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#### ABSTRACT

*The banking industry in India is undergoing rapid evolution, successfully adapting to technological advancements over the past two decades. By harnessing various emerging technologies, banks in India have been providing services like ATM, anywhere branch banking, internet banking, and mobile banking, etc. In recent years, Banks in India have experienced substantial growth, particularly in digital payments and instant lending, thanks to the utilization of APIs, Cloud platforms, and Fintech collaborations. The remarkable achievements of UPI (Unified Payment Interface) and the success of RuPay cards as an indigenous brand have garnered attention both domestically and internationally. Furthermore, the implementation of digital journeys by banks in India and the consolidation of smaller banks into larger entities have bolstered the growth trajectory of the Indian banking sector. Instant loans through simple clicks and video KYC and Aadhaar-based authentication for opening new bank accounts have facilitated business growth and financial inclusion. Banks have embraced technologies such as APIs, Artificial Intelligence, Business Analytics, and cloud platforms to drive rapid progress. In light of these developments, this study aims to explore how banks can transform themselves by leveraging various technologies while critically examining the opportunities and challenges faced by the Indian banking industry, in order to adapt to the emerging technologies.*

#### KEYWORDS

emerging banking technologies, future of banking, banking transformation, digital banking journeys.

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#### INTRODUCTION

The banking sector in India has so far undergone a remarkable journey. While banks have existed in the country for a very long time, significant growth was observed following the nationalization of banks in 1969 and 1980. The process of bank computerization gained momentum after the opening up of the economy in 1991-92. Subsequently, the newly licensed private banks in India embraced technology, setting themselves apart from state-run banks. This compelled previously resistant banks to follow suit, leading to transformative decades for the banking landscape. Over two decades later, India has transitioned to new forms of banking with the licensing of payment banks, electronic fund transfers, and seamless instant fund transfers, etc.

Computerization in Indian banks commenced in 1993, starting with standalone PBC (Partial Branch Computerization) and progressing to Total Branch Automation (TBA). Gradually, banks adopted Core Banking Solutions (CBS) to facilitate services like anywhere banking, ATM, internet banking, and mobile banking, etc. Embracing various technologies for faster and more efficient customer service, banks introduced CTS (Cheque Truncation System), ECS (Electronic Clearing Service), IMPS (Immediate Payment System), NEFT (National Electronic Fund Transfer), RTGS (Real Time Gross Settlement), and many more. To strengthen technology adoption in Indian banks, the RBI established IDRBT (Institute for Development & Research in Banking Technology) in 1996 as an autonomous centre. IDRBT played a crucial role in promoting the adoption of banking technology, contributing to the growth of Indian banks. Subsequently, NPCI (National Payment Corporation of India) was established in 2008 under the Payment and Settlement Systems Act 2007, an initiative by the RBI and IBA (Indian Banks Association) to operate retail payments and settlement systems in India. NPCI achieved significant success in the retail payment space, particularly with the Rupay brand of debit and credit cards, competing with MasterCard and VISA. The NPCI's UPI platform also garnered immense success, making headlines and setting records in recent years.

Today, India takes pride in having one of the world's best payment system platforms. Instant payment platforms such as UPI, IMPS, and 24x7x365 NEFT and RTGS systems are in operation. Digital payments using the UPI platform have become highly convenient for users, with popular apps like Paytm and PhonePe widely used for retail transactions, including payments to street vendors like fruit and vegetable sellers. Even balloon sellers near traffic lights accept digital payments. Instant loans through banks' mobile apps or internet banking have gained popularity in India. Banks entice customers with the ease of availing instant personal loans with just a few clicks or OTP verification. Many banks now offer WhatsApp Banking and have even ventured into Metaverse Banking. Today's banking experience is fascinating, with contactless payments, cardless ATM cash withdrawals, paperless loan applications and disbursements, and other technological advancements that enhance convenience. Against this backdrop, this study aims to explore how banks can transform themselves by leveraging various emerging technologies while critically examining the opportunities and challenges faced by the Indian banking industry.

#### RESEARCH OBJECTIVES

We aim to analyze the current trends in the adoption of various banking technologies by banks operating in India. By examining their use of technology, we can gain insights into the evolving landscape of banking in the country. Our goal is to predict the future of banking by harnessing innovative and futuristic technologies. By envisioning the potential advancements in the banking sector, we can understand how technology can shape the industry and improve customer experiences. We seek to discuss the challenges and opportunities that banks encounter when adopting new technologies. By examining the potential hurdles, they face and the advantages they can gain, we can provide insights into the transformative power of technology in the banking sector.

