoSense tool to locate potential customers and control credit risks.

Outstanding achievements : By 2023, Techcombank served more than 14.4 million customers, with 90% of personal transactions conducted online. In the first quarter of 2023, the bank attracted more than 424,000 new customers, of which 68% came from digital channels. The total number of electronic transactions reached 238.4 million with a value of up to VND 2.1 million billion.

Vietcombank applies Big Data to develop the digital banking platform VCB Digibank, focusing on customer behavior analysis, product personalization and fraud prevention. Technologies such as Data Lakes, MongoDB and Hadoop are used to process multi-source data, including unstructured data.

Outstanding achievements: VCB Digibank reached nearly 13 million regular users, processing more than 6 million transactions/day. The rate of customers operating on digital platforms reached 88%, with the number of transactions and mobile banking customers increasing by 50% over the same period.

TPBank applies Big Data in the LiveBank system - a 24/7 automatic transaction model without a counter,

integrating artificial intelligence. In addition, the virtual assistant T'aio continuously supports customers on multiple channels, helping to optimize customer care services.

Outstanding achievements: By the end of September 2022, TPBank served more than 7 million customers, of which Gen Y and Gen Z accounted for 70%. Card transaction turnover reached more than 27,000 billion VND, the active card rate was twice as high as the market average .

MBBank integrates Big Data into mobile applications and deploys projects such as Customer Insight, Smart Channel and Onboarding. At the same time, the bank applies RPA combined with AI to automate 40 business processes with 23 robots.

Outstanding achievements: By the end of 2023, MBBank application will reach more than 17 million users, with digital transaction growth exceeding 40%. MBBank also builds a super-app ecosystem with more than 200 mini-apps, providing multi-service experiences on the same platform.

Banks and other financial institutions

- Cake by VPBank uses Big Data to serve hard-to-reach groups, reaches 5 million users and is the first digital bank in Vietnam to make a profit (EBITDA).
- TNEX operates entirely on the AWS platform, integrating microservices architecture and real-time data analysis.
- VIB shortens credit card issuance process to 15–30 minutes thanks to e-KYC and AI.
- FE Credit, Home Credit, Mirae Asset exploit Big Data and cloud computing to analyze credit and customer behavior.

The table below summarizes the digitalization scores of some Vietnamese banks based on criteria such as user experience, service delivery, payment channels and sales:

Table 1 Comparison of digitalization levels among typical banks

Bank	Digital Innovation	Mobile users	Customer Experience	Service	Pay	Sell	Total score
Techcombank	5.0	15	10.0	10.0	5.0	5.0	50.0
Vietcombank	2.0	9.6	7.0	1.9	2.8	1.2	24.5
BIDV	1.5	9.4	7.0	1.6	2.6	0.5	22.5
TPBank	1.0	8.6	3.4	1.8	2.2	0.5	17.5
VPBank	1.0	6.2	7.1	1.2	1.4	0.5	17.3

Source: Author's synthesis

The table shows that Techcombank excels across all digital transformation metrics, while Vietcombank stands out in terms of mobile penetration and customer digital activity. TPBank and VPBank show potential in younger customer

segments, thanks to their focus on automated digital banking and youth-friendly products.

Connecting the National Population Database (NDB) with the banking system is playing a fundamental role in improving the quality of input data for Big Data. Many

large banks such as Vietcombank, BIDV, and VietinBank have deployed customer authentication via chip-embedded citizen identification and VNeID application. As of April 2024, 58 banks have applied citizen identification authentication and 14 banks have tested VNeID; CIC has also compared data of more than 48.5 million customers with the NDB.

This integration enables:

- Clean and standardize customer data.
- Increase accuracy in credit analysis, fraud detection.
- Create a data interconnection platform, supporting the development of a digital banking ecosystem based on Big Data.

Limit Big data applications at commercial banks in Vietnam

About technology

The IT infrastructure at many Vietnamese commercial banks is still limited and not strong enough to effectively handle large volumes of data in the context of strong digital transformation. The lack of investment in modern systems has hindered the ability to fully exploit the potential of Big Data. The characteristics of Big Data are its complexity, requiring sophisticated data collection, processing, filtering and integration processes, along with the ability to store intelligently, query quickly and analyze accurately in real time.

However, many banks have yet to widely deploy advanced technologies such as the Hadoop ecosystem, NoSQL databases, or IMDB in-memory databases—tools that enable flexible and distributed processing of big data and unstructured data. Instead, most are still relying on legacy systems that lack scalability and efficiency. In addition, the trend of cloud storage is placing high demands on choosing the right technology, updating processing algorithms, and ensuring data security and privacy—challenges that many banks' IT departments are still struggling to solve.

About the data

Data at Vietnamese commercial banks is still scattered, unstandardized and not fully cleaned due to the lack of synchronous IT systems deployed by many suppliers, making it difficult to process and analyze data. At the same time, Vietnamese consumer behavior often fluctuates according to social media trends and influencers, making forecasting customer demand unstable, easily leading to strategic deviations if Big Data is not exploited properly. In addition, strict security regulations such as GDPR or Decree 117/2018/ND-CP also set high requirements for information protection and determining the time of data use, requiring banks to both ensure legal compliance and optimize analytical efficiency to avoid financial and reputational risks.

