

IMPACT OF EMERGING TECHNOLOGIES ON INDIAN BANKS

Dr. Namita Singh*

ABSTRACT

In this paper, we discuss the introduction of various emerging technologies and its effects on the Indian Banking sector in detail. The banking sector in India has undergone dynamic changes in the last two decades in terms of moving away from traditional concepts of banking operations towards digitally driven methodology. Digitization and artificial intelligence has helped the banks in reducing turnaround time for various services and human interference in every day operations thereby reducing scope of errors and increasing operational efficiency. While the technological transformation has helped the banks to come up with cost effective ways of reducing carbon foot print, front-line labor costs in various stages of its operations, it has also given way to various challenges like cyber-crime, regulatory compliance risk, credit risk modelling, availability of technologically skilled man power, increased risk of managing complex data bases to avoid data leakage. The objective of this research paper is to study & analyze the fundamental changes in banking operations brought by introduction of these technologies. growth of the country introducing specialized platforms to drive enterprise growth, profitability and sustainability by covering customer's in rural India, improving customer selection, reduction of operating costs and optimization of the business processes. The study is based upon references from books, employee experiences, research journals, blogs etc.

KEYWORDS: Information Technology, Bank, Digital Transformation, Neo Banking, Innovation.

Introduction

The speed with which the Banking sector in India has evolved is overwhelming. Today, the banking sector is providing a host of digital self-services such as account opening, operation of accounts like listing of debit cards, funds transfer, control of credit cards, application for loans via dedicated applications which can be controlled by smart phones.

Advances in digital technology and the arrival of novel technological solutions have brought the changes in payments systems, borrowing virtual loans, digital wallets etc. for example paytm, rupay, phonepe etc. This changing model has prompted the banks to redefine their services in order to align with new trends in the use of emerging technologies.

Banks play a vital role in economy as they service various organizations and companies for their requirements in day to day operations like raising of working capital, bank guarantees for exports and imports, letter of credit etc. hence these emerging technologies have immensely influenced the banks as playing a crucial role in the economic field.

The advent of Fintechs and Neo banks has created a competitive environment by providing new opportunities to serve the customers with cutting edge technologies and expanding their influence on the market shares held by various banks and financial institutions. The technologies underpinning digital

* Assistant Professor, Faculty of Commerce, Lajpat Rai College, Sahibabad, Ghaziabad, Uttar Pradesh, India.

banks include Biometrics, Artificial Intelligence, and the Internet of Things. Biometrics are particularly instrumental in driving the banking system towards digitalization, enabling secure access through the recognition of unique identifiers like ear prints, voice patterns, facial features, and retinal scans of authorized individuals, thereby securing services and protecting public funds.

This research aims to investigate the influence of new technologies on the banking sector and to explore how digitalization has transformed India's overall economic landscape, with banks playing a central role. We will also examine the repercussions of the changes brought about by this technological disruption on banks as key drivers of the nation's economic progress.

Methodology

The assessment of technological disruption and impact of emerging technologies requires different methods that take into account rate of penetration, change in business behavior, change in decision making etc.

- **Secondary Data:** The research conducted here relies on secondary data, sourced from a range of journals, magazines, online platforms, and published figures from the RBI and various state-owned banks.

Literature Review

The transformation in banking system can be classified as below.

- **Pre- Reform Period**

The evolution of the banking system can be categorized into the following phases.

- **Pre-Reform Era**

- A phase of bank mergers and strengthening until 1966.
 - A period of significant growth in both geographical reach and service offerings from 1966 to 1980.
 - A phase of branch network optimization from the mid-1980s to 1991.

- **Post -Reform Period**

- **Post-Reform Era:** The current stage of reforms commenced in 1997, focusing on restructuring initiatives, enhancing employee skills, modernizing technology, and developing the organizational framework. These efforts assisted banks in meeting global standards for sound financial management and leading industry practices.