The three primary objectives of this research study are as follows:

1. Investigating the adoption of banking technologies by banks in India.
2. Envisioning the future of banking by leveraging futuristic technologies for transformation.
3. Examining challenges and opportunities for the banks in embracing new technologies.

#### RESEARCH METHODOLOGY

The study relies on secondary sources of data, including research publications, case studies, white papers, and reports published by reputable organizations such as the Reserve Bank of India and the National Payment Corporation of India (NPCI). These sources provide valuable insights and information that form the foundation of our research. By leveraging the wealth of knowledge available through these secondary sources, we aim to ensure the credibility and reliability of our study's findings.

#### IMPORTANCE OF THE STUDY

The research study holds several important implications:

- **Understanding Banking Technology Trends:** The study allows for a comprehensive understanding of the current trends in banking technology adoption. This knowledge is crucial for banks and financial institutions to stay up-to-date with technological advancements and make informed decisions regarding their technology strategies.

- **Benchmarking and Comparison:** By exploring the use of banking technologies in India and other countries, the research enables benchmarking and comparison. This helps identify gaps, areas for improvement, and potential best practices that can be adopted by banks to enhance their technological capabilities.
- **Future Insights:** The study provides insights into the future of banking by examining the potential impact of futuristic technologies. This foresight is essential for banks to proactively adapt to emerging trends, stay competitive, and deliver innovative solutions to their customers.
- **Identifying Challenges and Opportunities:** By discussing the challenges and opportunities associated with technology adoption, the research offers valuable guidance for banks. It helps them navigate potential obstacles and capitalize on the opportunities presented by new technologies, thereby driving growth and improving customer experiences.
- **Decision-Making Support:** The findings and recommendations of the research study serve as a valuable resource for decision-making within the banking industry. Banks can utilize the insights gained to strategize their technology investments, prioritize initiatives, and align their operations with the evolving technological landscape.

Overall, this research study plays a crucial role in informing and guiding the banking sector's approach to technology, facilitating innovation, competitiveness, and sustainable growth.

## LITERATURE REVIEW

The overview of banking technology delves into the evolution of technology in the banking sector, highlighting its transformative impact on banking operations. It discusses key advancements that have shaped the industry, such as online banking and digital payment systems. The literature review explores existing research on futuristic technologies in banking, including AI, machine learning, blockchain, IoT, and biometrics. It summarizes studies that investigate the potential applications of these technologies in banking, showcasing their potential benefits.

Examining the adoption of futuristic technologies by banks in India, the review analyzes research studies focused on implementation and explores the drivers and motivations behind banks' decisions to embrace these technologies. Analyzing the implications and benefits, the review assesses how adopting futuristic technologies can improve operational efficiency, enhance customer experiences, and drive innovation within the banking industry. Addressing challenges and limitations, the review identifies regulatory hurdles, cybersecurity concerns, infrastructure requirements, and the need for skilled talent as crucial factors impacting the adoption of futuristic technologies in the Indian banking context.

Recent events have unequivocally demonstrated the importance of operational maturity, dispelling any doubts that may have existed. While banks have traditionally focused on enhancing operational efficiency, progress has been incremental. However, evolving client expectations, regulatory demands, technological innovations, and the emergence of aggressive competitors have exposed the lag in banks' operational evolution compared to other industries. To address this disparity, banks must embrace agility and resilience to effectively navigate future challenges such as pandemics, financial crises, or cyber-attacks.

Furthermore, banks are currently grappling with compressed profits due to low interest rates, credit losses stemming from the COVID-19 pandemic, uneven economic recovery, and intensified competition from fintech firms. To thrive in this landscape, banks need to elevate their productivity and efficiency levels while seizing new opportunities to create business value.

A transformative strategy that infuses intelligence and digital capabilities into all facets of operations—technology, processes, and people—is crucial for banks to remain competitive. This approach empowers them to proactively assess their environment and swiftly respond to emerging circumstances, ensuring their continued success. Recent events have unequivocally demonstrated the importance of operational maturity, dispelling any doubts that may have existed. While banks have traditionally focused on enhancing operational efficiency, progress has been incremental. However, evolving client expectations, regulatory demands, technological innovations, and the emergence of aggressive competitors have exposed the lag in banks' operational evolution compared to other industries. To address this disparity, banks must embrace agility and resilience to effectively navigate future challenges such as pandemics, financial crises, or cyber-attacks.

