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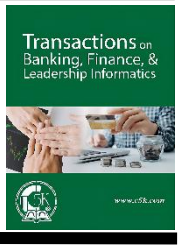

Research Article

Strategic Digital Transformation and Business Analytics for Optimizing U.S. Traditional Banking Operations

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ABSTRACT

There is growing interest among leading academic institutions in the United States to explore the concept of digital transformation. Despite a shared focus, there is still no clear or universally accepted definition. Existing interpretations vary significantly, covering areas such as smart living, the future of work, automation, and industry convergence. These interpretations often lack consistency and are difficult to compare. Meanwhile, major consulting firms, technology companies, and analysts continue to promote their own models and frameworks. This study focuses on understanding the demand for digital transformation within the U.S. banking sector by analyzing how four major North American banks have approached the adoption of digital technologies. Using a combination of qualitative analysis, supported by quantitative techniques and visual data, the research examines five years of annual reports from these banks to identify key themes, including drivers, perceived benefits, institutional readiness, and implementation efforts. From these findings, the study introduces a Digital Transformation Maturity Model that offers valuable guidance for financial institutions and technology providers seeking to navigate and assess their progress in digital adoption.

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1. Introduction

In the modern era, we are witnessing a rapid proliferation and adoption of digital technologies such as social media, mobile platforms, data analytics, cloud computing, the Internet of Things (IoT), artificial intelligence (AI), 3D printing, blockchain, autonomous vehicles, wearable devices, and augmented reality. Several researchers suggest that this wave of innovation is ushering in a new machine age, where hardware, software, and networks form the backbone of economic and social progress (Brynjolfsson & McAfee, 2014). Across the globe, emerging institutions and technology startups are leveraging these digital tools as core resources to build agile business models that not only grow rapidly but also create significant economic value (Initiative, 2017).

Within the United States, this trend has been especially transformative in the financial sector. The continuous emergence of fintech startups and the rising demand for seamless digital experiences are compelling traditional financial institutions to rethink their operational and strategic models. These new competitors are effectively "unbundling" the traditional banking value chain, offering specialized services with speed and efficiency that large banks can no longer afford to ignore (Lee & Low, 2018).

The adoption of digital technology by large financial institutions is often driven by a mix of motivations—ranging from regulatory compliance and stakeholder expectations to operational efficiency, risk preparedness, innovation, and business model advancement. This study presents a qualitative exploration of these dynamics by examining the public disclosures of four major North American banks over a five-year period (FY 2013 to FY 2017). The objective is to understand the nature and drivers of digital transformation within these institutions and to uncover whether true transformational change is taking place through digital adoption.

Through thematic narrative analysis supported by visual analytics, the study categorizes disclosures into logical themes such as key drivers, perceived benefits, organizational readiness, and instances of technology deployment. These themes are further classified into standard and mature practices, helping to illustrate the varying degrees of digital maturity among institutions. The methodology is grounded in existing literature and validated by expert input from seasoned technology practitioners.

The findings underscore the significance of understanding how large U.S. banks interpret and implement digital

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transformation strategies. This analysis not only highlights the essence of transformation from the perspective of major financial institutions in an advanced economy, but also introduces a Digital Transformation Maturity Model (DTMM). This model offers a benchmark for other institutions and provides strategic insights for technology providers seeking to align with the evolving needs of the financial sector.

The remainder of this paper is structured into five sections. Section 2 outlines the theoretical foundation, covering institutional technology adoption, digital business strategy, technology-enabled change, and the digital transformation of banking. Section 3 discusses the research methodology. Section 4 presents key findings, including a visual analytics-based understanding of institutional narratives and a detailed theme-based analysis. Section 5 examines the implications of these findings, particularly in the context of digital maturity classification. Finally, Section 6 concludes the paper with a discussion of future research directions that can expand upon these insights in broader contexts.

