MEASURING DIGITAL TRANSFORMATION IN BANKS: LITERATURE AND PRATICAL IMPLICATIONS FOR VIETNAMESE BANKS

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Abstract

This paper investigates how digital transformation in the banking sector can be measured by synthesizing insights from global literature and analyzing the specific context of Vietnamese commercial banks. It identifies widely adopted frameworks and key performance indicators (KPIs) for assessing the progress and effectiveness of digital transformation initiatives. Additionally, the study provides an overview of the status-quo of digital transformation within Vietnamese banks, highlighting notable achievements and persistent challenges influenced by technological capabilities, regulatory frameworks, and strategic direction. Based on these findings, the paper proposes practical recommendations to enhance both the measurement methodologies and the implementation of digital transformation. The results are expected to support Vietnamese banks in developing more structured, data-driven digital strategies to improve operational efficiency, competitiveness, and customer experience in the digital age.

Keywords: *Digital transformation, banking sector, measurement methods, textual analysis, Vietnamese banks.*

Đo lường chuyển đổi số trong ngân hàng: Tổng quan lý thuyết và hàm ý thực tiễn cho các ngân hàng Việt Nam

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Tóm tắt

Bài viết này nghiên cứu cách thức đo lường quá trình chuyển đổi số trong ngành ngân hàng thông qua việc tổng hợp các quan điểm từ các nghiên cứu quốc tế, đồng thời, phân tích bối cảnh thực tiễn tại các ngân hàng thương mại Việt Nam. Nghiên cứu xác định các khung đo lường phổ biến và các chỉ số hiệu quả chính (KPIs) được sử dụng để đánh giá tiến trình và hiệu quả của quá trình chuyển đổi số. Ngoài ra, bài nghiên cứu cũng cung cấp một cái nhìn tổng quan về thực trạng chuyển đổi số tại các ngân hàng Việt Nam, chỉ ra những thành tựu nổi bật cũng như các hạn chế còn tồn tại dưới tác động của năng lực công nghệ, điều kiện pháp lý và định hướng chiến lược. Từ những phân tích này, nghiên cứu đề xuất các khuyến nghị thực tiễn nhằm cải thiện cả phương pháp đo lường và triển khai chuyển đổi số. Kết quả của nghiên cứu được kỳ vọng sẽ hỗ trợ các ngân hàng Việt Nam xây dựng chiến lược chuyển đổi số có cấu trúc rõ ràng hơn và dựa theo dữ liệu, từ đó, nâng cao kết quả hoạt động, tăng cường năng lực cạnh tranh và cải thiện trải nghiệm khách hàng trong thời đại số.

Từ khóa: *Chuyển đổi số, ngành ngân hàng, phương pháp đo lường, phân tích văn bản, các ngân hàng Việt Nam.*

1. Introduction

Digital transformation has reshaped the global banking industry by integrating advanced technologies such as artificial intelligence (AI), blockchain, cloud computing, and big data analytics. These innovations enhance operational efficiency, reduce costs, and improve customer experiences. In Vietnam, digital transformation is a strategic priority, driven by government initiatives like the National Digital Transformation Program 2025. Major

banks have adopted mobile banking, AI-driven services, and digital payment platforms to modernize financial operations and expand financial inclusion.

Despite significant progress, challenges remain. The digital divide between urban and rural areas, cybersecurity risks, and regulatory uncertainties hinder the full-scale adoption of digital transformation. Additionally, while front-end services have been digitized, legacy infrastructure still requires modernization. These factors highlight the need for further research on digital transformation's role in enhancing bank performance.

Measuring digital transformation in banking is essential for assessing its effectiveness and guiding strategic decisions. Various approaches exist, ranging from financial-based metrics, such as the proportion of income from digital channels, to qualitative methods like text analysis of annual reports. Understanding these methods is crucial for evaluating the extent of digital transformation adoption and its impact on bank performance.