Furthermore, banks are currently grappling with compressed profits due to low interest rates, credit losses stemming from the COVID-19 pandemic, uneven economic recovery, and intensified competition from fintech firms. To thrive in this landscape, banks need to elevate their productivity and efficiency levels while seizing new opportunities to create business value.

A transformative strategy that infuses intelligence and digital capabilities into all facets of operations—technology, processes, and people—is crucial for banks to remain competitive. This approach empowers them to proactively assess their environment and swiftly respond to emerging circumstances, ensuring their continued success. India has experienced a digital transformation in financial services, thanks in part to the India Stack and open-stack technology. The India Stack is a digital identity and payment system built on an open API, enabling easier access to financial services. This system incorporates the Aadhaar national identity program, benefiting its 1.3 billion users and promoting financial inclusion.

The open-stack technology forms the foundation of the Unified Payments Interface (UPI), which revolutionized digital payments in India. By promoting the use of open-stack technology and encouraging the participation of both private fintech companies and public sector banks, India facilitated the rapid adoption of these technologies. Notably, these services are accessible to citizens at no cost, highlighting the unique aspect of India's digital transformation. Looking ahead, policy-makers are exploring the development of a central bank digital currency (CBDC) to enhance monetary policy objectives, financial stability, and efficient currency and payment operations. The Reserve Bank of India (RBI) sees advantages in areas such as currency management, reducing settlement risks, and improving cross-border payments. The RBI Payments Vision 2025 in India aims to enhance the payment systems by providing affordable and convenient options accessible anytime and anywhere. The goal is to create a less-cash and less-card society, empowering users with seamless digital payment experiences. This vision not only reinforces India's position as a global leader in digital payments but also addresses potential risks arising from geopolitical developments. The Payments Vision 2025 is built upon five anchor goalposts: Integrity, Inclusion, Innovation, Institutionalization, and Internationalization. Resilience to operational and security concerns is prioritized to withstand and recover from evolving threats. Maintaining the integrity of payment systems is crucial to bolster customer confidence. The document recognizes the shift in customer behaviour towards digital and touchless payment methods, accelerated in part by the COVID-19 pandemic. There has been a significant increase of 50% in mobile banking users, indicating the inclusion of first-time digital users. The challenge lies in making this shift irreversible and ensuring the availability of convenient and tailored payment solutions to meet user demands. Overall, the Payments Vision 2025 seeks to transform India's payment systems by fostering integrity, inclusion, innovation, institutionalization, and internationalization. It aims to provide a secure, accessible, and user-friendly digital payment ecosystem, reinforcing India's leadership in the global digital payment's domain.

Banks face the need to accelerate their digital transformation efforts due to ecosystem opportunities and efficiency requirements. This involves adopting cloud technology, integrating APIs, and embracing digital currencies. The emergence of next-generation social technologies and automation/AI tools further drives the need for banks to enhance their capabilities. Adaptability and resilience initiatives undertaken during the pandemic must continue to navigate prevailing market conditions, competition, and recessionary pressures. Business Model Innovation allows banks to create value and meet evolving customer needs. Enterprise security is crucial to protect against cyber threats and safeguard customer data. Composability enables banks to capitalize on ecosystem opportunities while managing risks by leveraging partnerships and collaborations. Overall, banks need to focus on digital transformation, adaptability, and resilience while exploring innovative business models and ensuring enterprise security. In order to meet the expectations of customers, banks need to shift from being customer-first to "truly" customer-first. This entails providing highly personalized services that are accessible anywhere, anytime, and on any device. Convenience, access, and speed will outweigh the importance of branding.

Millennials will continue to embrace social banking, voice-assisted purchase journeys, and virtual reality environments. However, older generations may still prefer assisted in-branch services over self-help chatbots. Banks will need to offer hybrid connections, allowing customers to choose the type of service that suits their preferences, thus creating more inclusive ecosystems and delivering greater value.