2. Background

Technology adoption at the institutional level has been widely explored in information systems literature, with several theoretical models providing foundational understanding. Among the most prominent are Rogers' Diffusion of Innovation (DOI) theory, the Technology-Organization-Environment (TOE) framework, and Iacovou's model for Inter-Organizational Systems (IOS) (Razzaq et al., 2021; Rogers, 2003). Rogers' DOI model emphasizes how leadership characteristics, organizational structure, and external environmental factors influence the adoption of innovation within firms (Mohammadi et al., 2018). This research draws from leadership narratives to assess the role of leadership in driving technological change. The TOE framework identifies three core dimensions—technological, organizational, and environmental—that affect an institution's ability to adopt and implement new technologies. It serves as a robust extension of Rogers' model by offering a more comprehensive view of intra-firm innovation. Iacovou's IOS model introduces the variables of perceived benefits, organizational readiness, and external pressures—elements that align with and build upon TOE dimensions. Institutional theory further enriches this understanding by asserting that decisions to adopt technology are shaped not just by internal efficiency goals but also by social legitimacy, cultural norms, and coercive, mimetic, or normative pressures from the broader institutional ecosystem. These external pressures often come from competitors, regulatory agencies, partners, and customers, particularly in the U.S. financial sector where technology vendors and industry influencers have a significant presence. Our study aligns with and draws upon these models to examine drivers, perceived benefits, institutional readiness, and digital transformation outcomes within large U.S. banks.

Beyond technology adoption, institutions are increasingly focusing on developing digital business strategies—defined as organizational strategies that leverage digital resources to generate differentiated value. Digital technologies are no longer just tools for solving specific problems but are enabling organizations to establish core competencies and competitive advantages. While traditional technology adoption models focus on operational implementation, they often overlook the strategic dimensions of digital integration (Ghobakhloo & Ching, 2019). Emerging viewpoints on digital business strategy emphasize its scope, scale, agility, and the sources of value creation. The scope is shaped by the institution's ecosystem and intent to generate value through digital opportunities. Scale and speed are influenced by how well institutions leverage networks and platforms, while business value is typically measured through performance outcomes that vary based on digital maturity. Another perspective frames digital business strategy as a response to industry-level competition, forming what is known as a digital strategic posture. This refers to an institution's positioning relative to industry peers and complements other strategic orientations such as innovation, market responsiveness, and customer centricity. Our research investigates these postures through narrative evidence from major U.S. banks, providing insights into how these institutions strategically approach digital transformation.

Institutions are at varying stages of digital technology adoption, and their transformation journeys are influenced by their digital maturity levels. One widely cited definition by Westerman frames digital transformation as the use of technology to significantly enhance business performance or reach (Westerman et al., 2011). According to Westerman et al. (2011), this transformation manifests in three primary domains: customer experience, operational processes, and business models. Lankshear and Knobel (2008) suggest that true transformation occurs when digital competencies enable innovation and lead to meaningful changes within professional domains. These definitions emphasize that transformation is not solely about technology implementation, but also about reimagining business models, integrating digital and traditional operations, and adapting to evolving customer and stakeholder expectations. Leadership plays a pivotal role in driving this change by fostering a risk-tolerant culture and prioritizing strategic digital initiatives. IBM's research traces the history of digital transformation from its early impact in the 1990s to a surge in the 2010s with the rise of mobile technology, social media, and data analytics (Omol, 2024). The degree of transformation across industries varies, from limited transformation in primarily physical industries like agriculture and mining, to substantial digital adoption in sectors like financial markets, gaming, and software. Industry environment plays a crucial role in shaping digital strategic posture, influencing whether institutions follow convergent or divergent digital strategies. Our research captures these dynamics within the banking sector, offering a detailed

view of how digital transformation is unfolding in one of the most highly digitized service industries in the U.S.