Present day innovative banking practices include:

- **Mobile Banking:** The past few years have witnessed a revolutionary impact from mobile banking, which has thoroughly transformed the operational dynamics of banking systems. It permits clients to manage numerous financial services through their smartphones. Such services include finding ATM locations, receiving notifications for bill payments, making payments within the same bank or to other banks, settling bills, and much more.
 - **Internet Banking:** The widespread availability of the internet has grown significantly in recent years. This service enables users to conduct and manage virtually any financial transaction or banking service online.
 - **Tele- Banking:** This service allows customers to conduct various financial tasks, such as generating PINs, ordering demand drafts, and requesting cheque books, through a specific phone number provided by the banks.
 - **Retail & Wholesale Banking:** Retail banking involves the regular, day-to-day financial dealings between banks and individual customers. Conversely, wholesale banking, its direct opposite, pertains to financial services provided to industrial clients. This sector of banking encompasses trading firms, national corporations, and international enterprises.
 - **Narrow & Universal Banking:** Narrow banking involves allocating a significant portion of deposits to secure, low-risk investments such as government bonds. Its primary purpose is to manage and control Non-Performing Assets (NPAs). In contrast, universal banking encompasses a wide spectrum of financial services, including insurance, commercial investment, and other related activities.

- **Electronic Clearing Services:** Introduced by the Reserve Bank of India (RBI) in 1995, ECS functions similarly to automated clearing houses. It represents a method for electronically transferring funds between different bank accounts and is particularly advantageous for processing large volumes of transactions.
- **Electronic Funds Transfer:** Implemented in 1995 and currently known as the National Electronic Funds Transfer (NEFT) system, this is a countrywide electronic mechanism for transferring retail funds between connected bank branches. NEFT was designed to integrate with the Structured Financial Messaging Solution (SFMS) of the Indian Financial Network (INFINET).
- **Automated Teller Machine:** First introduced in the early 1990s by foreign banks, ATMs represent the most ground-breaking development in virtual banking. These machines are accessed using a plastic card equipped with a magnetic strip that stores customer and bank details.

Studies & Journals Referred

Kirikal, 2004: According to Kirikal's 2004 study, within a single Decision Making Unit (DMU), such as a bank, enhanced productivity leads to better product and service quality, reduced operational expenses, and increased market share and profitability. DMUs that outperform the industry average in productivity typically exhibit greater profit margins. Furthermore, if a DMU's productivity growth surpasses that of its rivals, its profit margins will expand. Consequently, measuring productivity is a key responsibility for management teams.

OECD 2020: As highlighted in the OECD's 2020 report, digital disruption can foster efficiency gains, greater supply diversity, and increased competitiveness, yet it may also push established firms to adopt riskier strategies. Business model adjustments are necessary alongside the rise of new competitors, ensuring no single entity becomes permanently dominant. New market entrants, especially Big Tech, should secure market share through improved efficiency rather than by finding ways around regulations. Regulatory agencies must be adept at identifying new threats to financial stability arising from emerging systemic risks.

Bhasin & Rajesh, 2021: Bhasin and Rajesh stated in 2021 that the Indian banking industry is currently experiencing significant shifts, moving from traditional banking practices towards digital banking product collaborations and partnerships with FinTech companies. These developments are causing financial disruption and transforming the payment landscape. Indian banks with substantial customer bases and extensive branch networks stand to gain from this. However, despite their technological strengths, FinTech firms need to build customer trust to encourage the adoption of their novel digital and FinTech offerings.

Sankar. T.R.2022: Sankar's 2022 work emphasizes that a robust focus on customer needs, pioneering leadership, skilled personnel, and a collaboratively flexible organizational culture are essential for successful digital transformation. Partnering with FinTech firms and implementing agile methodologies will assist Indian banks in accelerating their digital transformation efforts, enabling them to stand out in a competitive market.

RBI, Jul 16, 2022: The Reserve Bank of India (RBI) noted on July 16, 2022, that the demand for FinTech regulation stems from the issues they create for the financial system and the new risks they entail. These risks have an impact on the general stability of the financial sector and the fairness of the market.