Omnichannel engagement, characterized by personalized, consistent, and real-time interaction, will be crucial. This approach enables banks to gather data from multiple touchpoints, which can then be leveraged to explore innovative and compelling ways of engaging with customers. By utilizing these diverse sources of data, banks can enhance their understanding of customer behaviour and preferences, leading to improved customer experiences. Banks must prioritize delivering highly personalized and convenient services that can be accessed through various channels. This includes accommodating the preferences of different generations

and creating inclusive ecosystems. Adopting omni-channel engagement and leveraging customer data will enable banks to stay ahead by providing compelling and tailored experiences for their customers.

It is crucial for banks to transform their business processes to prioritize customer-centricity, adopt a digital-first approach, and implement ubiquitous automation. This transformation will simplify and enhance complex customer engagement processes while enabling banks to track outcomes more effectively. In addition, banks should leverage modern technologies and data-driven insights to enhance the overall customer experience. By aligning people, processes, and technology, banks can drive financial well-being and empower customers to make better decisions in areas such as saving, borrowing, paying, insuring, and investing. In summary, banks are adapting to the changing landscape by nurturing universal bankers, improving employee engagement, transforming business processes, and leveraging technology and data-driven insights. These efforts aim to enhance customer experience, drive financial well-being, and enable customers to achieve better financial outcomes.

## MAGIC BANKING

Today's banking is nothing less than magic. It will be more exciting in the days to come. Days are not far off when we would experience banking as follows:

### SCENARIO 1

In this scenario, the customer interacts with their bank's super app to request a personal loan of five lakh rupees. The app responds by providing information about the available loan options, stating that the customer can get a personal loan of up to eight lakh rupees at an interest rate of 8% compounded. The app then asks the customer if they would like to avail the loan. The customer expresses their interest in availing a loan of five lakh rupees, specifying that they want the amount to be credited to their savings account. The app confirms the request and informs the customer that the personal loan of five lakh rupees has been disbursed and credited to their savings account, which is identified by the account number ending with 789.

The process is facilitated by the bank's super app, which integrates various services and features such as loan applications, customer authentication, execution of e-agreement and instant disbursement. The app uses data and algorithms to evaluate the customer's eligibility for the loan, determine the loan amount and interest rate, and initiate the disbursement process. By leveraging the convenience and efficiency of the super app, the bank provides a seamless and streamlined experience for the customer to avail a personal loan and have it credited to their specific account.

### SCENARIO 2

In this scenario, the customer interacts with a voice assistant, Alexa, to initiate a fund transfer. The customer instructs Alexa by saying, "Alexa, please transfer Rs 10,000 to my sister Sonali by IMPS." Alexa acknowledges the request and informs the customer that Rs 10,000 has been transferred to Sonali. Additionally, the voice assistant confirms that the amount has been credited to Sonali's SBI (State Bank of India) account. The transaction is processed using the Immediate Payment Service (IMPS), a real-time interbank electronic funds transfer system in India. Alexa acts as a facilitator, taking the customer's voice command, initiating the transfer process, and providing immediate confirmation of the successful transfer. The customer benefits from the convenience and speed of using a voice assistant to initiate the fund transfer, eliminating the need for manual input or logging into a banking app. The transaction is seamlessly completed, ensuring that the specified amount is transferred to the intended recipient's SBI account and it also confirms credit of the amount to the beneficiary's SBI account. It is important to note that the specifics of the scenario may vary depending on the actual voice assistant, banking app, and the bank's integration with the voice assistant technology.

### SCENARIO 3

In this scenario, the customer interacts with their bank's super app to initiate a transfer of funds from their savings account to their savings account with SBI (State Bank of India). Additionally, the customer requests to close their existing savings account. The customer instructs the super app by saying, "Please transfer my funds in the savings account to my savings account in SBI and then close my savings account." The super app acknowledges the request and proceeds with the actions. The super app first calculates the applicable interest for the savings account and credits the interest, then initiates the balance transfer process, moving all the funds from the customer's current savings account to his/her SBI savings account. Once the transfer is completed successfully, the super app confirms that all the funds have been transferred to the designated SBI savings account. Furthermore, the super app informs the customer that their original savings account, identified by the account number ending with 789, has been closed. This confirms that the customer's request to close the savings account has been fulfilled. By utilizing the capabilities of the bank's super app, the customer can conveniently transfer funds between their accounts and close accounts with ease. It streamlines the process, ensuring a smooth transition of funds and closure of the specified savings account.