The banking industry in the United States is particularly reliant on emerging digital technologies, spanning both information and financial systems (Pramanik et al., 2019). In this highly regulated sector, compliance requirements have historically driven system updates and innovations. Recent legislation, however, is pushing banks toward more open architectures, enabling integration with cardless payment systems and third-party service providers. At the same time, advances in technologies such as artificial intelligence, big data analytics, and mobile platforms—combined with the rise of fintech competitors—are accelerating the need for transformation (Awotunde et al., 2021). Fintech startups are rapidly unbundling traditional banking services and capturing profitable market segments without the regulatory burdens faced by full-service banks. These disruptors employ combinatorial strategies that integrate cost efficiency, enhanced user experience, and cross-functional convergence to achieve exponential growth. As a result, traditional banks must now reconsider how they deliver value and innovate to retain market relevance. Digitization is allowing both incumbents and newcomers to offer enhanced solutions through reimagined business models, improved distribution, and agile service delivery (Crittenden et al., 2019).

Patterns of digital transformation in banking reveal a convergence toward customer-centric design, emphasizing simplicity, transparency, self-service, and convenience (Sultana & Faisal, 2024). These characteristics are becoming essential for meeting modern customer expectations. Studies suggest that banks must develop both customer orientation and customer response capabilities to remain competitive. High-quality information systems enhance customer service capabilities, and digital technologies directly contribute to improving customer service performance (Chuang & Lin, 2013). At the same time, the growing emphasis on automation, AI, algorithmic decision-making, and hybrid human-machine interfaces is reducing the centrality of human labor. This shift is redefining the nature of work in financial services, raising important questions about the future workforce and customer engagement strategies. As digital transformation advances, it becomes crucial to examine how human-machine interactions will evolve and what implications this has for organizational structures and customer experiences (Nardo et al., 2020). Interestingly, many banks appear to be pursuing nearly identical digital strategies, leading to minimal differentiation despite widespread transformation efforts. The literature identifies four key dimensions of digital transformation initiatives: the use of digital technologies, the transformation of value creation processes, changes in organizational structure, and financial impact (Thomas, 2020). While these efforts may yield short-term competitive advantages, sustaining long-term benefits remains a challenge. Financial innovations are often quickly replicated, diminishing their uniqueness. This points to a need for continued research on how financial institutions can manage transformation challenges, design resilient business models, and navigate the risks of disintermediation. Key questions emerge around the limits of digitization, return on investment, and the balance between serving tech-savvy and traditional customers. Our study addresses these issues through narrative analysis of four major U.S. banks, offering insights into how these institutions are responding to digital pressures.

The methodology applied in this research involves qualitative narrative analysis of annual reports from four large North American banks over a five-year period. These narratives provide rich insights into institutional priorities in a highly digitized market environment. The findings, discussed in subsequent sections, highlight recurring themes in digital transformation and reveal varying levels of digital maturity. This research lays the groundwork for broader studies across additional financial institutions and geographic regions, offering a comparative view of digital transformation across the global financial services landscape.

3. Methodology

3.1 Identification of Sample and Data Source

This research investigates the key tenets of digital technology-driven transformation as demonstrated by large financial institutions in North America. Four prominent banks, each with assets exceeding one trillion U.S. dollars, were selected for the study. Although unnamed for confidentiality, these institutions are referred to as Bank 1 through Bank 4. Each of these banks holds global relevance and demonstrates a substantial commitment to adopting and leveraging digital technologies. The primary data for the study was obtained from publicly available annual reports and statements disclosed on the investor relations sections of the respective bank websites. These annual disclosures serve as credible and structured documentation of institutional strategies, performance metrics, technological initiatives, and leadership priorities. The data set includes twenty annual reports spanning five years, from fiscal year 2013 through 2017, which corresponds to calendar years 2012 to 2018. This longitudinal scope allows for a consistent and evolving view of digital transformation trends, aligned with the global rise of digital technologies and the emergence of financial technology startups during the same period.

3.2 Data Collection and Keyword Strategy

Relevant data was collected through a keyword-based content extraction approach, designed to isolate and identify disclosures relating to digital transformation, technological adoption, institutional strategies, and business model changes. Using the “find” function within PDF files, iterative searches were conducted across the twenty annual reports. Initial searches began with a basic keyword set, which expanded over time

based on context, narrative patterns, and expert validation. The final set of keywords was reviewed and endorsed by experienced digital technology researchers to ensure completeness and contextual relevance. The extracted narratives were compiled into a centralized document for further analysis, with approximately 37,984 words identified as contextually significant. These words, found in text, tables, visuals, and dedicated sections, provided a detailed representation of each institution's strategic communication around digital technologies.

