DIGITAL TRANSFORMATION IN VIETNAMESE COMMERCIAL BANKS CURRENT SITUATION AND FUTURE RESEARCH DIRECTIONS

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ABSTRACT

Research purpose: In the current era of digital technological development, the traditional business model of commercial banks is being replaced by a modern one. Especially after the COVID-19 pandemic, the majority of people's tendency to use digital services has prompted banks to actively engage in the digital transformation process. In Vietnam, despite making progress in applying digital technology to banking operations, digital transformation has confronted numerous challenges. This article aims to explore the strategic challenges that commercial banks have encountered in their digitalization process to enhance operational efficiency and customer satisfaction, achieving sustainable growth in the digital era. By identifying challenges in banking digitalization, this paper also proposes several comprehensive solutions to promote this process, to create a modern, flexible, and sustainable banking system.

Research motivation: In Vietnam, the digitalization of the banking sector is recognized as one of eight priority areas under Prime Minister's Decision No. 749/QD-TTg (2020), which approves the "National Digital Transformation Program to 2025, with an Orientation to 2030." In recent years, the banking industry in Vietnam has undergone the most rapid and significant digital transformation. The article examines problems surrounding banking digitalization, providing strategic solutions to help Vietnamese commercial banks alleviate existing barriers and enhance long-term competitiveness.

Research design, approach, and method: This study applied a narrative review approach to examine the challenges and potential solutions to the digital adoption process in the banking sector. The criteria for selecting documents are determined as follows: (1) publications from 2020 onwards to reflect recent trends in digital banking, fintech, and legal regulations; (2) sources focused on the Vietnamese context or similar emerging markets; (3) research documents on aspects of technology application, digital infrastructure, cybersecurity, human resources, customer satisfaction, and legal frameworks.

Main findings: The study emphasized that digital transformation is crucial for enhancing customer satisfaction, keeping pace with state-of-the-art technologies, and promoting sustainable development goals. Recognizing the urgency of this issue, Vietnamese commercial banks are proactively advancing their digital transformation, reaching the second of three levels in banking digitalization. After evaluating the current situation, the article identified several challenges that Vietnamese banks have encountered during their digitalization process. One of the primary challenges is the lack of a comprehensive regulatory framework governing digital banking activities. Cybersecurity is another factor due to an increase in fraud cases, cyberattacks, and data breaches in the banking infrastructure. In addition, a shortage of well-qualified human resources remains a major challenge in the digitalization process of commercial banks, particularly experts in artificial intelligence, cybersecurity, and digital innovation management.

Practical/Managerial implications: The proposed practical implications include establishing a comprehensive legal framework for digital banking, enhancing technology infrastructure and skilled human capital, and strengthening communicative strategies, as well as raising customer awareness regarding digital services and cybersecurity practices. The paper also provided a clear roadmap to accelerate banking digitalization in Vietnam in favour of sustainable development and long-term economic growth.

Keywords: *digital transformation, Vietnamese commercial banks, banking digitalization, sustainable developments*

1. INTRODUCTION

In the modern era, Gross Domestic Product (GDP) or economic growth is no longer the sole criteria to access a developed economy. Instead, it depends on the capacity to drive automation, invest in intelligent infrastructure, capitalize on transformation, and utilize advanced technologies to become a digital economy. The banking sector is one of the most crucial pillars boosting the Vietnamese digital economy. The Vietnamese government determined that the banking industry as plays a pivotal role in facilitating the shift toward cashless payment and enhancing the efficiency and accessibility of digital transactions.

Over the past five years, Vietnamese commercial banks have undergone a robust wave of digital transition, particularly accelerated by the COVID-19 pandemic, resulting in a significant increase in the demand for contactless payments and online transactions. Most Vietnamese banks have either implemented or are in the process of developing their digital transformation strategies. Banks can better understand customer needs and behaviors due to the effective adoption of information technology, along with innovative management and operational practices. Consequently, this helps banks reduce costs, boost competencies, and enhance transparency in corporate operations. Digital banking allows customers to access financial services easily and securely, thereby enhancing customer satisfaction, reducing operational costs, improving financial efficiency, and promoting the development of online business. The advancement of digital banking necessitates the adoption of cutting-edge technologies, including innovative financial services for clients and strategic applications in mobile and online platforms (Zhu & Jin, 2023).

Despite growing interest and prior studies on the topic, the existing literature indicates that there remain several limitations and unresolved issues regarding the digitalization of the banking sector. While numerous economists have examined the digital transformation in the Vietnamese banking industry, none have yet provided a clear roadmap for this process. Thus, the article seeks to address that void in research by assessing the current situation of the digital transition in Vietnamese commercial banks by answering the following questions:

(1) What is the current situation of the digitalization process in Vietnamese commercial banks?
(2) What are the challenges for the development of digital transformation by Vietnamese commercial banks?
(3) What are solutions, and how can a conversion roadmap to digital banking, with an emphasis on retail banking, be designed for Vietnamese commercial banks?