This paper provides an overview of digital transformation measurement methods in banking and discusses their practical implications for Vietnamese banks. By analyzing different methodologies, the study aims to offer insights that support financial institutions in optimizing their digital strategies and improving performance in a rapidly evolving financial landscape. This paper is structured as follows: Section 1 introduces digital transformation in banking and its measurement. Section 2 reviews the theoretical background and influencing factors. Section 3 discusses methods for measuring digital transformation, including textual analysis and financial indicators. Section 4 presents the status-quo of digital transformation in Vietnamese banks, applying textual analysis to measure the degree of digital transformation. Finally, Section 5 offers practical implications and concludes with recommendations for future research.

2. Theoretical Background of Digital Transformation in Banking

2.1. Definition of Digital Transformation in Banking

Digital transformation in banking refers to the strategic integration of digital technologies into all aspects of banking operations, with the goal of enhancing service quality, optimizing internal processes, and improving financial performance. According to Pousttchi and Dehnert (2018), this transformation involves shifting from traditional banking to fully digitalized systems that increase scalability and efficiency. Omarini (2018) further emphasizes that digital transformation is not simply digitizing existing processes but rather reconfiguring entire business models to accommodate new technologies such as artificial intelligence, fintech platforms, and real-time data processing.

In developing markets such as those in Vietnam, the process of digital transformation is taking progressing in stages. MIT (2017) identifies three levels of digital maturity: initial digital adoption, hybrid service models, and full digital banking. Currently, most Vietnamese banks are moving toward the second stage, which combines digital solutions such as mobile and internet banking with conventional service channels. This transformation is being accelerated by the rise of fintech, supportive regulatory frameworks, and shifting customer expectations.

2.2. Essential Concepts Pertaining toDigital Transformation in Banking

Digital transformation in banking is underpinned by a range of interrelated concepts that provide the technological, strategic, and operational foundations for its development. Understanding these key concepts is essential to grasp the broader implications and mechanisms through which digital transformation is reshaping the banking industry.

Technological Innovation refers to the application of new technologies and methods to improve efficiency, productivity, and service delivery. In banking, it enables the shift from manual, branch-based services to digital operations using tools like AI, big data, and biometrics (Chesbrough, 2003). Innovation lays the groundwork for faster decision-making and more responsive customer interactions.

Digital Technology includes systems such as cloud computing, mobile applications, blockchain, and data analytics. These tools facilitate real-time services, automation, and personalization, helping banks meet evolving customer expectations while reducing operational costs (Bharadwaj et al., 2013).

Fourth Industrial Revolution (Industry 4.0) marks the convergence of digital technologies such as the Internet of Things (IoT), AI, and robotic process automation (RPA) into everyday business processes. In banking, this revolution has driven advancements like open banking, embedded finance, and predictive credit scoring (Schwab, 2017; Vial, 2019). It pushes banks to rethink their business models and

adopt smarter, data-driven systems.

Digital Banking involves offering banking services entirely through digital platforms, minimizing or eliminating the need for physical branches. It enhances accessibility, reduces costs, and enables 24/7 banking services (Bunea et al., 2016). Notable features include online account management, digital onboarding, mobile payments and virtual financial advisors.

Fintech (Financial Technology) refers to the use of technology to innovate financial services, often through startups or tech-driven platforms. It introduces solutions like digital wallets, peer-to-peer lending, and robo-advisors, encouraging both competition and collaboration in the banking sector (Gomber et al., 2017).

2.3. Factors Influencing Digital Transformation in Commercial Banks

Digital transformation in the banking industry is driven by a wide range of organizational and environmental factors. In the context of emerging economies like Vietnam, these determinants reflect both global trends and country-specific dynamics that influence the strategic direction and digital maturity of banks.

At the firm level, **technological readiness**-including the quality of IT infrastructure, system interoperability, and data management capabilities-plays a central role in enabling digital transformation. Banks with higher levels of internal digitalization are better positioned to adopt advanced technologies and integrate digital tools across operations (Gozman et al., 2018; Li et al., 2021). In Vietnam, where digital maturity remains uneven across institutions, technological preparedness is a key differentiator between leading and lagging banks.