3.3 Data Analysis Methodology

The research employs a blended methodological approach, integrating visual analytics with qualitative theme-based narrative analysis. Visual analytics was conducted through the generation of individual word clouds for each bank using the MS Office Pro Word Cloud tool. Word clouds are a recognized method for highlighting term frequency and visualizing dominant themes in textual data. Each word is represented in varying size and orientation, indicating its relative frequency and significance. These visual outputs offered a preliminary indication of each bank's key areas of focus regarding digital transformation. Following visual analytics, qualitative narrative analysis was applied to decode and contextualize the extracted narratives. Thematic coding techniques were used to structure the findings and insights, supported by visual elements, graphs, and illustrative content found within the original annual reports. These supplementary components are critical in corporate disclosures, offering a fuller understanding of each institution's communication strategy.

3.4 Narrative Coding Framework and Research Questions

Narrative coding was conducted by organizing content into five broad thematic categories, each with relevant subthemes. These categories were derived from a combination of literature review, expert insights, preliminary narrative analysis, and validated keyword patterns. High-frequency terms from the word clouds also played a role in confirming thematic relevance. The themes are structured around five guiding research questions: the external drivers influencing digital transformation in U.S. banks, the observed benefits of adopting digital technologies, institutional perceptions and attitudes toward digital transformation, the banks' readiness and intentions regarding technology deployment, and real-world instances of digital technology usage. Each theme was populated with contextually rich narratives that exemplify institutional focus and actions. These were categorized not only by theme but also by year, allowing for a longitudinal assessment of patterns and continuity in strategic emphasis.

3.5 Ensuring Rigor, Validity, and Reliability

The methodological rigor of this study is enhanced by the selection of a single industry—banking—within a defined geographical region, ensuring consistency in business environment and regulatory context. The U.S. banking and financial services sector provides an ample and appropriate sample for institutional study, especially due to the availability of publicly listed firms with comprehensive disclosure practices (Jizi et al., 2014). The use of annual report narratives as data sources is both timely and methodologically sound, particularly in light of evolving disclosure standards such as the International Integrated Reporting framework. Previous studies have explored the link between environmental pressures and corporate disclosures, often highlighting tendencies toward self-serving bias (Barrow, 2013). While such biases are acknowledged, annual reports remain reliable sources due to strict regulatory compliance and standardized reporting expectations.

To address potential subjectivity in narrative analysis, this study implemented a structured and validated coding process. Three independent researchers analyzed the same data set and reported minimal discrepancies, thereby ensuring reliability through triangulation. Predefined categories and clear coding guidelines aligned with the research questions were employed to maintain consistency and internal validity. Past studies have shown that a well-designed coding framework can reduce the need for multiple coders while maintaining analytical rigor. The application of both qualitative and visual analytics allowed for comparison and validation of findings across methods, strengthening the robustness of the research. This triangulation of techniques—narrative extraction, visual analytics, and thematic coding—delivers a comprehensive and reliable exploration of digital transformation in the U.S. banking sector.