This paper is structured into five main sections. The first introduces the study and explains the rationale for selecting the topic. The second reviews the relevant literature. The third outlines the research methodology, followed by a presentation and discussion of the findings. The final section concludes the paper by summarizing the key results.

2. LITERATURE REVIEW

2.1. Digital transformation

Digital transformation, a new concept that emerged in the Internet era and the fourth industrial revolution (Industry 4.0), has been widely discussed in recent studies. The definition of *"digital transformation"* remains diverse and multifaceted. Vial (2019) conceptualizes digital transformation as the integration of information, computing, and communication technologies to induce profound changes in organizational attributes and enhance overall performance. By contrast, Fitzgerald et al. (2014) emphasize a more application-oriented perspective, framing digital transformation as the adoption of digital technologies, such as embedded systems, mobile applications, and social media platforms, to enhance organizational capabilities, particularly in areas like customer experience and the development of new business models. Thus, digital transformation can be interpreted as the integration of data and advanced technologies to innovate aspects of socio-economic life, reshaping the way people connect with each other. In addition, digital transformation is the process of creating changes by applying digital technologies to operations and services to meet the increasingly demanding needs of customers. Financial and non-financial institutions are currently undergoing three levels of digital transformation (OECD, Digital Transformation Project), including:

Digitisation - also known as computerization - is the transition from paper, physical, and internal business processes to a digital environment (e.g., job automation, paperwork reduction, etc) with the result of reducing operational costs.

Digital application or digitalization is the usage of digital technologies, data, and interconnections to simplify business processes and organizational work.

Digital transformation refers to the economic and social impact of the digitalization process and digital applications. Thus, it represents the most advanced and comprehensive stage of digitization, generating the highest level of efficiency and serving as a strategic trajectory for all organizations and enterprises.

2.2. Digital transformation in banking concept

In the context of banking transition, two frequently used concepts are *"digital banking"* and *"digital transformation."* Digital banking refers to the digitization of all banking activities, from products and services that interact directly with customers (front-end) to automation of internal processing systems (back-end). The scope of these activities includes: (i) depositing, withdrawing, and transferring money; (ii) managing checking and savings accounts; (iii) applying for financial products; (iv) managing loans; (v) paying bills; and (vi) other account-related services, etc. Meanwhile, digital change is the integration of technological advances into all banking operations, fundamentally driving a paradigm shift in banking operations and customer value delivery. It also represents a cultural transformation, compelling banks to continuously challenge established norms, embrace experimentation, and develop tolerance for failure. The innovation in digital banking is supported by the adoption of potential digital technologies, such as artificial intelligence, big data, blockchain, cloud computing, and the Internet of Things, for process automation and more intelligent banking services. A flexible approach meeting new market demands while efficiently satisfying customer expectations is the overall intent of digital transformation (Luong Van Hai, Nguyen Thi Hong Lan, 2022). Hence, digital banking can be perceived as an ultimate goal, while digital transformation is a multi-level process on the road to true digital banking.

Banking digital transformation goes beyond simply *"transforming"* traditional banking activities into the digital world. Instead, it marks a strategic redefinition of how banks and financial institutions engage with and serve customers. A successful digital transformation process commences with a deep understanding of customer behaviors, preferences, choices, needs, and aspirations in the digital world. This transformation subsequently drives major shifts in how banks organize their business operations and deliver products and services, moving from a product-centric orientation toward a customer-centric one.

Digital transformation requires banks to transform rapidly and decisively to digital services in the online environment to effectively engage with customers at the front end, along with changes in back-end processes to support front-end shifts and improve operational effectiveness by digitalizing and automating. Within the banking sector, there are three primary approaches to digital transformation. The first involves the digitalization of front-end channel developments, including:

(1) Digitalizing of front-end channel development;
(2) Focusing on digital transformation in internal processes (back-end)
(3) Combining the first and the second approach, along with the development of standalone, digital-only banks

Given the analytic framework of the banking digitalization process in Vietnam, a case study of some Vietnamese commercial banks indicates that banks must transform to provide embedded banking utility driven by behavior, location, sensors, machine learning, and artificial intelligence (AI). This transformation is essential for smart cities to thrive and develop.