Leadership Commitment and a clearly articulated digital vision are also pivotal. Executive sponsorship ensures prioritization of digital projects, mobilization of financial and human resources, and alignment of transformation efforts with long-term strategic goals (Westerman et al., 2011). Vietnamese commercial banks that have demonstrated strong leadership in digital initiatives-such as TPBank, Techcombank, and MB-have typically outperformed peers in digital adoption and customer engagement.

Human Capital is another critical internal factor. The availability of IT talent, staff adaptability, and organizational learning capabilities significantly influence how banks absorb and deploy digital technologies. In Vietnam, the shortage of highly skilled digital labor, particularly in AI, cybersecurity, and data analytics, presents a constraint for many banks aiming to scale up digital transformation (World Bank, 2023).

Externally, **customer expectations and digital behavior** have evolved rapidly, especially among younger, urban populations. The widespread adoption of smartphones and mobile banking applications has raised customer demand for seamless, fast, and personalized banking services (Zachariadis et al., 2016). Vietnamese consumers are increasingly favoring digital-first interactions, prompting banks to accelerate development of omni-channel platforms and digital self-service solutions.

The rise of **fintech companies** and **non-bank digital platforms** poses both challenges and opportunities for traditional banks. Fintech firms in Vietnam have disrupted segments such as payments, lending, and wealth management, driving competitive pressure and prompting banks to invest in innovation, partnerships, and open banking models (Nguyen & Doan, 2022).

Moreover, **regulatory support** has been a significant enabler. The State Bank of Vietnam (SBV) has introduced various initiatives to promote digital banking, including the issuance of circulars on eKYC, digital payment regulation, and the development of a national digital transformation strategy for the banking sector (SBV, 2021). Government support in building digital infrastructure (e.g., broadband access, mobile penetration) and promoting financial inclusion has also facilitated the sector's digital evolution.

Lastly, **macroeconomic and institutional conditions**, such as Vietnam's high internet penetration rate, rapid urbanization, and supportive digital ecosystem, provide a favorable environment for digital transformation. However, disparities in digital infrastructure between urban and rural areas, and concerns about data privacy and cybersecurity, remain challenges that banks must navigate.

In conclusion, digital transformation in the Vietnamese banking sector is shaped by the interplay of internal capabilities, customer-driven demand, competitive disruption, regulatory frameworks, and broader economic conditions. Recognizing and addressing these factors is essential for banks seeking to enhance operational efficiency, improve customer experience, and maintain competitiveness in an increasingly digital financial landscape.

3. Methods of Measuring Digital Transformation in Banks

3.1. Conceptual and Theoretical Approaches

In recent years, digital transformation in banking has become a popular topic for researchers and practitioners. As banks adopt new technologies to improve customer experience and operational efficiency, measuring their progress has become increasingly important. Some researchers approach the topic from a theoretical standpoint. Verhoef et al. (2021) developed a three-stage model of digital transformation: digitization, digitalization, and full transformation. Their framework outlines the organizational and strategic shifts required in each phase, though it does not provide empirical tools for measurement. Similarly, Gomber et al. (2017) proposed the "Digital Finance Cube," a conceptual model classifying digital transformation by business functions, enabling technologies, and institutional form. While these contributions help structure understanding, they are limited to descriptive categorization and do not offer practical means to quantify digital transformation.

3.2. Textual Analysis Methods

Textual analysis has emerged as a popular data-driven method to measure digital transformation using language in public disclosures. Kriebel and Debener (2019) analyzed annual reports of 60 U.S. banks from 2010 to 2017. They created a custom digital transformation dictionary using keywords from IT investment disclosures and emerging digital banking trends. They applied Latent Dirichlet Allocation (LDA) for topic modeling and word embeddings to capture semantic relationships, ultimately measuring the frequency and sentiment of digital terms. The study linked these textual indicators with IT investment and financial performance to assess transformation progress.