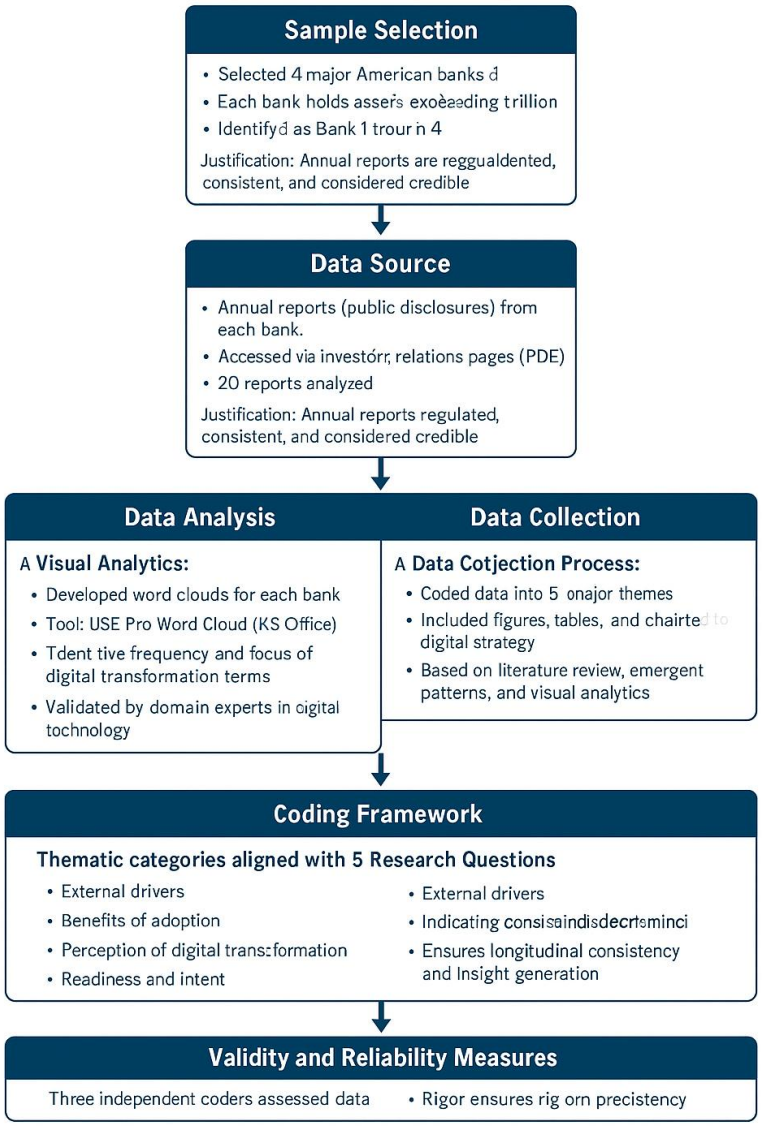

Fig. 1. Research methodology

4. Results and Discussions

4.1 Bank 1: Customer-Centric Innovation and Strategic Deployment

Bank 1's digital transformation strategy strongly emphasizes customer convenience and seamless banking experiences. Mobile banking was extensively promoted, enabling clients to manage investments, transfer money, deposit checks, and access loans through their mobile devices. The bank's use of biometric authentication and real-time alerts emphasized user empowerment and financial awareness.

The bank demonstrated a forward-looking attitude by investing in digital identity, blockchain, and artificial intelligence. Partnerships with startups further reinforced its future-oriented approach. It promoted video banking to humanize digital interactions and used mobile-enabled platforms like ATM with Teller Assist. Environmentally, the bank used digital platforms to reduce emissions and promote financial inclusion in low-income communities.

Narratives show the bank achieving massive transaction volumes, including billions in mobile payments, and leveraging award-winning apps. This illustrates scale and maturity. Digital transformation is framed as a journey tied to broader sustainability and innovation goals, both domestically and internationally.

4.2 Bank 2: Digital Leadership, Risk Management, and Ecosystem Integration

Bank 2 positioned digital transformation as a strategic driver across its operations. It adopted a "mobile-first" strategy and developed an app integrating banking, wealth management, and personalized financial services.

The app supported multiple biometric logins and seamless global transfers. The bank viewed customer expectations as a major catalyst for innovation and cited fintech disruption as both a threat and opportunity.

To address risk and competition, Bank 2 emphasized cybersecurity, compliance, and proactive adaptation. It initiated innovation programs, established agile development teams, and collaborated with technology startups through accelerators and open innovation competitions. The bank promoted its digital leadership through recognitions such as "Best Overall Global Digital Bank" and used digital platforms for social impact, such as text receipts and financial inclusion initiatives in Asia.

Notably, Bank 2 executed global rollouts of smart branches and services in Australia, Mexico, and Asia, highlighting international scalability. It also embraced blockchain and API technologies, pushing innovation in payment systems and customer data integration. Its extensive use of analytics, cloud, and user-centered design underscores a well-integrated transformation agenda.