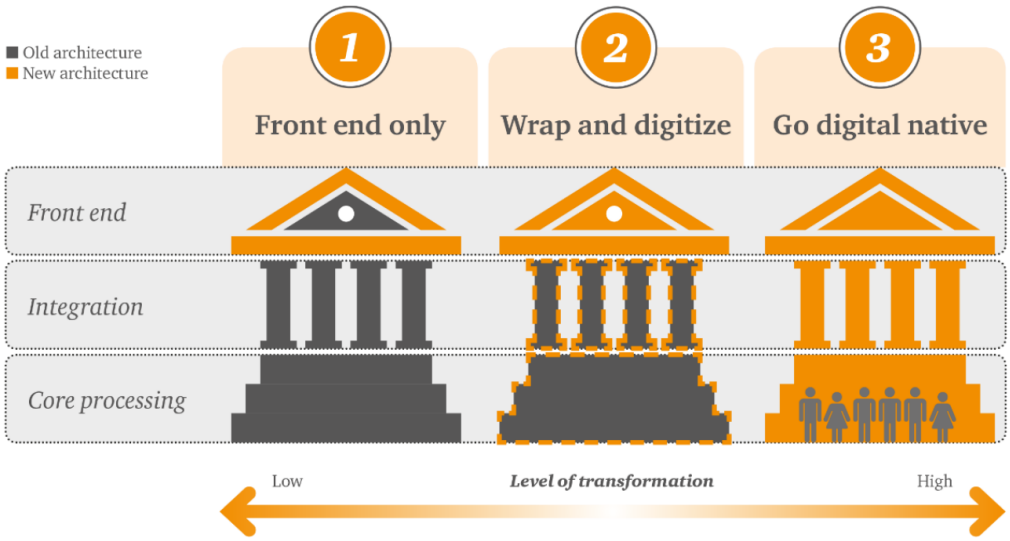


Fig. 1. Banks are responding in three different ways

Source: Bank to the future: Finding the right path to digital transformation

(1) Digitize front-end only

The front-end-only approach is often regarded as the quickest and most accessible means of initiating digital transformation, particularly for banks that seek immediate outcomes. This strategy focuses solely on enhancing the way in which customers interact with the institution, typically through website platforms, mobile applications, or chatbots, without making any significant changes to internal workflows or core IT infrastructure.

This approach is characterized by a limited scope transformation, confined only to the UI/UX interface. Along with the limited scope of transformation, the organization still depends on legacy systems without modernizing its core technological system. In such cases, the organization receives web and app design, digital forms, and low-level chatbots intended to improve the visual appeal and usability of digital platforms. While these changes can, for a short while, enhance user experience by making interfaces and interactions more intuitive and visually appealing, they do not resolve deeper structural inefficiencies.

Improving the front end could lower customer attrition, but the benefits may not be sustained if the back-end system fails to meet customer expectations. In fact, costs could increase if banks have to hire more employees to operate the new digital front end or assign an additional IT team to design and build solutions to fulfill customers' requests. In the long run, digitizing the front end without making additional investments could cost more than sticking with the status quo. Still, it is a starting point for banks facing budget or organizational constraints that make a more extensive transformation difficult.

(2) Wrap and Digitize

Another part of the digital transformation is called wrap and digitize. It is an intermediate strategy that goes beyond modifying the surface elements. It involves upgrading the internal systems and back-end infrastructure, without changing the front-end system. This approach also emphasizes the automated management of middle and back-office functions. Employees who previously engaged in monotonous tasks can now be redeployed to more innovative and strategic positions. Although this strategy can be slow due to its iterative, step-by-step approach, it is well-suited to banks that prefer gradual change. It enables commercial banks to try new technology and rapidly showcase the advantages, and tends to be less expensive and more politically favorable than an *all-in* strategy.

One of the prevailing challenges that banks encounter in this approach is its laborious and time-intensive implementation. Because this process primarily focuses on upgrading one component at a time, it takes a while before

the bank's entire system is modernized. However, this gradual approach has several potential advantages. It is an ideal option for banks that cannot commit to a massive, immediate overhaul. They can test a single IT upgrade, quickly demonstrate its benefits, and manage costs more effectively. These also render the project more persuasive to convince the Board of Directors in banks, as they help sidestep the political conflicts that often come with a full-scale transformation.

(3) Go digital native

With this strategy, financial institutions create fully digital banks that use customer-facing and back-end systems with a completely digital interface. The adoption of this approach improves organizational responsiveness while yielding financial savings, which offer competitive advantages. However, the primary purpose of going digital native is agility. This approach enables banks to adapt to customers' needs more effectively. It also allows testing and repeating of processes. The integration of external and internal systems to provide additional services can be achieved with relative ease owing to the digital core and open architecture. Additionally, it is feasible to establish a fully functional, digitally native bank by leveraging third-party cloud computing.

Over the past five decades, banking practices have undergone a profound transformation in favour of technological advancements. We no longer have branch-only access to banking services. We can move to multi-channel and omni-channel access at higher levels of digitalization. In the first stage, banks are integrating new technologies to enhance the traditional banking model. At the final stage, banks operate as fully digital omni-channel institutions, with all customer engagement taking place through digital platforms. Having these three levels allows us to construct the roadmap for Vietnamese banks to adapt to the smart city model. Similar to other services, banking is increasingly being integrated into smart economies that demand instantaneous service delivery.

International studies highlighted that digital transformation provided significant competitive advantages for banks by optimizing efficiency, lowering costs, and introducing new sources of revenue. Xie and Wang (2023) developed an index system to measure the digital transformation of banks across three dimensions, including strategy transformation, business transformation, and management transformation. The results showed that digitalization had a positive influence on operational performance and accelerated the integration of both online and offline channels. As well, in Indonesia, Arsjah and Sugihyanto (2023) evaluated the bank's performance after digital transformation, collected data using questionnaires, and analyzed the data using PLS SmartPLS software. The findings reveal that the Indonesian banking industry has typically improved efficiency after the implementation of digital banking.