Nguyen-Thi-Huong et al. (2023) adopted a similar strategy for Vietnamese banks. They compiled annual reports from 26 joint stock commercial banks over 2015–2021 and performed keyword frequency analysis to construct a digital transformation score. Unlike Kriebel and Debener, their study did not use advanced NLP techniques but instead focused on the raw count of predefined keywords. They then examined how this score related to return on assets (ROA) and return on equity (ROE), and found mixed results, including negative impacts of digital transformation on financial performance in some cases.

3.3. Survey-Based Approaches

Surveys represent a valuable method for capturing perceptions and readiness regarding digital transformation. Kitsios et al. (2021) conducted a structured survey involving 161 employees from Greek banks, utilizing the Technology Acceptance Model (TAM) as their foundation. The survey measured factors such as perceived usefulness, ease of use, and behavioral intention to adopt e-services. Multivariate regression analysis was then used to identify the key factors influencing employees' acceptance of digital technologies. Although the authors also listed a comprehensive set of digital transformation-related keywords to support their conceptual framework (including *digital transformation, digitalization, digital bank, neobank, mobile banking, internet banking, self-service banking, platform banking, embedded finance, banking as a service, internet, website, ATM, web, fintech, card, computer, online, information system, IT, information technology, bankcard, virus, digital, e-banking, payment service, hardware, cloud, email, mobile device, server, tablet, password, encryption, smartphone, LAN, wireless, 4.0, technological revolution, digital technology, AI, cloud, blockchain, big data, online, digital application,...*), they did not perform any textual analysis on actual documents or language corpora. Therefore, the method remains firmly survey-based.

In a related study, Boufounou et al. (2022) surveyed both employees and customers across multiple Greek banks. Their questionnaire focused on satisfaction, digital literacy, and service accessibility, and results showed significant demographic differences in the willingness to adopt digital banking services.

3.4. Financial and Proxy Indicators

Several studies have used financial data as proxies to assess digital transformation. Trịnh Đoàn Tuấn Linh (2024) created a proxy variable using the ratio of digital banking income to total operating income across 20 Vietnamese commercial banks. He applied Data Envelopment Analysis (DEA) to measure operational efficiency and Tobit regression to examine the effect of digitalization on efficiency scores. In contrast, Nguyễn Văn Thủy (2022) used the ICTIndex, published by Vietnam's Ministry of Information and Communications, as a national-level proxy for IT readiness and digital transformation across banks. This composite index includes infrastructure, human resources, and IT application criteria.

Nan Chao et al. (2024) proposed a Digital Transformation Index developed by Peking University. This index evaluated 54 rural commercial banks in China by scoring them on digital strategy, business process automation, and IT governance. The study used these scores to perform regression analysis and found that banks with higher index values had better profitability due to improved risk management and asset quality.

3.5. Econometric and Advanced Statistical Methods

Advanced econometric techniques are frequently employed to estimate the causal impact of digital transformation. Do et al. (2022) examined 13 Vietnamese commercial banks from 2011 to 2019, using System Generalized Method of Moments (SGMM) and Bayesian analysis. While the exact proxy for digital transformation was not specified, the authors implied IT spending and digital infrastructure investment as core variables. Their results showed positive impacts of digitalization on both performance and risk control.

A foundational study by Brynjolfsson and Hitt (1996) should also be noted. They used a Cobb-Douglas production function and Iterated Seemingly Unrelated Regressions (ISUR) on a dataset of 367 large U.S. firms from 1987 to 1991. The study included variables for IT capital and IS labor, and demonstrated that IT investments contributed positively to output, contradicting the earlier notion of the IT productivity paradox.