In their communication dated July 16, 2022, the Reserve Bank of India proposed several approaches for overseeing financial technology firms. One method, Activity-Focused Regulation, suggests that similar operations should be regulated uniformly, irrespective of the institution's legal structure or type. Another approach, Institution-Based Regulation, implies that rules should be applied to authorized entities or groups engaged in comparable and specified activities, such as accepting deposits, handling payments, providing credit, and underwriting securities. A different regulatory path is Results-Oriented Regulation, which establishes fundamental, shared, and technology-neutral or business model-agnostic outcomes that entities must achieve.

RBI, Jan 18, 2024: In a press release dated January 18, 2024, the Reserve Bank of India highlighted the growing prominence of Generative AI (GenAI). This category of artificial intelligence, which can produce varied content like written text, visuals, audio, and artificial datasets, has sparked

considerable attention due to its possible effects on the economy. GenAI is believed to possess a broad intelligence and thinking abilities comparable to humans. Unlike AI limited to specific functions, it can adapt and learn across different domains, demonstrating a level of autonomy, logical reasoning, and the capacity to solve problems. Present forecasts concerning AI's influence on output and economic development are significant yet carry a high degree of uncertainty. Scholarly investigations indicate that employees in organizations that adopt AI early on see greater gains in workforce efficiency, with most projections pointing to an approximate annual rise of 2–3 percentage points. Furthermore, an assessment by Goldman Sachs posits that generative AI might increase global Gross Domestic Product by roughly 7 percentage points over the span of a decade.

Existing evaluations regarding the positive impact of AI on efficiency and economic expansion are considerable but subject to much doubt. Academic findings suggest that individuals working in companies that are early adopters of AI witness greater improvements in their work output, with the majority of predictions suggesting an approximate yearly increase of 2–3 percentage points. A specific projection from Goldman Sachs² indicates that generative AI has the potential to elevate worldwide GDP by approximately 7 percentage points throughout a ten-year timeframe.

Neha Chhabra Roy (2018) Workforce challenges in Indian Banking Sector: According to a 2018 study by Neha Chhabra Roy titled "Workforce challenges in Indian Banking Sector," the increasing adoption of digitalization in the banking industry has transitioned conventional banking practices towards digitally-driven operations. The swift integration of technology, utilizing internet and mobile platforms to streamline banking processes, has generated a need for IT proficiency among the workforce. Consequently, this technological shift has resulted in a deficiency of digital skills among current bank employees. Therefore, the banking sector requires a digitally adept workforce to integrate diverse platforms such as mobile solutions, social media, and biometrics to deliver personalized banking services. Another significant challenge encountered by bankers is the rapid pace of technological advancements in banking operations, which intensifies work pressure and increases workload due to new regulations.

Various Technologies in Application

- **Artificial Intelligence [AI]:** AI, a branch of computer science, is dedicated to creating intelligent machines capable of functioning and responding similarly to humans. Banks are exploring AI for applications like identifying fraudulent activities, offering customer assistance and helpdesk services, enhancing security measures, and improving wealth management strategies.

Common Applications of AI include:

- **Forecasting:** Prediction has gained greater significance due to the constant flux in financial sectors. The current financial environment is highly dynamic and unstable, driven by the introduction of novel technologies, new services, and extensive market competition. Significant research efforts are underway to develop accurate forecasting methods. Integrating AI with data analytics enables financial institutions to obtain precise estimations.
- **Decision Making:** Incorporating AI into decision-making processes can yield profitable outcomes for financial firms. Prior research has demonstrated that decisions supported by AI are superior to those made solely through human judgment.
- **Bankruptcy:** In the past, predicting bankruptcy was a complex task, leading to substantial losses due to the interconnectedness of various stakeholders, including lenders, investors, regulators, and suppliers. While several theoretical solutions have been proposed, their accuracy has been limited.
- **Process Automation:** AI facilitates the automation of numerous tasks. For example, Optical Character Recognition (OCR) can progressively reduce the time and enhance the efficiency of tasks performed by employees. Extracting specific information from large datasets could previously take several hours before the implementation of AI, but now, it requires only a few minutes. Essentially, AI processes extensive data volumes to generate valuable insights.