### SCENARIO 4

In the given scenario, where one does not have cash, debit or credit cards, or a mobile phone, it is still possible to do a fund transfer or withdraw cash from Branch or ATM. Branch can authenticate the customer based on Aadhaar using customer's biometric such as fingerprint or face recognition and make the payment or effect the fund transfer. In ATM also, customer can input his/her account number/mobile number/Aadhaar number (for customer identification) and his/her fingerprint/face for authentication to withdraw require amount from his/her bank account. This would be a transaction of AEPs (Aadhaar-enabled payment system). This allows for a secure and convenient way to make payments or transfer funds without having ATM card or even mobile phone.

Looking towards the future, customer data is expected to become a valuable asset for institutions. It may be highly regulated and guarded, similar to oil. However, there is also a possibility that customer data could become more like water, a public utility accessible to all and therefore lower in value.

The successful banks of the future are envisioned as networks of platforms. While not all banks will capture all platform opportunities, many will participate in multiple platforms. These platforms have the potential to create significant value for shareholders and stakeholders. However, for banks to thrive in this new paradigm, they need to move beyond their traditional operating models and be willing to evolve.

As more banks undergo this transformation, the market will witness the change and recognize the increasing potential. This will lead to an industry with a bright future, improving the quality of life for all stakeholders, including customers, employees, shareholders, and regulators. The new era of banking, although involving complex and confusing evolution, holds the promise of enhancing customer service and overall financial experiences for everyone involved.

## INSPIRING SUCCESS STORY OF UPI (UNIFIED PAYMENT INTERFACE)

The story of India's growth in the retail payment space would indeed be incomplete without mentioning the Unified Payments Interface (UPI). UPI has played a significant role in transforming India's digital payments landscape and has become one of the most popular and widely adopted payment systems in the country. India has been making significant strides in expanding the network of its digital payment systems like UPI (Unified Payments Interface) and RuPay globally, with Europe being among the latest regions to accept India's payment systems. Other countries that have embraced different forms of Indian payment systems include France, UAE, Saudi Arabia, Bahrain, Singapore, Maldives, Bhutan, and Oman. This implies that Indians will now be able to make payments through UPI, RuPay etc. in these countries.

The number of UPI transactions and volume of these transactions during May 2022 to April 2023 are given below:

TABLE 1: NUMBER OF TRANSACTIONS &amp; VOLUME OF UPI DURING MAY 2022 TO APRIL 2023

| Month  | No. of Banks live on UPI | Volume (in Mn) | Value (in Cr.) |
|--------|--------------------------|----------------|----------------|
| Apr-23 | 414                      | 8,898.14       | 14,07,007.55   |
| Mar-23 | 399                      | 8,685.30       | 14,10,443.01   |
| Feb-23 | 390                      | 7,534.76       | 12,35,846.62   |
| Jan-23 | 385                      | 8,036.89       | 12,98,726.62   |
| Dec-22 | 382                      | 7,829.49       | 12,82,055.01   |
| Nov-22 | 376                      | 7,309.45       | 11,90,593.39   |
| Oct-22 | 365                      | 7,305.42       | 12,11,582.51   |
| Sep-22 | 358                      | 6,780.80       | 11,16,438.10   |
| Aug-22 | 346                      | 6,579.63       | 10,72,792.68   |
| Jul-22 | 338                      | 6,288.40       | 10,62,747      |
| Jun-22 | 330                      | 5,862.75       | 10,14,384      |
| May-22 | 323                      | 5,955.20       | 10,41,506      |

Source: NPCI

### ChatGPT

ChatGPT empowers banks by enhancing digital transformation, customer engagement, automation, risk management, compliance, data analytics, user experience design, technology adoption, and employee training and support. The major advantages of using ChatGPT in banks can be summarized as follows:

- ❖ ChatGPT aids banks in their digital transformation by providing insights and best practices for leveraging technology effectively.
- ❖ It enhances customer engagement by offering personalized interactions and addressing real-time customer queries.
- ❖ ChatGPT automates routine tasks like account opening, KYC verification, and transaction monitoring, improving operational efficiency.
- ❖ It provides personalized product recommendations based on customer data, transaction history, and financial goals.
- ❖ ChatGPT assists in risk management by analyzing transaction data and detecting potential anomalies or fraudulent activities.
- ❖ It supports banks in complying with regulatory requirements and staying up-to-date with compliance standards and guidelines.
- ❖ ChatGPT analyzes customer data to generate actionable insights, helping banks understand customer behavior and preferences.
- ❖ It contributes to user experience design, providing insights on user preferences and optimizing the overall banking application or platform experience.
- ❖ ChatGPT assists banks in evaluating and adopting new technologies, such as AI, blockchain, or biometric authentication.
- ❖ It serves as a training tool, providing up-to-date information, product knowledge, and ongoing support for bank employees.