Human resources

Currently, deploying and exploiting Big Data requires a team of high-quality personnel with deep expertise in big data analysis, machine learning, and technologies such as IMDS,

virtualization, and cloud computing. However, this human resource is still scarce. According to Navigos Group (2023), nearly 90% of businesses have difficulty recruiting senior positions such as Product Owner or DevOps Engineer. This directly affects the ability to develop and maintain technology strategies, especially for small and medium-sized banks.

About the cost of implementation

When big data is applied, significant cost challenges arise. Large investments pose a financial burden to banks, including:

- **Infrastructure and software costs**
 - **High Initial Investment:** Implementing a Big Data system requires significant investment in infrastructure such as servers, storage systems, and networks. Big Data platforms such as Hadoop and Spark require powerful hardware to process and store large volumes of data. For example, a petabyte Hadoop cluster can cost around \$1 million.
 - **Software and licensing costs:** Most Vietnamese businesses that want to use Big Data must go through foreign service providers, resulting in high licensing costs. In addition, customizing and integrating Big Data software into existing systems also requires significant costs.
- **Personnel costs:** Hiring Big Data experts, such as Hadoop experts, requires high salaries, typically between \$70,000 and \$150,000 per year. If outsourced, the average cost is between \$81 and \$100 per hour. In addition, banks need to invest in training and skill development for existing employees so that they can work with big data technology most effectively.
- **Management and maintenance costs:** Requires regular maintenance to ensure stable operation of Big Data systems, including personnel and hardware costs. Special tools and processes are required, resulting in additional costs for deployment and operation.
- **Security and compliance costs:** Customer data and transactions are highly sensitive, requiring banks to invest in modern security solutions and strict system controls. At the same time, compliance with legal regulations such as Decree 117/2018/ND-CP or GDPR is necessary to minimize risks and protect customer trust.
- **Opportunity cost:** Commercial banks need to consider costs, benefits and strategies. Investing in Big Data can reduce resources for other projects, causing opportunity costs.

4. RECOMMENDATIONS

Firstly, in terms of technology, commercial banks need to prioritize upgrading IT infrastructure, deploying Hadoop ecosystem, NoSQL database and IMDB to process unstructured data, increase query speed and ensure scalability. Using cloud technology such as AWS or

Microsoft Azure helps reduce initial investment costs, integrate multi-source data and enhance security. Apache Spark should be applied to analyze real-time data, supporting quick decision making. Importantly, technology solutions need to be compatible with existing systems to optimize available resources.

Second, in terms of data, banks need to invest in modern management systems to standardize data and clearly classify structured and unstructured data. Artificial intelligence (AI) and machine learning technologies can support automatic data cleaning, reducing manual errors. It is necessary to use international standard software and set up APIs to ensure synchronous connection between systems. Banks need to build a data strategy that should aim for sustainable infrastructure, including backup centers, security, human resource management and operating procedures. Advanced encryption technologies should be applied to protect data during storage and transmission. At the same time, access control and real-time monitoring help reduce the risk of information leakage. Banks should cooperate with technology partners such as IBM or domestic enterprises according to the criteria of security, performance and scalability.

Third, in terms of human resources, banks should invest in in-depth training for employees on Python, R, SQL, Hadoop, Spark and clouds such as AWS and Azure. It is necessary to cooperate with universities, technology centers and develop policies to attract talent with a clear career path. Attracting international human resources and creating an attractive working environment helps overcome the shortage of high-quality human resources. For small banks, it is possible to cooperate with startups or deploy Big Data on cloud platforms to reduce costs and risks. In addition, it is necessary to establish a technology and data department to orient long-term strategies, combined with R&D investment to maintain competitive advantages.

Fourth, in terms of implementation costs, banks should apply cloud technology (AWS, Google Cloud) with flexible payment models, reduce infrastructure investment costs and access super computing technology. In terms of personnel costs, banks should prioritize internal training and strategic outsourcing with reasonable cost partners. To optimize management and maintenance costs, it is necessary to apply automation tools and centralized database management. At the same time, investing in integrated security solutions on the Big Data platform helps save costs, reduce security risks and comply with legal regulations. Banks should start with small-scale pilot projects, carefully analyze costs and benefits to reduce risks and align with long-term strategies. At the same time, it is possible to establish industry alliances to share technology costs, cooperate with fintech to build a modern service supply chain, meet customer needs, reduce data costs and improve the efficiency of Big Data exploitation.

5. CONCLUSION

In the context of increasingly fierce competition and rapid development of technology, the Vietnamese banking industry is promoting the application of Big Data to improve operational efficiency and competitiveness. The above research shows that although some banks such as Techcombank, Vietcombank, TPBank and MB Bank have achieved initial results in credit analysis, fraud detection and customer experience personalization, barriers in investment costs, outdated infrastructure and lack of high-quality human resources still limit implementation efficiency. To fully exploit the potential of big data, banks need to have a long-term strategy that connects technology, data and people; at the same time, strengthen cooperation with technology partners and management agencies to perfect the legal framework, data standards and training policies. Only then will Big Data truly become a strategic driving force for sustainable digital transformation in the banking industry.

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