In Vietnam, digital transformation has gained momentum as governments promote national digitalization strategies. Dang Thi Hong Nhung (2022) used a qualitative method and interviewed experts in the banking industry to assess the early stages of the digital banking ecosystem in Vietnam. The results indicated that, under the impact of the COVID-19 pandemic, the demand for digital banking services has increased sharply, posing new requirements for banks in maintaining and developing digital systems. As Nguyen and Le (2021) explained, Vietnamese commercial banks have placed a greater emphasis on investing in digital platforms, such as mobile banking and e-wallets. Nevertheless, problems related to cybersecurity, customer trust, and legal framework remained pressing.

Although existing literature provides valuable insights that digital transformation plays a vital role in enhancing banking efficiency and competitiveness, several gaps still exist. While international research emphasizes both the technological and organizational dimensions of digital transformation, Vietnamese studies mainly concentrate on technology adoption, leaving managerial and policy perspectives underexplored.

These studies also underestimate specific challenges that Vietnamese commercial banks have encountered in implementing their digital strategies, particularly in relation to regulatory frameworks, human resource willingness, and customer acceptance. Moreover, prior studies have not yet established a clear roadmap tailored to the Vietnamese banks, where digital maturity, regulatory environments, and customer behaviours differ significantly from those in more developed economies. The unavailability of a structured roadmap has made it challenging for managers and policymakers to deliver theoretical insights into practical strategies. In this article, the author provides a systematic analysis of the issues

and challenges impeding digital transformation in Vietnamese commercial banks and proposes a processual and context-specific roadmap that identifies key stages to contribute to scholarly conversations surrounding, and to add to practical policy options

3. RESEARCH METHODS

This study adopts a narrative review approach, synthesizing findings from existing research on digital banking services alongside an examination of their recent implementation in the Vietnamese context. A systematic review of the relevant literature was conducted to construct a comprehensive overview of the current state of digital banking and its business practices in Vietnam over the past few years.

In addition, the study applies an analytical strategy that incorporates independent researchers' observations to enhance objectivity and strengthen the interpretation of findings. To ensure rigor, the review process followed key criteria, including:

(1) Relevance of studies to digital banking development in Vietnam
(2) Reliability of sources, with preference given to peer-reviewed articles, government reports, and industry white papers
(3) Recency of publications, with a focus on studies from the last five years.

4. RESULTS AND DISCUSSION

4.1. The current state of digital transformation in the global banking sector

As for the banking sector, digital transformation has been intensively underway. From the original traditional banking model, commercial banks in the world have gone through steps towards digital banking (digitizing procedures customers experience), open banking and beyond (banking as a service), and decentralised finance (applying Blockchain technology). Currently, the world has been witnessing the emergence of *Metaverse Banking*, also referred to as the *"digital space in banking"*, representing the next generation of the Internet that integrates the physical and digital realms.

According to Juniper Research (2021), 53% of the global population will have access to digital banking services by 2026, rising from 2.5 billion users in 2021 to over 4.2 billion. Juniper Research (2021) analyzed the world's top 30 banks to determine the digital transformation readiness index. The index was measured based on several factors, such as digital features, digital investment, and innovation in digital technologies, as well as agility of scale, profitability, and brand strength. The research identified 5 commercial banks with the highest digital transformation readiness index: Bank of America, HSBC, JPMorgan Chase, BBVA Bank, and DBS Bank. (Fig 2)

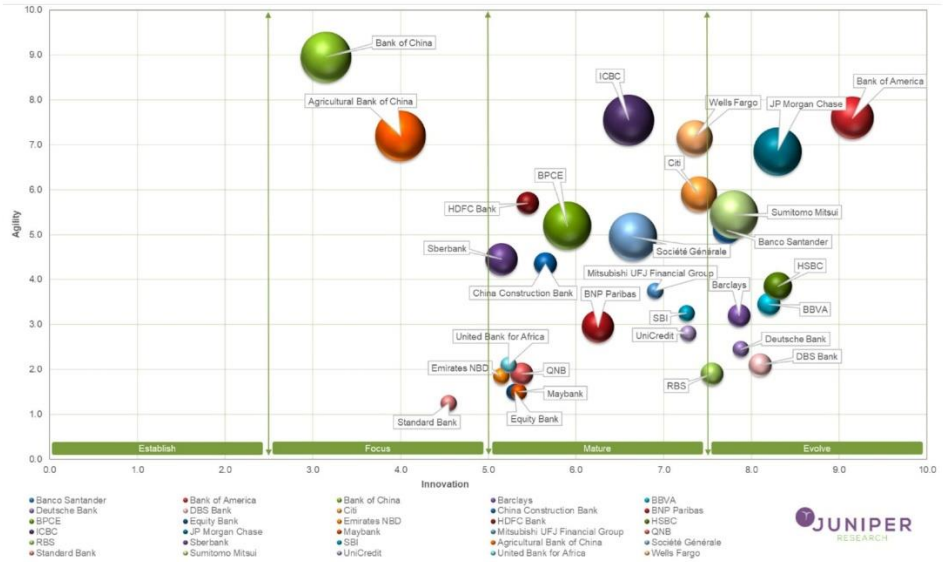


Fig 2: Readiness for digital transformation of banks in many countries around the world, Juniper Research (2021)