4.3 Bank 3: Technology Core Integration and Human-Centered Efficiency

Bank 3 adopted a highly integrated digital strategy, embedding technology across business units. It treated digital tools as strategic enablers, with technology investments accounting for nearly one-third of its IT budget. The bank highlighted the use of robotic process automation, cognitive computing, and AI to streamline operations, reduce costs, and enhance customer experience. It also rolled out facial recognition, digital wallets, and real-time payment systems.

The bank maintained a strong human touch by emphasizing digital experiences that complement physical branches. Narrative examples included smart ATMs, hybrid customer interactions, and assisted service models. Leaders frequently reiterated the importance of innovation, stating that technology "fuels everything we do." The bank engaged over 2,500 developers in hackathons and formed cross-functional innovation teams.

Global expansion efforts included blockchain pilots and API platforms. Big data initiatives were employed across investment banking, customer analytics, and internal fraud detection. These efforts aligned with its strategic orientation toward building a resilient, adaptive digital ecosystem. Awards for mobile banking and customer engagement affirmed the bank's market leadership.

4.4 Bank 4: Seamless Digital-Human Integration and Service Accessibility

Bank 4 emphasized the integration of digital and traditional banking channels. It offered features like video banking, AI-powered virtual assistants, and customized ATM messages. The bank's strategy was customer-first, focusing on simplifying experiences while retaining a human touch. It used digital messaging for personal greetings and touchpoints such as mobile appointment scheduling and teller-assisted ATM transactions.

Investment in innovation included forming dedicated business units like the Payments and Virtual Solutions group. The bank participated in fintech collaborations and accelerator programs to access emerging technologies. International efforts were visible in mobile platform expansions and P2P payment rollouts across Asia and Latin America.

Operational efficiency was a major goal. The bank digitized over 4,500 branches, reduced paper transactions, and streamlined data systems to consolidate customer profiles. Cloud integration and API capabilities were gradually deployed. Awards in social media and customer service validated its commitment to digital transformation. Corporate social responsibility was also embedded, with accessibility features like Braille cards and voice-enabled ATMs.

4.5 Cross-Bank Comparative Insights

Across all banks, common themes included customer-driven innovation, risk-responsive strategies, and a push toward mobile-first platform. Each institution demonstrated varying levels of investment in AI, cloud computing, big data, and blockchain. All promoted digital transformation not only as an operational necessity but as a competitive differentiator.

While attitudes were consistently positive, their expression and scope varied. Bank 1 emphasized scale and environmental goals, Bank 2 highlighted global integration and fintech partnerships, Bank 3 embedded technology into its core strategy, and Bank 4 balanced digital innovation with service accessibility.

These insights informed the development of a Digital Transformation Maturity Model (DTMM), offering a comparative framework for evaluating transformation strategies in financial institutions.

5. Discussions

This section builds on the narrative evidence to distinguish between broadly adopted practices and those that represent more advanced, differentiated approaches to digital transformation. Using both frequency analysis and expert judgment, the research classifies observed practices across four major North American banks into standard and advanced categories. The differentiated practices often indicate a more evolved stage of maturity and, in many cases, are only possible after foundational (standard) practices have been well established.

This segmentation reflects the varying levels of digital transformation maturity among the institutions studied, despite the commonality in strategic objectives. The analysis confirms that while many banks share similar goals in leveraging digital technology, the paths they take and the maturity of their implementations differ significantly. These distinctions highlight the

heterogeneity in how benefits are realized, even when institutions operate within a shared industry framework.

The classification is presented in Table 2 as a comprehensive framework capturing both standard and advanced practices. This framework is informed by longitudinal narrative analysis, which allowed the researchers to trace how practices emerged and matured over a five-year period. The extended time horizon was critical in identifying trends and progressions that might not have been visible in a shorter-term analysis.

Importantly, this research provides practical insights for institutions seeking to navigate their digital transformation journey. It offers a reference point for financial institutions, especially U.S.-based banks, as well as technology providers and consultants, to assess current positioning and identify necessary steps toward greater digital maturity. The Digital Transformation Maturity Model (DTMM) developed from these findings offers a structured lens to benchmark practices and measure institutional progress.