According to PwC's report, 'Artificial Intelligence in India - Hype or Reality,' decision-makers within the banking, financial services, and insurance (BFSI) sector identified machine learning, automated data analysis, and robotics as the top three AI-powered solutions. Specifically, Machine Learning, automated data analysts, and virtual private assistants have emerged as leading AI

applications in BFSI. This aligns with the industry's emphasis on risk management, customer service, and process automation. As organizations restructure their business models to leverage emerging technologies, the risk management function is also undergoing a significant transformation to keep pace with these advancements. Sophisticated technologies like ML and cloud computing have enabled organizations to analyze vast quantities of both structured and unstructured data to accurately identify and evaluate emerging risks and implement optimal pricing strategies. Furthermore, increased regulatory oversight in the financial services sector and the rising costs associated with compliance breaches are also motivating organizations to develop advanced risk management capabilities to effectively operate in an increasingly open and interconnected global landscape. By utilizing AI-powered engines for risk assessment and optimal pricing, many financial services organizations are transitioning from outdated rule-based systems to AI-driven engines for managing both internal and external risks. Traditional rule-based systems are inadequate for handling the massive volumes and complexity of transactional data generated by financial services organizations today. Moreover, these expert-driven rules are static and do not adapt to the evolving nature of emerging risks, leading to their failure in identifying underlying relationships between the entities being investigated. ML algorithms also ensure that existing models continuously learn and self-correct to maintain consistent risk pricing.

- **Vast Datasets:** Financial institutions or banks generate substantial amounts of internal data daily, referred to as structured data. Additionally, they need to incorporate data originating from external sources (disorganized data), known as unstructured data. This type of data is typically gathered by observing customer behavior, for instance, through social media platforms like LinkedIn, Instagram, and Facebook. To address daily challenges, maintain a competitive edge, and expand their operations, they must collect both unstructured and structured data comprehensively. Financial firms are also characterized as data-intensive entities, requiring extensive data to identify unique opportunities, which they then process, analyze, and utilize for internal decision-making, strategy formulation, and implementation. Big data functions based on the 4Vs: Variety, Volume, Velocity, and Veracity. Presently, financial institutions and banks encounter numerous challenges stemming from competition, regulatory hurdles, and increasing consumer demands, prompting them to leverage technologies for enhanced effectiveness and efficiency. Traditionally, financial firms and banks relied on manual calculations performed by staff, and decisions were based on these results. This approach led to a significant number of errors by decision-makers due to the prevalence of inaccurate data. In contemporary times, the incidence of such mistakes has been considerably reduced through the adoption of technologies like big data.
- **Machine Learning:** Machine learning, often abbreviated as ML, involves the use of algorithms that enable computer systems to learn from data without explicit programming. Banks utilize ML applications for various purposes, including market analysis and streamlining cumbersome loan approval procedures. It can also improve the efficiency of call center operations. A particularly crucial application of ML in the banking sector is Customer Identification Protocol (CIP), commonly known as Know Your Customer (KYC). Contemporary machine learning aims to achieve two primary goals: first, to categorize data based on established patterns or models; and second, to forecast future trends or results using these models. For instance, a theoretical algorithm designed for data classification might employ computer vision to analyze skin moles, coupled with supervised learning techniques, to train it in identifying cancerous moles. Similarly, a machine learning algorithm applied to stock trading could provide traders with insights into potential future price movements.
- **Networked Devices:** The Internet of Things (IoT) is a technology that comprises a network of interconnected devices that communicate and exchange data via the internet. This technology assists banks in strengthening customer relationships and loyalty. It aids banks in determining optimal locations for installing Automated Teller Machines (ATMs). By leveraging IoT, banks can ascertain the ideal number and placement of ATM centers based on usage patterns.

IoT devices transmit the sensor data they gather by connecting to an IoT gateway, which functions as a central point where IoT devices can transmit information. Prior to data transmission, it can also be routed to an edge device for local analysis. Analyzing data locally reduces the amount of data transmitted to the cloud, thereby minimizing bandwidth usage.