4. Digital Transformation in Vietnamese Banks

4.1. Overview of the Current State of Digital Transformation in Vietnamese Banks

Digital transformation has become a strategic imperative across Vietnam's banking sector, driven by technological advancements, increasing competition from fintech firms, and shifting customer expectations. However, the scale, approach, and effectiveness of digital initiatives vary significantly between large commercial banks and smaller banking institutions, largely influenced by differences in size, resources, and strategic orientation.

In Vietnam, the classification of banks as large or small is typically based on financial metrics such as total assets, equity capital, branch network, customer base size, and market share (State Bank of Vietnam [SBV], 2023). According to SBV classifications, large banks-often state-owned or major joint-stock commercial banks-include Vietcombank, VietinBank, BIDV, Techcombank, MB Bank, and VPBank. These institutions commonly hold total assets exceeding 500 trillion VND (approximately 21 billion USD), possess extensive nationwide branch networks, and command dominant market shares. In contrast, smaller banks such as Bac A Bank, Nam A Bank, and SaigonBank typically manage total assets below 100 trillion VND (approximately 4 billion USD), have more limited geographic presence, and face constraints in financial capability.

Since around 2015, large commercial banks have taken the lead in Vietnam's digital transformation efforts. These institutions have adopted ambitious strategies supported by substantial investments in technology infrastructure. Banks such as Techcombank, MB Bank, Vietcombank, and TPBank have modernized their core banking systems, launched advanced mobile and internet banking platforms, and integrated emerging technologies including artificial intelligence (AI), blockchain, and robotic process automation (RPA). Techcombank, for instance, initiated a comprehensive digital transformation strategy in 2016, which led to more than 90% of its transactions being conducted via digital channels by 2022. This shift contributed to a 40% increase in retail revenues from digital channels compared to 2020 (Techcombank Annual Report, 2022). Similarly, MB Bank reported a notable reduction in operating costs through the implementation of RPA, which lowered its cost-to-income ratio (CIR) from approximately 44% in 2018 to 38.6% in 2022 (SBV, 2023).

Despite these achievements, large banks still face several ongoing challenges. Chief among them are cybersecurity threats, increasing regulatory complexity, and intensified competition from agile fintech startups. For example, Vietcombank experienced a series of cyberattacks in 2021 that targeted its digital platforms, highlighting vulnerabilities that persist despite substantial investment in IT security (Nguyen & Hoang, 2023).

On the other hand, smaller banks have approached digital transformation more cautiously, primarily due to limited financial and technological capacity. Institutions like Bac A Bank and SaigonBank began their digital initiatives relatively late, around 2018 to 2020, and have generally implemented only basic tools such as mobile banking apps, online bill payments, and e-KYC (electronic Know Your Customer) procedures. Nam A Bank, in a noteworthy move, introduced its "Robot OPBA" digital kiosks in 2021 to

expand access without needing extensive physical branch expansion. However, customer adoption of these digital services remains modest, particularly in regions with low digital literacy (Vietnam Investment Review, 2023).

These smaller institutions face a host of structural challenges, including outdated core banking systems, underdeveloped digital infrastructure, a shortage of qualified technology professionals, and limited customer readiness to transition away from traditional banking channels. According to the World Bank (2021), smaller banks in Vietnam often struggle to integrate digital systems effectively, resulting in fragmented customer experiences and limited improvements in business outcomes.

Overall, while digital transformation has brought measurable benefits to the Vietnamese banking sector, its effects are not evenly distributed across institutions. Large banks, supported by superior infrastructure and digital maturity, tend to enjoy more immediate and direct benefits such as enhanced customer experiences, expanded revenue streams, and improved operational efficiency. Conversely, the impact on smaller banks is typically less pronounced, with benefits being delayed or realized only under favorable conditions. In such cases, the success of digital transformation is often mediated by contextual factors, including the level of digital literacy among customers, the availability of supporting IT infrastructure, staff readiness, and the extent to which digital tools are integrated into core operations.