Interestingly, the analysis reveals that advanced practices are not confined to a single institution; rather, they are distributed across the banks in the sample. Some banks demonstrate a blend of both foundational and differentiated practices depending on the theme. For example, one bank may excel in advanced customer experience capabilities while relying on more traditional systems in internal operations. The cross-bank distribution of advanced practices reinforces the idea that digital maturity is not uniform and may develop unevenly across different domains within an organization.

This evolving understanding emphasizes that as institutions continue to prioritize digital transformation, they are likely to advance along the maturity curve. The catalogue of practices derived from this study offers a valuable tool for benchmarking and strategic planning. Expanding this research to include more banks across diverse geographies and sizes would enhance the robustness of the model and provide more generalized guidance. Additionally, extending the study to other industries would broaden the application of the DTMM and contribute to a deeper understanding of institutional transformation in the digital age.

Table 1: Standard and differentiating advanced practices from narrative analysis across the themes (Pramanik et al., 2019)

External Drivers Influencing Digital Technology Adoption		
Theme	Standard Practices	Differentiating / Advanced Practices
Customer Demand for Digital Technology	• Understanding customer expectations • Developing digital capabilities aligned with those expectations	• Analyzing how expectations differ across customer segments • Evaluating how aligning with expectations supports future digital strategies
Advances and Proliferation of Digital Technology	• Awareness of emerging technologies and capabilities • Readiness to transform workflows using digital interventions	• Assigning strategic value to digital technologies for business impact • Designing digital solutions for differentiation and competitive advantage
Associated Risks of Not Adopting Digital Technology	• Ability to recognize and respond to risks of not adopting digital tools • General awareness of technology-related risks	• Ongoing monitoring of traditional and emerging technologies and competitors • Engagement with technology start-ups as potential disruptors • Proactive identification of new risks from digital adoption
Benefits of Adopting Digital Technology		
Business Benefits	• Improve customer acquisition, satisfaction, and efficiency • Realize savings and growth by streamlining workflows and simplifying processes	• Understanding how digital investments improve performance • Attributing returns on investment from digital initiatives
Operational Benefits	• Benefits include simplification, faster processes, reduced errors • Enhanced customer and employee experiences • Promoting self-service through redesign	• Linking operational benefits to business outcomes • Identifying improvement opportunities via digital interventions
Scale of Growth	• Institutions show growth in digital technology-enabled services	• Continuous tracking of adoption metrics • Focus on successful initiatives based on adoption and scale
Awards and Accolades	• Promote leadership and capabilities through recognition to build trust	• Understanding expected standards and global benchmarks

		• Establishing a differentiated leadership position
Corporate Citizenship	• Demonstrating paperless, greener operations • Financial inclusion via digital outreach	• Including differently-abled customers via digital access

Attitude Towards Digital Technology		
Theme	Standard Practices	Differentiating / Advanced Practices
Positive Attitude Towards Digital Technology	• Belief in digital technology to drive performance and stakeholder value • Continuous commitment to digital technology	• High reliance on digital tech as a core competency • View of digital as essential to future growth and excitement for a digital-centric future
Digital to Render Human Interaction for Customer Experience	• Empathy and relationship emphasized alongside tech use • Education on digital tools for customer usage	• Use of digital to enable human-like service via cost-effective channels • Experience through self-service, advisory, and personalized digital services
Continuity of Focus Towards Digital Technology	• Multi-year future tech focus • Consistent investment in transformation efforts	• Prioritized and purposeful tech investments • Aimed at both running and transforming business models