Here's a rephrased version of the provided text, using different words and sentence structures while retaining the original meaning:

- **Distributed Ledger Technology (DLT):** A block chain operates as a digital record-keeping system, akin to a shared spreadsheet, that facilitates and validates transactions across a broad network of participants. These transactions are chronologically recorded, incorporating timestamping mechanisms for accuracy. Once data is inscribed within a block, it receives a timestamp and is subsequently linked to the next block for further data storage. This methodology effectively prevents data duplication and mitigates the risk of fraudulent activities during transactions. Functioning as a value transfer mechanism, DLT enables payments, service and product acquisitions, and monetary transfers. It streamlines processes by removing intermediaries, thereby accelerating transaction speeds and lowering costs. Prominent Indian financial institutions are adopting this technology for international trade financing. The Reserve Bank of India (RBI) has expressed interest in DLT, and the Institute for Development and Research in Banking Technology (IDRBT) is actively exploring its application within the banking sector. Banks are leveraging DLT for Know Your Customer (KYC) procedures, combating money laundering, facilitating cross-border remittances, and managing digital currencies like Bitcoin.
- **Cloud Computing:** Cloud computing represents the provision of diverse computing resources – encompassing servers, data storage, databases, networking infrastructure, software applications, data analysis tools, and artificial intelligence capabilities – via the internet, often referred to as "the cloud." This delivery model fosters rapid innovation, adaptable resource allocation, and cost efficiencies. The Indian Banking Community Cloud (IBCC), an initiative by IDRBT, delivers cloud-based services specifically tailored for Indian banks. It offers Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) options. Numerous smaller financial institutions, including small finance banks, credit cooperatives, and Non-Banking Financial Companies (NBFCs), are employing cloud-based solutions. This adoption not only curtails their upfront capital expenditures but also provides the agility to scale their IT infrastructure as their business expands in the future. The public cloud grants banks flexibility and the capacity to establish an IT foundation without investing in their own physical hardware, leading to reduced operational expenses.

The open cloud presents a variety of engagement frameworks, such as platform, software, infrastructure, and data services, allowing banks to select options that align with their specific requirements. Cloud infrastructure has significantly lowered data storage expenses, enhanced application scalability, and empowered banks to leverage big data by applying sophisticated analytics to gain insights into customer behavior. Banks are utilizing the cloud as an analytical platform to glean customer understanding by accessing data from various partners through Application Programming Interfaces (APIs) and micro services, enabling them to respond more promptly to customer needs. Major banking institutions are increasing their cloud investments, with a focus on open cloud deployments.

- **Conversational AI (Chat GPT):** An artificial intelligence tool capable of generating human-like responses to text-based inquiries is gaining widespread traction. Conversational AI platforms like Chat GPT can aid individuals with disabilities by offering text-based interactions, which can be more accessible than other interface types. Automating customer support using such AI can boost query handling capacity and decrease operational costs. It can provide immediate responses to inquiries and offer personalized recommendations based on customer information.

Impact of Emerging Technologies

- **Human Resources:** The workforce forms the essential foundation of any organization. The banking industry needs to hire specialists in various domains, including cybersecurity, credit analysis, block chain architecture, and process modelling. Consequently, the existing workforce requires upskilling in these novel technologies to ensure adherence to business regulations and effective performance management. Individual employee attributes, such as gender, years of experience, job title, and department, influence their perception of IT applications.

The emergence of these advanced technologies has prompted banks to recruit personnel with technological proficiency while simultaneously upskilling their current employees through training programs and re-orientation initiatives, recognizing that technology implementation necessitates a skilled

workforce. This impact on human resources has placed significant pressure on HR departments to re-evaluate recruitment strategies to prevent inconsistencies in employee career paths due to skill gaps. To address this issue, the RBI has also mandated that banks implement employee certification programs.

- **Digital Collaboration and Consolidations:** The amalgamation of several Indian banks was primarily facilitated by shared core banking software systems, which enabled seamless integration during the transfer of customer accounts, as exemplified by the mergers of PNB, OBC & UBI, Canara Bank & Syndicate Bank, and Andhra, Union & Corporation Bank. While technology has served as a catalyst for strategic moves by banks, it has also fostered the growth of non-traditional entities known as Fintech firms. Recognizing their limitations in scale, access to a broader customer base, and expertise in regulatory compliance, FinTech and banks have realized the significant potential for collaboration and co-operation. This partnership can drive innovation and deliver enhanced products and services to customers.