### MAJOR FINDINGS

Banks in India have significant opportunities in the digital payment space. Highlights include capitalizing on the growing adoption of digital payments, leveraging the Unified Payments Interface (UPI) for real-time fund transfers, expanding merchant services for businesses, tapping into contactless payments, facilitating cross-border transactions, forming e-commerce partnerships, driving financial inclusion through digital payment solutions, integrating with digital wallets, prioritizing security and fraud prevention measures, and utilizing data analytics for personalization. These opportunities allow banks to enhance customer experiences, drive innovation, and stay competitive in the digital payment landscape.

- ✓ India's Banking Technology initiatives have achieved significant success over the last decade, driving digital transformation in the banking sector. Here's a brief summary of their accomplishments:
- ✓ Introduction of Unified Payments Interface (UPI) revolutionized retail payments, enabling real-time, seamless fund transfers between bank accounts via mobile devices.
- ✓ Aadhaar-enabled Payment System (AEPS) facilitated financial inclusion by leveraging biometric authentication to enable secure and easy banking services for the unbanked population.
- ✓ Pradhan Mantri Jan Dhan Yojana (PMJDY) aimed at promoting financial inclusion, resulting in the opening of millions of new bank accounts and enabling access to various banking services for previously unbanked individuals.
- ✓ Immediate Payment Service (IMPS) provided real-time interbank electronic fund transfers, enhancing the speed and convenience of transactions.
- ✓ Mobile banking apps like BHIM, PhonePe, and Google Pay gained popularity, offering a user-friendly interface for digital transactions and further promoting cashless payments.
- ✓ The introduction of Bharat Bill Payment System (BBPS) centralized bill payment services, allowing users to pay various bills such as electricity, water, gas, and more through a single platform.
- ✓ The adoption of Open Banking APIs and interoperable systems promoted collaboration and innovation, encouraging fintech companies to develop innovative solutions and expand financial services to a wider audience.
- ✓ These initiatives collectively demonstrate India's successful efforts in leveraging technology to promote financial inclusion, enhance convenience, and drive the digitization of banking services, ultimately contributing to the country's economic growth and development.

The future of banks in India presents both challenges and opportunities as the industry evolves in the digital era.

### CHALLENGES

- Cybersecurity threats will require continuous investment in robust security measures to safeguard customer data and prevent unauthorized access.
- Navigating complex regulatory requirements will demand ongoing efforts to ensure compliance with changing laws and standards.
- Adapting to digital transformation will necessitate the modernization of legacy systems and the adoption of emerging technologies.
- Fierce competition from fintech companies will require banks to embrace collaboration, innovation, and agility to remain competitive.
- Attracting and retaining top tech talent will be crucial as banks strive to build and maintain technological expertise.
- Managing vast amounts of data effectively will require robust data management strategies and technologies.
- Adapting to changing customer expectations and delivering personalized, convenient, and seamless banking experiences will be a key challenge.

Addressing these challenges requires a strategic approach, proactive investment in technology infrastructure, collaboration with fintech partners, continuous training of employees, and a customer-centric mindset. Banks that successfully navigate these challenges will be well-positioned to thrive in the evolving landscape of banking technology in India. By embracing these opportunities, banks in India can enhance their competitiveness, drive growth, and improve customer experiences. However, successful implementation requires a robust technology infrastructure, agility in adopting innovations, collaboration with fintech partners, and a customer-centric approach to banking services.

### OPPORTUNITIES

- Digital financial inclusion offers banks the chance to reach underserved populations and provide access to financial services through digital channels.
- Mobile banking and payments can be leveraged to cater to the growing base of smartphone users in India, offering convenient and secure banking services.
- Data analytics and personalization can enable banks to gain insights into customer behaviour and preferences, enhancing customer satisfaction and loyalty.

- Blockchain and distributed ledger technology have the potential to streamline banking processes, improve security, and enable faster cross-border transactions.
- Open banking and collaboration with fintech companies can foster innovation, create new revenue streams, and deliver customer-centric products and services.
- Automation and robotics can enhance operational efficiency, reduce manual processes, and improve customer service.
- Enhanced security measures and fraud prevention technologies can build trust and protect customer data.