Readiness and Intention to Deploy Digital Technology		
Theme	Standard Practices	Differentiating / Advanced Practices
Digital Technology as a Strategic Alternative	• Technology acknowledged as a means to develop core competencies and drive differentiation	• Clear strategic digital goals and initiatives • Alignment with broader organizational objectives
Continuous Focus on Forward-Looking Technology	• Assess and deploy emerging technologies • Use of innovation to create capabilities	• Ability to identify emerging technologies early • First-mover advantages in deployment
Technology and Operation Linkage to Ensure Leadership Focus	• Integration of tech into core processes • Responsibility placed with top leadership	• Creation of cross-functional tech-innovation groups • Dedicated labs for deep collaboration with business units
Developing Digital Capabilities and Promoting Innovation Culture	• Encourage employee innovation • Internal idea harvesting	• Engagement with startups for ideas • Hackathons and open innovation culture
Significant Collaborations and Partnerships	• Acknowledge digital startups as partners • Collaborate with tech providers	• Defined governance for engagements • Co-branded solutions with partner firms
Ability to Promote Differentiated Leadership	• Showcase leadership via awards and competitions	• Assess against benchmarks and create standout solutions

Usage and Deployment of Digital Technology		
Theme	Standard Practices	Differentiating / Advanced Practices
Usage and Deployment of Mobile Technology	• Significant focus on mobile services across institutions • Multiple mobile applications targeting customer segments	• Identifying key areas for mobile tech deployment • Use of branding and proper promotion for innovation • Track business value from mobile adoption • Empower employees through mobile platforms
Usage and Deployment of Big Data / Analytics	• Use of big data to reduce risk and improve service with predictive analytics	• Employing AI, machine learning, and other advanced tools for insight • Use of VR, automation, and visual dashboards • Analytics-driven employee enablement and insight generation
Usage and Deployment of Cloud Technology	• Limited cloud technology focus • Risk assessment in adoption	• Cost-saving strategies using cloud • Robust security implementation
Usage and Deployment of Social Technologies	• Use of social channels for customer interaction • Identification of reputational risk through social platforms	• Advanced usage like video and multi-handheld devices • Creation of branded online communities and networks

Adoption of Forward-Looking Digital Technology	• Limited adoption of emerging tech • Branding and promotion of tech-led services	• Strategic partnerships with tech providers • Emphasis on first-mover advantage and long-term positioning
Roll-out of Digital Innovations / Operations at Global Scale	• Global-scale roll-out aligned with market context • Focus on LATAM, APAC, Eastern Europe	• Learning and applying global innovations to domestic digital solutions

6. Conclusions

This study presents a comprehensive narrative analysis of digital transformation across four large North American banks, capturing five years of public disclosures to understand the underlying drivers, benefits, perceptions, readiness, and deployment of digital technologies. Through qualitative theme-based analysis and visual analytics, the research establishes a spectrum of practices—from standard approaches to advanced differentiators—that shape the trajectory of digital transformation within the banking sector. The findings underscore that while common goals such as enhanced customer experience, operational efficiency, and innovation are widely shared, banks demonstrate varied levels of digital maturity depending on institutional focus, leadership intent, and strategic integration.

The Digital Transformation Maturity Model (DTMM) developed from this analysis offers a structured framework for institutions to assess their current transformation status and identify benchmarks for future progression. Notably, the study highlights that advanced practices typically emerge when foundational practices are well established, suggesting a layered and progressive approach to transformation. These insights offer valuable guidance not only to banks but also to consultants and technology providers supporting digital initiatives.

While the current research scope is limited to major U.S. and Canadian banks, there is significant potential for broader applicability. Future research can extend the DTMM framework to similarly sized institutions in Europe and the Asia-Pacific, as well as mid-sized financial organizations. Such comparative studies would enrich our understanding of global digital maturity patterns and support the development of a generalized theoretical model for institutional transformation. Incorporating case-based validations and exploring institutional change models would further strengthen the applicability and robustness of the maturity framework.

Ultimately, this research provides a solid foundation for financial institutions navigating digital transformation, offering both strategic clarity and practical tools. The evolving landscape of digital banking in the United States presents opportunities for continuous learning, adaptation, and leadership in shaping the future of financial services.

CRediT Authorship Statement

Declare the credit and contribution of each author in this research. For example:

First author: Conceptualization, writing original draft, methodology. **Second author:** data curation, writing original draft, validation, analysis.

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