Digital collaboration between FinTechs and banks has led to the development of new business models, such as outsourcing services like credit evaluation and customer risk modelling, as well as the deployment of data analytics tools to reduce non-performing assets.

- **Unified Payment Interface (UPI):** This is a real-time payment system enabling customers to instantly transfer funds by linking multiple bank accounts to a mobile application. The advantages of UPI include single-click two-factor authentication, leveraging existing infrastructure, and facilitating smooth merchant transactions. Through UPI, India maintains its leading global position in instant payments, accounting for 46% of all such transactions worldwide in 2022. An Accenture Report from 2020 forecasts that Indian digital payments will reach \$856.60 billion by 2030. According to RBI data, UPI transactions surged from ₹2.23 Lakh Crores in the fiscal year 2020-21 to ₹139.15 Lakh Crores in 2022-23.
- **Digital-Only Banks:** In India, numerous financial technology companies offer digital financial services, often referred to as challenger banks or neobanks. However, there isn't yet a fully licensed digital banking institution authorized by the government. A proposal for the authorization of completely digital banks was submitted to the government by Niti Aayog in November 2021. This proposal is titled "Digital Banks: A Proposal for Licensing and Regulatory Regime for India." These envisioned banks, once licensed, would provide a full spectrum of services, including loan origination and deposit acceptance, operating entirely online and through other digital channels. Following Niti Aayog's submission to the government, many founders of neobanks in India are petitioning for licenses to transition into fully operational digital banks. This development is anticipated to significantly boost the nation's economy and provide substantial advantages to Micro, Small, and Medium Enterprises (MSMEs). The essential characteristics proposed for fully digital banks include: a stipulated minimum paid-up capital, a demonstrable track record and a viable pool of potential applicants, equitable access to foundational infrastructure, prudent regulations concerning liquidity and risk, a gradual easing of business restrictions, robust business continuity planning, and effective technology risk management.
- **Digital Security and Regulatory Adherence:** Financial institutions, as custodians of public funds, have a fundamental responsibility to ensure the security of deposits and the timely delivery of services. Technologies like distributed ledger technology (DLT) enhance the detection of fraudulent activities and identity theft, thereby protecting banks from considerable financial losses through the implementation of smart contracts, secure share trading, and high-level communication safeguards. The management of intricate datasets by banks can raise concerns regarding data privacy. These technological advancements have empowered regulatory bodies to identify breaches in compliance, leading to financial penalties for both banks and Fintech firms, as seen in recent instances involving HDFC Bank credit cards and Paytm. Market regulators have begun to employ sophisticated technologies to improve their oversight and supervisory functions, including the use of machine learning (ML) techniques to pinpoint higher-risk transactions within the 'suspicious transaction' reports filed by regulated entities. Due to the inherently cautious nature of these filings, the investigation of suspicious transactions often yields numerous false positives, causing significant delays. By applying ML methodologies, market regulators can focus their attention on transactions warranting closer examination and uncover intricate patterns associated with money laundering, thus saving valuable time and enhancing the accuracy of Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT) detection.

The Reserve Bank of India (RBI) has also prioritized the modernization of technological infrastructure within the financial system through the establishment of the Institute for Development and Research in Banking Technology (IDRBT) in 1996 and the Indian Financial Network (INFINET) in 1999. The central bank continuously strives to evaluate and upgrade its IT security framework to improve its efficiency and effectiveness in addressing emerging threats and safeguarding its IT infrastructure, which supports critical payment systems. As part of this effort, the RBI is enhancing its Security Operation Centre (SOC) technologies with innovative capabilities and advanced features such as security orchestration, automation and response, user and entity behavior analytics, and extended detection and response. According to the Indian Computer Emergency Response Team (CERT-In), over 490,000 cybersecurity incidents were reported in India during 2020.

In India, the process of card tokenization is gradually gaining acceptance. Tokenization involves substituting sensitive data, such as card or account details, with a randomly generated value, or token, provided by the bank. During a transaction, it is this token value that is exchanged, not the user's actual data. This ensures that merchants cannot store sensitive customer information, thereby reducing the likelihood of fraud. With the RBI issuing a directive permitting its use in specific scenarios, tokenization is poised to play a vital role in securing payments within the country.