(Source: Juniper Research (2021))

When compared to the global landscape, Vietnamese commercial banks have also made significant progress in advancing their digitalization. Table 1 illustrates the range of digital applications adopted by leading banks in Vietnam, including BIDV, Vietinbank, Vietcombank, Agribank, TPBank, and VIB. These applications encompass automated services, customer identity verification through e-KYC, mobile banking platforms with diverse digital features, redesigned user-friendly websites, chatbots/virtual assistants, APIs, and big data technologies. Such developments highlight both the alignment of Vietnam's banking sector with international trends and the unique local innovations being implemented.

No.	Applications	BIDV	VTB	VCB	Agri	TPBank	VIB
1	Automated services	✓	✓	✓	✓	✓	✓
2	Customer identity verification via e-KYC	✓	✓	✓	✓	✓ Live Bank	✓
3	Mobile banking applications are integrated into operational business	✓ Smart banking	✓ Ipay Mobile	✓ VCB Digital	✓ E-Mobile Banking	✓	✓
4	Portal website with a user-friendly and convenient interface	✓		✓		✓	✓
5	Chatbot / Virtual Assistant	✓	✓	✓		✓ T' Alio	
6	Application Programming Interface (API)	✓ BIDV Pay Gate	✓ iConnect Platform				
7	Big Data	✓	✓	✓	✓	✓	✓

Table 1: Application of digital technologies in the banking industry by the end of 2022

(Source: SBV, BIDV's Training and Research Institute)

In the United States, the banking market is renowned for its dynamism, serving as a financial hub across the globe. The rapid growth of digital banking has brought significant breakthroughs in service delivery and customer satisfaction. Today, American banks are leveraging artificial intelligence to develop intelligent virtual assistants, thereby enhancing customer experience and driving the advancement of digital banking. A notable highlight in this digital transformation process is that as many as 16 million users are now using the Zelle money transfer application, and the virtual assistant Erica engaged with customers for 2.2 million hours in 2021. These achievements reaffirm the United States' commitment to providing comprehensive, convenient, and secure financial experiences for customers through advanced digital solutions.

China is well-known not only for its dynamic economy but also for being a leader in electronic payments. E-wallets have become an indispensable part of day-to-day transactions, from retail purchases, taxi payments, to charitable donations, etc. The secret behind this success lies in the powerful combination of vast e-wallet ecosystems, notably Alibaba and WeChat Pay, along with Chinese consumers' preference for domestic products. Chinese commercial banks are undergoing an intensive phase of digital transformation, driven by the rapid development of technology, changing customer behaviors, and supportive policies of the Government. The Digitalization process is occurring concurrently across numerous banks on a large scale, exerting a significant influence on the entire industry. This context has given the digital transformation process in China several distinctive features compared with other countries. The Bank of China (BoC) is one of the world's largest financial institutions in terms of international operations, and it is actively accelerating digital transformation to enhance its global competitiveness. A key initiative of BoC has been the development of mobile payment and e-commerce platforms to serve international clients, alongside the application of artificial intelligence to detect fraudulent activities such as scams and money laundering. In addition, BoC has introduced digital financial

solutions tailored for multinational enterprises. The bank serves as a testament to the successful transformation in the current banking sector, supported by an advanced model, effective strategies, and substantial investment in financial, technological, and human resources. Continuing its path of innovation, BoC is striving to maintain its pioneering position and to establish itself as one of the world's leading digital banks.

In Thailand, Krung Thai Bank transitioned from a traditional banking model to a digital banking model over three years, from 2015 to 2017. The transformation involved the development of multiple systems, including an integrated multi-channel management system, card management system, internet banking system, mobile banking system, and transaction system at branches. Similarly, Siam Bank Thailand introduced a service that allows customers to create pre-ordered orders via the mobile channel; upon arrival at the branch, tellers can simply scan a QR code to process the transaction without re-entering the information. In addition, the bank has emphasized the concept of "seamless transactions" to enhance the customer experience.