## CONCLUSION

The future of banking is expected to be shaped by various forces that are impacting bank revenue, value, profits, and customer satisfaction. While it is uncertain how exactly banks will evolve, it is believed that successful banks will leverage technology and data to establish a more integral presence in customers' lives. They will offer real-time services that were previously unimaginable, driven by advancements in technology and data analytics. By embracing these transformative changes, banks have the opportunity to provide seamless, personalized, and highly convenient services to their customers. Through innovative technologies, they can embed themselves deeper into customers' lives, offering solutions tailored to individual needs and preferences. The key to capitalizing on this future lies in agility and speed. Banks that are quick to adapt and embrace the new possibilities can position themselves as leaders in this evolving landscape. By leveraging various emerging technologies and data effectively, they can enhance customer experiences, increase efficiency, and create new revenue streams.

Banks can now enhance their services by utilizing APIs and cloud platforms, resulting in faster and more cost-effective operations. The banking industry faces potential transformative changes due to advancements in regulations, technology, geopolitical factors, and unforeseen innovations. Various digital tools, applications, and systems can expedite the process of digitalization. Furthermore, banks are actively exploring the potential of technology platforms like 5G. To meet evolving demands, banks require flexible, open, real-time, and easily integrated solutions. They can now leverage application programming interfaces (APIs) and external data sources to streamline activities across the front, middle, and back-office operations. With the integration of data analytics, artificial intelligence (AI), machine learning (ML), and automation, banks can further enhance their offerings. Successfully navigating the future of banking in India will require strategic investments, partnerships, technological advancements, and a customer-centric approach. Banks that can overcome challenges and seize opportunities have the potential to thrive in the evolving digital landscape, enhance customer experiences, and drive growth in the industry.

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**A STUDY ON IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN INDIA'S BANKING SECTORS****A.P.SURIYA****STUDENT****PG DEPARTMENT OF COMMERCE****JAWAHARLAL NEHRU RAJKEYA MAHAVIDYALAYA****PORT BLAIR****ABSTRACT**

*Banks are already offering a wide range of products integrated with technology and automation, the most common being ATM machines around us. Now moving to the next phase in the current Industry 4.0 era, Banking segments is all set to increase its strategy execution by leveraging newest digital technology so that its customers may practice speedy and secure processing of transactions. This study reveals, the advancement, acceptance, execution and potential opportunities of focusing on Artificial Intelligence (AI) for successful strategy execution in India's banking sector. In this study secondary data about the research effort done on AI in Banking Sector to find the current status of research as well as realistic application of AI in various parts of banking strategies e.g. surveillance, scam detection, ensure compliances, credit assessment, customer tune, handling repetitive large tasks etc. in general and focus on current developments in India's banking sector, inspire banking leaders to move their focus proactively towards leveraging Artificial Intelligence with an aim to bring in delight for customers.*

**KEYWORDS**

artificial intelligence (AI), researchers, banking, technology, machine language, banking industry 4.0.

**JEL CODES**

G20, G21, O32, M15.

**INTRODUCTION**

Artificial intelligence in the current market becomes more pervasive. Business approaches are concerned with speedy decision making, business promotion, industry growth, profitability, productivity, cost reduction, capital formation, investments, market share, efficiency, effectiveness, customer satisfaction, their retention, achieving & managing customer delight, optimum utilization of resources, enriched products & services so that they may remain competitive. In the present Industry 4.0 era, all banking businesses are seriously influenced by technological innovations or absence thereof. This paper is an attempt to setup a connection between successful strategy execution and latest digital technologies in these areas with specific reference to India's Banking sector. Since banks are pivotal for economic development of nation's economy and India is moving ahead with an aim to achieve \$ 5 trillion economy by the year 2024, so a standard shift is bound to take place in its banking sector, refining their strategy application by leveraging latest digital technologies, serving broader goals of balanced development of the entire nation. The most common example of claim of digital technology being virtual assistants enabled by banks on their websites. In this study the author explores such applications of technology, its evolution, implementation and future opportunities with focus being on Artificial Intelligence (AI) as a collaborator for successful strategy implementation in India's banking sector. Digital Technology is a critical element of the Information Technology (IT) strategy of every bank operating in the present agile Industry 4.0 era as every bank needs brightness into its people, customers, processes, tools, utilization trends and strategic goals.