- **Cost Reduction and Non-Performing Asset Management:** These technological advancements and the rise of neobanks (virtual banking institutions) have assisted traditional banks in lowering their operational costs by improving service delivery efficiency, decreasing the necessity for extensive branch networks, reducing personnel requirements, lowering their environmental impact, and increasing profitability through better management of non-performing assets (NPAs). This includes refining pricing structures for various financial products and services, such as mortgages, unsecured loans, depository services, credit cards, insurance, investment banking, and securitization. Organizations have begun to develop AI-driven Early Warning Systems (EWS) to help predict potential payment defaults at an early stage and proactively manage credit risk exposures. By employing advanced analytics to analyze both external and internal data sources related to borrowers, with an emphasis on leading indicators rather than lagging indicators, the likelihood of a borrower defaulting can be predicted, and preventative actions can be implemented. Furthermore, EWS systems can facilitate the real-time dissemination of this information via interactive dashboards and intelligence reports to key internal stakeholders, enabling them to take necessary corrective measures to prevent asset deterioration into NPAs. Advanced analytics plays a crucial role not only in forecasting NPAs but also in optimizing other downstream activities in the value chain, such as borrower collections and the resolution of delinquent accounts. AI-based 'smart collections' strategies are being adopted to suggest tailored actions to recovery agents, aiming to optimize the recovery of outstanding amounts.
- **Customer Relationship Management and Evolving Customer Demands:** Customer Relationship Management (CRM) encompasses the strategies and tools that assist businesses in managing customer interactions in a structured manner – encompassing the processes of identifying, acquiring, and retaining customers. It empowers employees to respond to customer inquiries effectively based on behavioral patterns and data analysis. Customer acquisition within the banking sector has emerged as a particularly promising area for innovation. Organizations are investing in social media and web analytics to improve lead conversion by analyzing unstructured data from social media and the web and utilizing AI techniques to predict customers' purchase intentions. Additionally, organizations are mining their core transaction and Internet of Things (IoT) data to analyze customer spending and payment habits to recommend 'next best offers.' This has not only helped in reducing high customer acquisition costs but has also led to increased revenue opportunities through cross-selling and upselling. This has elevated customer expectations, as they now anticipate immediate service delivery, and heightened competition has diminished customer loyalty towards individual banks.
- **India's Digital Transformation Initiative:** As a developing nation amidst a global landscape of advanced countries, India has been diligently working to keep pace with rapid global progress. The Digital India Initiative, spearheaded by the Government of India, envisions transforming India into a digitally empowered nation with enhanced online infrastructure, on par with developed countries and their banking systems. Launched by Prime Minister Narendra Modi on

July 1st, 2015, its primary goal is to extend high-speed internet access to rural regions and improve digital literacy among citizens. Its core objectives encompass digital empowerment, streamlined governance and services, and ensuring digital infrastructure accessibility for every individual.

Overseen by a Monitoring Committee chaired by the Prime Minister, a Digital India Advisory Group led by the Minister of Communications and IT, and an Apex Committee headed by the Cabinet Secretary, the Digital India campaign has marked six years of innovative concepts and practical solutions that have been reshaping the country as a whole. It strives to provide all citizens with opportunities to access digital services, governance mechanisms, knowledge resources, and information, with the aim of fostering greater financial inclusion.

The Digital India Programme has spurred numerous advancements that have significantly transformed the nation. Key achievements of this initiative include:

- **Aadhaar Cards:** A digital identification system based on biometric data.
- **Smart Cities Mission:** An undertaking focused on the revitalization and development of urban centers.
- **Government e-Marketplace (GeM):** A unified online platform for the procurement of commonly used goods and services by government entities.
- **BharatNet:** An endeavor to establish broadband connectivity in every village council (gram panchayat) across the country.
- **Bharat Interface for Money (BHIM) App:** An application enabling simple and swift transactions through the Unified Payments Interface (UPI).
- **Study Webs of Active Learning for Young Aspiring Minds (SWAYAM):** A digital platform providing access to high-quality teaching and learning materials for all educators and students, irrespective of their socioeconomic background.
- **MyGov:** An online platform designed to foster collaboration between citizens and the Government of India.
- **Opening of JAN DHAN accounts:** An initiative promoting financial inclusion through the opening of bank accounts for the unbanked.