4.2. The current situation of banking digital transformation in Vietnam

4.2.1. Achieved results

Firstly, Vietnamese commercial banks are proactively advancing their digital transformation, reaching the second of three levels in banking digitalization

As mentioned above, there are three key levels of digitalization for banks, including digitize front-end only, wrap and digitize, and go digital native. Vietnamese commercial banks have invested heavily in new technologies and core banking to support their digital transformation, with the T24 system of Temenos being the most widely adopted (accounting for 18%), followed by the Flexcube system of Oracle (15%), and Silverlake (5%). Several systematic upgrades are prioritized to ensure operational stability, strengthen data security, minimize systemic risks, and meet the ever-increasing needs in the upcoming years, with 47% of surveyed institutions having implemented relatively new core banking systems. According to the survey findings, as shown in Figure 2, 95% of credit institutions have been developing or planning to build a digital transformation strategy, of which 39% of credit institutions have approved the digital transformation strategy or integrated it into the business or information technology development strategy; 42% of credit institutions are building digital transformation strategies.

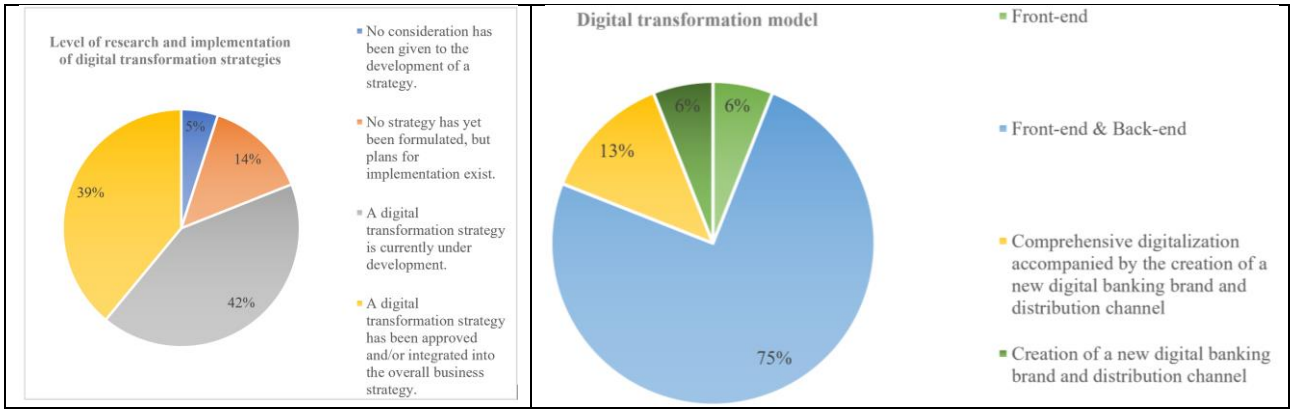


Fig. 3: Level and model of digital transformation and

(Source: Payment Department - SBV)

In the digital transformation strategy, 88% of credit institutions have chosen comprehensive end-to-end digitization, covering both customer communication (front-end) and internal business processing (back-end). To implement this strategy, the majority of credit institutions have opted for establishing innovation centers (digital hubs) and internal testing environments (sandboxes). These are the most prioritized tools for current and future development, with 20.6% of institutions already implementing internal sandboxes and 12.7% establishing digital hubs.

Second, non-cash payments have experienced substantial growth

Payment method	Number of transactions (Item)	Transaction value (billion VND)
Bank card (*)	188.137.673	350,740
Czech	17,115	12,586
Payment order, payment authorization	5,036,964,044	79,354,427
Collection, collection authorization	5,939,008	374,893
Other means of payment (**)	2,164,866	483,870

Table 2: Domestic payment transactions data by non-cash payment methods (by quarter 1, 2025)

(Source: Payment Department – SBV)

According to the latest data from the State Bank of Vietnam (SBV), by the end of the first quarter of 2025, cashless payment transactions had increased by 44.43% in volume. In particular, payments via the Internet channel increased by 40.41%, the mobile phone channel rose by 39.82%, and QR code payments witnessed a remarkable surge of 81.64%. Mobile Money accounts of three telecommunications operators, including VNPT, Viettel, and Mobifone, also increased sharply, reaching 10.4 million accounts, of which more than 72% were used for payments in rural, mountainous, deep-lying, remote, border, and island areas. These figures show that digital transformation is reshaping customers' transaction preferences and improving the pivotal role of digital payment in people's daily lives. Although the COVID-19 pandemic has negatively affected the economy, it is undeniable that this is one of the reasons that motivated people to increase the use of digital banking services. So far, even after the lockdowns were lifted, customers have maintained this payment habit.

4.2.2. Challenges in banking digital transformation

Firstly, the absence of a coherent legal framework from regulatory authorities may hinder the digitalization process of credit institutions.

The government has issued several significant legal instruments to promote innovation and the development of digital infrastructure in the banking industry. Decision No. 749 / QD-TTg dated June 30, 2020 of the Prime Minister approving the National Digital Transformation Program to 2025, with a vision to 2030 sets out objectives for the development of digital government, digital economy, the digital society, with a particular emphasis on building an integrated digital infrastructure, enhancing the efficiency of governance, and delivering banking services on digital platforms. Resolution No. 57-NQ/TW dated December 22, 2024, of the Political Bureau identifies the role of science, technology, innovation, and digital transformation as key drivers of socio-economic development. The legal instruments not only establish a favorable framework but also cultivate digital transformation and innovation in Vietnam's banking sector. However, preferential policies related to taxation, green credit, and financial support for innovative projects in the banking sector are still inadequate. In addition, the regulation framework for bank innovation has been poorly developed and piecemeal, posing significant challenges to the advancement of innovation for banks.