Despite these advances, several challenges continue to hinder the realization of full-scale benefits. Banks with limited capital, particularly those operating in rural areas, often face outdated infrastructure, restricted access to skilled personnel, and institutional resistance to change. Additionally, uncertainties in the regulatory environment, cybersecurity risks, and a lack of customer trust in digital channels remain substantial barriers. The high upfront costs of digital investment, coupled with slow or uneven returns, further strain these institutions' ability to sustain long-term digital strategies.

Therefore, the overall effectiveness of digital transformation in Vietnam's banking sector depends not only on technology adoption but also on the bank's strategic alignment, internal readiness, and adaptability. To maximize the benefits and overcome persistent structural and organizational barriers, banks should adopt a phased and context-sensitive approach-one that goes beyond infrastructure upgrades to include investment in human capital, internal restructuring, and initiatives aimed at improving customer digital literacy. Only through such a holistic strategy can digital transformation generate lasting improvements in competitiveness and performance across the sector.

4.2. Measuring Digital Transformation in Vietnamese Banks Using Text Analysis

Text analysis has emerged as a particularly suitable method for assessing the degree of digital transformation in Vietnam's banking sector. This approach involves systematically examining official documents, such as annual reports, strategic plans, and financial disclosures to quantify the emphasis and integration of digital initiatives within banks' strategic narratives. It allows researchers to assess how frequently and in what context digital transformation is communicated, thus serving as a proxy for strategic commitment and operational progress.

This method is particularly pertinent in in the Vietnamese context for several reasons. First, commercial banks are mandated to regularly disclose strategic and financial information, much of which increasingly reference digital-related initiatives in response to government policy shifts and rising competition. These documents provide a rich and consistent textual dataset that can be analyzed over time and across institutions. Second, text analysis is both scalable and objective. It avoids the limitations of traditional surveys or interviews, such as response bias or limited managerial access, and instead derives insights directly from institutional communication. Third, this method enables longitudinal analysis, tracking how digital narratives evolve in response to external factors such as the COVID-19 pandemic or the national digital transformation agenda.

To operationalize this method, a **dictionary-based textual analysis technique** was employed. Specifically, we constructed a list of keywords and phrases that reflect digital transformation efforts in the banking sector. These included terms "digital banking", "core banking system," "e-KYC," "mobile banking," "online transaction," "automation," "AI," "big data," "cloud computing," "chatbot," and "digital customer experience," among others. The selection of keywords was guided by existing literature (e.g., Loughran & McDonald, 2016; Bui & Duong, 2025) and cross-referenced with the actual terminology used in the reports of Vietnamese banks.

Using this keyword dictionary, we applied a **frequency-based word count approach** to compute a **Digital Transformation Score** (also referred to as the Digital Transformation Index) for each bank in each year from 2019 to 2023. The score reflects the number of times digital-related terms appeared in each bank's annual report. To enhance comparability, all documents were pre-processed to remove formatting inconsistencies and standardize text before analysis. Higher scores indicate a greater emphasis on digital transformation in the bank's communication and, by extension, strategic orientation.

Applying this method to the reports of 22 Vietnamese banks over five years reveals several important trends. First, the overall intensity of digital transformation discourse-as measured by the frequency and contextual usage of digital-related terms-has risen steadily. Larger commercial banks tend to have higher Digital Transformation Scores, reflecting a more consistent and integrated digital strategy. For example, BIDV and Techcombank exhibit the highest average scores over five years (292.6 and 253.4 respectively), suggesting a sustained focus on digitalization in both their strategic communication and operational initiatives.

In contrast, smaller or less technologically advanced banks such as Bac A Bank, BV Bank, and VietinBank recorded much lower average scores, typically below 70. These banks tend to reference digital transformation superficially or inconsistently, often without clear articulation of implementation efforts or measurable results. This disparity highlights a structural divide in digital capacity, financial investment, and long-term digital vision across the banking system.

Temporal patterns also reveal that 2022 marked the peak year in terms of digital discourse, likely due to post-pandemic recovery efforts and the acceleration of digital services in response to shifts in customer behavior. Some institutions showed a slight decline in 2023, possibly due to strategic realignment, investment fatigue, or operational bottlenecks in implementation.