The Digital India campaign has garnered international recognition and support. Notable endorsements include Mark Zuckerberg's commitment to establishing Wi-Fi hotspots in all rural areas of India, Google's pledge to provide broadband connections at five hundred railway stations, and Microsoft's agreement to extend internet connectivity to five hundred thousand villages in India. These significant endorsements are highly valued in realizing the vision of a digitally transformed India.

Conclusion

The burgeoning field of emerging technologies presents a wealth of possibilities alongside considerable hurdles and prospects for the Indian banking industry. The rise of virtual banking across the nation is fuelled by the reduced overhead associated with physical branches and staffing, enabling banks to provide more competitively priced financial products and services compared to conventional models. These technological advancements have empowered banks to better serve their clientele, aiming for complete customer satisfaction. This progress has fostered a mutually beneficial scenario for all involved parties.

Technology will be pivotal in shaping the future landscape of Indian banking, a direction underscored by the government's Digital India initiative, which emphasizes a transition towards a cashless economy and extending financial services to previously underserved communities. Given India's vast population and the fact that banking penetration is still only moderately widespread, banks should prioritize the continuous integration of technology and investment in digital platforms, which will undoubtedly exert a positive and substantial influence on their profitability.

Furthermore, the Indian Government should provide explicit tax benefits to FinTech companies operating in crucial sectors and extend similar incentives to both domestic and international investors who invest in smaller, higher-risk FinTechs with significant growth potential. Establishing FinTech bridges would facilitate the global expansion of Indian FinTech firms. Both central and state governments should invest strategically in select global regions to cultivate an ecosystem comprising FinTech expertise,

investors, and regulatory bodies, thereby fostering collaboration and expanding market opportunities for Indian FinTechs. To safeguard consumer interests and promote responsible growth within the FinTech sector, the government needs to accelerate the implementation of a comprehensive data protection framework, providing clear guidelines and directives on data sharing and consent mechanisms that organizations must integrate.

According to KPMG, "The technological progress achieved by banks in recent times has laid a strong groundwork for future expansion through the delivery of enhanced, digitally driven banking solutions and inventive products. In 2023, banking leaders will face the delicate balancing act of fostering innovation and growth within an increasingly cost-sensitive environment, while also securing the necessary tech-proficient personnel to sustain this upward trajectory."

References

1. Sankar T.R. (2022, December 21) Fintech and Regulation [Speech]. Business Standard Summit, Mumbai retrieved from https://rbi.org.in/scripts/BS_viewbulletin.aspx?Id=21531
2. OECD (2020) Digital Disruption in Banking and its impact on competition. Retrieved from <https://www.oecd.org/daf/competition/digital-disruption-in-financial-markets.htm>
3. Kirikal Ly (2004), "Productivity, the Malmquist Index and the Empirical Study of Banks in Estonia", Working Paper of the Goran Collert Foundation, Sweden.
4. RBI, Jul16 ,2022 retrieved from https://rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=21131
5. RBI , Jan 18, 2024 https://rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=22318
6. Bhasin, N.K.& Rajesh, A. (2021) Impact of E-collaboration between Indian Banks and Fintech companies for Digital Banking and New Emerging Technologies. International Journal of e – collaboration (IJEC), 17(1), 15-35.
7. Future jobs of India [https://www.ey.com/publication/vwLUAsstes/ey-future-of-jos-in-india/\\$FILE/ey-future-of-jobs-in-india.pdf#page=102](https://www.ey.com/publication/vwLUAsstes/ey-future-of-jos-in-india/$FILE/ey-future-of-jobs-in-india.pdf#page=102)
8. Roy, Neha Chhabra and T. Vishwanathan. "Workforce challenges in Indian Banking Scenario- Journey from identification till migration.
9. KPMG reports
10. PWC report on digital disruption and Its Impact on Financial Services.