Second, the high costs of technology investment and the inadequacies in infrastructure for digital banking development remain significant challenges.

The substantial cost of technology investment stems from banks' requirements to continuously upgrade, maintain, and innovate their systems to meet the ever-increasing needs of customers while consolidating their competitiveness. Although new payment methods such as QR codes and biometrics have been developed, they have not yet been

systematically assessed or planned for large-scale deployment. Moreover, the standardization and synchronization of technological infrastructure between the banking industry and other industries still confront numerous difficulties. The digital ecosystem requires interconnection and seamless integration between banks and fields (tax, customs, healthcare, education, etc.); however, this process currently remains challenging due to the lack of uniform infrastructure. This situation hinders the provision of comprehensive and seamless digital financial services to customers. Moreover, financial institutions, such as banks, payment intermediaries, and e-wallet providers, all develop their own payment systems at an acceptance point, resulting in inefficiencies due to the lack of shared infrastructure. The costs related to the adoption of emerging trends like the recent transition toward the Metaverse also pose a considerable challenge for many banks.

Thirdly, risks associated with information technology and digital transformation are on the rise, particularly in relation to cybersecurity, legal frameworks, data governance, and confidentiality.

Increasing security risk affects customer trust, and it is determined to be one of the main factors hindering the development of electronic channels in Vietnam. Furthermore, the current trend of Open Banking, in which banks cooperate with Fintech, also imposes requirements for information security and risk management within the banking system, since Fintech enterprises will be able to access and utilize banks' data sources. Security services like fingerprint authentication or biometrics have not been activated as they are in digital banks worldwide, despite being displayed on the mobile application.

Lastly, the sector faces a deficit of qualified human capital, notably in the areas of information technology, digital transformation, and data analytics.

Vietnamese commercial banks are currently facing a shortage of skilled human resources in digital banking development. At present, many bankers possess strong expertise in finance but lack technological knowledge, and conversely, those with IT skills often have a limited understanding of banking operations. This situation poses a challenge for both educational institutions and banks in Vietnam, as they struggle to keep pace with rapid technological advancements. In particular, high-quality professionals in digital banking remain scarce, and banks must engage in intense competition in terms of remuneration and benefits to attract talent in this field. The proposed practical implications comprise establishing a comprehensive legal framework for digital banking, enhancing technology infrastructure and skilled human capital, and strengthening communicative strategies, as well as raising customer awareness regarding digital services and cybersecurity practices. The paper also suggested a clear roadmap to accelerate banking digitalization in Vietnam in support of sustainable development and long-term economic growth.

4.2.3. Some recommendations to improve the effectiveness of digital transformation in commercial banks

First, with regard to the legal framework for digital banking, it remains necessary to continue revising and amending existing regulations in order to facilitate digital transformation. Particular attention should be devoted to creating regulatory mechanisms for pilot Fintech activities in the banking sector and to advancing the use of Open APIs.

Second, the development of technological infrastructure and the digital ecosystem must be prioritized. Vietnamese commercial banks are encouraged to invest consistently in modern, flexible, and secure IT systems that can support the provision of digital products. At the same time, effective integration with other sectors and local authorities (such as taxation, customs, and healthcare) would enable seamless digital banking services. Accelerating the implementation of the Government's Project 06, which applies population data and chip-based ID cards, is also vital for simplifying procedures and ensuring a one-time identification system usable across services. A strong technical foundation, together with a comprehensive digital ecosystem, will provide the launchpad for innovative banking initiatives.

Third, communication and customer awareness should be strengthened. The banking sector, in collaboration with media agencies and social organizations, needs to enhance financial literacy - particularly among populations in remote areas. Guidance on safe and efficient use of digital services, coupled with training in online risk prevention, would reduce fraud and related violations.

Finally, the development of high-quality digital human resources is indispensable. Banks should place emphasis on advanced training in digital technologies for managers and experts so that they can promptly adapt to new technological trends and steer digital strategies. Parallel efforts should be made to equip employees at all levels with digital knowledge and skills through internal programs, formal degree courses, and specialized training in areas such as Fintech and artificial intelligence (AI). Stronger cooperation with universities, research institutes, and technology companies will ensure that training programs meet practical needs. Ultimately, a workforce that is proficient in both banking operations and digital technologies will be decisive for successful transformation.