In summary, this text analysis approach confirms that Vietnamese banks are increasingly prioritizing digital transformation. However, the depth and consistency of this focus differ significantly among institutions. The Digital Transformation Score provides a robust and reproducible metric for benchmarking banks' strategic engagement with digitalization over time. This reinforces the importance not only of investing in new technologies, but also of embedding digital transformation into the long-term vision, governance, and communication practices of financial institutions.

5. Practical Implications for Vietnamese Banks and Conclusion

5.1. Practical Implications for Vietnamese Banks

The findings suggest several practical actions Vietnamese banks should adopt to maximize the tangible benefits of digital transformation. Initially, banks-particularly smaller and medium-sized institutions-should prioritize digital initiatives that directly enhance operational efficiency and cost control, such as implementing mobile banking, electronic Know Your Customer (e-KYC), and Robotic Process Automation (RPA). Real-world evidence from MB Bank demonstrates that RPA implementation effectively reduced manual processing tasks, significantly lowering the Cost-to-Income Ratio (CIR) from 44.3% in 2018 to 38.6% by 2022 (SBV, 2023). Similarly, Techcombank's advanced mobile platforms have substantially reduced transaction costs while expanding customer access to financial services.

Furthermore, banks should expand digital channels by improving user-friendly interfaces and offering personalized financial services through data analytics and AI-driven recommendations. Banks such as TPBank and Vietcombank have successfully leveraged digital channels, significantly increasing customer acquisition rates and retention, thus directly driving revenue growth from fees, cross-selling products, and interest income.

Investing in robust digital infrastructure, including core banking system upgrades and cloud-based solutions, alongside continuous training for bank employees, remains crucial for sustainable scalability. For instance, Vietcombank's recent core banking modernization allowed for real-time processing and improved responsiveness to customer demands and market changes, illustrating the importance of infrastructure readiness and skilled personnel in managing digital transformation effectively.

Moreover, proactive engagement in customer education and enhancing digital literacy, particularly among older customers or rural populations traditionally hesitant to adopt digital services, is essential. Initiatives such as Nam A Bank's "Robot OPBA" digital kiosks, which simplify digital banking interactions, reflect practical strategies to address digital adoption barriers, enhance customer trust, and expand service coverage

to underserved markets.

Finally, Vietnamese banks must strategically align their digital transformation initiatives with clear financial targets and measurable outcomes, such as specific reductions in CIR, increases in digital transaction volumes, and customer engagement rates. Aligning digital investments closely with concrete financial and operational goals ensures that digital transformation delivers sustainable and measurable improvements in bank performance.

5.2. Conclusion and Directions for Future Research

In conclusion, this study highlights the necessity for robust, context-appropriate methods to measure the degree of digital transformation in the banking sector in Vietnam. As digital transformation emerges as a strategic imperative for banks in Vietnam, the ability to quantify and compare the scope of digital initiatives is essential for both research and practical decision-making.

The application of text analysis, specifically through the Digital Transformation Index based on keyword frequency in annual reports and strategic documents, offers a scalable, objective, and replicable approach. This method is particularly well-suited to the Vietnamese context, where digital content in public disclosures is growing, yet quantitative assessments of digital maturity remain limited.. The findings indicate that this approach effectively differentiates between banks with high and low levels of digital commitment, tracks progress over time and identifies strategic gaps.

Future research could expand upon the digital transformation measurement methods compiled in this study to assess the degree of digital transformation in Vietnamese banks. Additionally, subsequent investigations may focus on exploring the impact of digital transformation on bank performance, both directly and indirectly, to better understand how digital strategies influence various operational outcomes within the banking sector. In particular, researchers can explore the relationship between digital transformation and key financial outcomes, such as profitability, operational efficiency, and customer growth. These future analyses will provide empirical evidence to inform the development of data-driven digital strategies in Vietnam's banking sector.

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