4.3. Roadmap for transitioning into digital banking with an emphasis on retail services

Given the current state of commercial banks in Vietnam, each institution operates with its own scale, range of activities, customer base, and market focus. As a result, creating a single, universally applicable model for all banks is not feasible. Each commercial bank bears the responsibility of selecting a digital banking model that aligns with its specific business strategy. Importantly, such a model must comply with Decision No. 810/QD-NHNN issued by the Governor of the State Bank of Vietnam. The proposed roadmap for developing digital banking is divided into three phases (Figure 6)



Fig. 4: Roadmap for digital banking development

Source: Author' proposal

Vietnamese commercial banks should formulate a clear and comprehensive strategy for their digital banking model, prioritising objectives such as streamlining business processes and procedures, improving the legal framework, promoting innovation, enhancing the customer experience and satisfaction, ensuring legal compliance, and delivering secure and diversified services. These measures should address the increasing needs of customers and support the sustainable and secure growth of the overall economy.

Moreover, the effective rollout of retail services built on digital banking models, along with the broader digital transformation of the banking sector, requires close cooperation among relevant sectors and entities. It also calls for government oversight in disseminating, revising, and supplementing legal documents. Such actions are especially important to eliminate barriers and address challenges that may emerge during the implementation and practical enforcement of Vietnamese commercial law.

4.4. Future research directions

Based on previous studies and practical developments in the digital transformation process of the banking sector in recent years, this paper proposes the following research directions related to digital banking technology in Vietnam:

(1) Investigating the impact of digital banking technology on investment flows, trade, and consumer activities in the economy.

The application of digital technology in the banking sector has driven the development of modern and user-friendly payment products and services, such as card payments, mobile payments, and internet-based payments. At the same time, digital banking technology in Vietnam will create favorable conditions for Vietnamese enterprises in particular and the

national economy in general to capitalize on investment opportunities, attract foreign capital, access international markets, adopt new technologies, gain competitive advantages, and keep pace with technological trends to develop products and services for market expansion. In addition, strong investment in research and development of technology, as well as leveraging the advantages of data, has the potential to outperform traditional organizational structures. This will also foster the integration of modern banking models and traditional banking through the provision of customer management and service delivery in a hybrid approach. Furthermore, the impact of digital banking applications will inevitably lead to changes in the legal and regulatory framework governing the industry, as well as in the operations of commercial banks. Consequently, the rapid pace of technological change necessitates research on the temporal evolution of technological factors. The results obtained can serve as a reference for regulators in formulating policies and development strategies for the banking sector. They also provide the basis for managerial decision-making grounded in evidence from technological transformations.

(2) Research on customer behavior based on big data and commercial banks' data centers.

The platform for data will fundamentally transform the character of all banking and financial services. Commercial banks, in a model for data, will make full use of customer data in order to optimize service delivery and determine legal compliance. This will improve governance and management efficiency, enable technology deployment in operations management for improved administrative cost reduction and traditional investment costs, and facilitate the development of innovative products and services aligned with Industry 4.0 trends. These developments will expand the customer base, stimulate macroeconomic growth, and advance mutual development. Therefore, new research can be conducted referencing drivers of customer conduct through the application of artificial intelligence technology against banking activities, e-banking, or banking security.

(3) Research on the impact of digital banking technology on the operations of enterprises and Vietnamese banks in terms of changes in methods, business models, and production processes.

Banks are increasingly applying artificial intelligence in combination with data science to transform traditional business models into more agile and flexible models, such as digital banking, platform banking, platform economy, banking-as-a-service, and incumbent banking. These new technologies will create significant breakthroughs in delivering modern banking services that meet the diverse needs of customers. On this basis, digital banking technology will influence the operations of enterprises in Vietnam. Moreover, during the digital transformation process, the banking sector is also affected in terms of the need to adapt its intellectual workforce to meet evolving demands. As digital banking becomes inevitable, the competition between banks that have strategic development plans and those that do not will intensify. The banking sector's intellectual workforce will play a crucial role in meeting new operational and management requirements. Therefore, research on the operations and activities of the banking sector under the influence of digital banking technology is also a new direction that requires further exploration. This is particularly relevant to the ongoing digital transformation process within commercial banks.

5. CONCLUSION

Vietnam is a country with a relatively high rate of information technology infrastructure development, but a low level of banking transactions via online systems and digital payment systems. Thus, digital technology solutions to banking operations in Vietnam have been, and continue to be, a matter of concern to regulatory agencies in general and banks in particular. A review of the literature reveals a considerable body of diverse studies on the impact of digital technology on banking activities with various datasets and methodological approaches. Nevertheless, the current studies have some limitations, as the impact of digital technology is ever-changing and scholars' knowledge regarding technological advancement is limited. In particular, Vietnamese banks retain many characteristics of traditional banks, so there is much potential for new research through the process of digital transformation. Following this, the present research proposes directions for research related to digital technology in Vietnamese banks. It makes a practical contribution by providing a detailed examination of the current state of the adoption of digital technology in Vietnam's banking industry. Besides,

the study mentions relevant studies conducted locally and internationally to present theoretical contributions that can assist researchers in making future study directions regarding digital technology in Vietnam's banking sector.

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