**LITERATURE REVIEW**

Ability of the human mind to process information and solve problems has motivated scientists to take similar intelligence into machines (Shachmurove, 2002). Since banks have a very crucial role in economic development of a nation, so their successful strategy execution, leveraging state-of-the-art technologies, improve value not only to their own business but to the growth of the entire nation, hence banks need to keep step with increasing expectations of today's swiftly changing environment (Brauer, 2005), placing its strategies to ensure continuity of business, addition of customers as well as retention of existing customers (Zineldin, 2006), duly banks are trying various strategies to innovate new products and services to achieve this (Alam & Khokhar, 2006). A technology that can act like human, has ability to learn languages, execute physical tasks, mimic human decision making (Russell & Norvig, 2003), enables machines to carry out task that require human intelligence (Brachman, 2006) by combining various technique of machine learning, pattern recognition, logic & probability theory in addition to biologically inspired models (Duch, Swaminathan, & Meller, 2007) known as computational intelligence. Customers' trust in technologies paved the way for mobile banking payments (Donner & Tellez, 2008) because system quality and information quality are a significant influence on the customers' satisfaction and trust (Lee & Chung, 2009). Artificial Intelligence has made its way in gauging of bank performance (Fethi & Pasiouras, 2010) and Information technology is being abundantly used by banking sector across the globe (Vedapradha, Ravi, & Jebasingh, 2016) in its operations like accounting, auditing and assurance domain, easing out some of its most toughest tasks and assist in decision making by collecting, analyzing and creating accurate financial information (Davenport, 2016). Banks are proceeds towards next level to create Expert Support System (ESS) and Decision Support System (DSS) to make managerial decision-making function more informed, consequently executing strategies more effectively in critical areas like service (Castelli, Manzoni, & Popovic, 2016), credit risk appraisal, loan defaulters, profitable investments, interest rate inflation etc. (Ghodselahe & Amirmadhi, 2011) (Moro, Cortez, & Paulo, 2015) (Vedapradha, Ravi, & Jebasingh, 2016). Considering the need of powerful systems which can understand the patterns in the data of market conditions and can adjust financial strategies, so that pragmatic and prompt service may be provided to the customer (Nuseibeh, 2017), research scholars have conferred end-to-end Robotic Framework with detailed hardware and algorithmic aspects which can be initiate to a wide range of industries, including banking, to simplify their processes (Chakraborty, 2017). Main factors encouraging Artificial Intelligence into the banking sector are its aptness of low cost production, open source system & accessibility of the same; hence within next 3 years Artificial Intelligence is predicted to become the primary way banks interact with their customers – without depending on bank branches and cheque books (Sinha, 2017). India's banking sector is investing in Robotics and Artificial Intelligence to serve its modern tech savvy customers in an effective manner (Ayachit, 2017). Banking products have moved towards from the conventional banking of India (KUMAR, 2018). Application of innovative technologies by banks in execution of their strategies to perform efficiency is praiseworthy (Lagarde, 2018) and is expected to create their globally unified practices, policies and framework with the help of Artificial Intelligence (Erdélyi & Goldsmith, 2018). Strong positive relationship (R- coefficient = 0.859) has been observed between Artificial Intelligence and proper record keeping (Longinus, 2018) and Artificial Intelligence has strong prospects of transforming all banking operations (Ghurair, 2018) refining investment strategies, managing customers' data, carrying out risk estimation, curbing money laundering issues and adding value by reducing costs of money transfer while increasing accuracy (Sophia, 2018), thus widen the profitability, improving the quality of decisions made at different operational levels of management (VEDAPRADHA & HARIHARAN, 2018), Providing human resources for innovating & executing intended strategies aligned with organizations vision & betterment of economy (Kurode, 2018). At present employees of banks are performing many unproductive tasks of repetitive nature whereas availability of manpower for owning creative and decision-making roles is limited (Kurode, 2018). The above provides insight about technical, practical and strategic aspects of Artificial Intelligence and its contribution towards business strategy to help banks to take calls to adopt or not to adopt Artificial Intelligence. One study has found that the adoption of AI in the banking sector may add approx. \$1 trillion to India's economy by 2035 (Lakshminarayana & Deepthi, 2019). The RBI has proactively promoted application of technology for implementing regulations and creating policy frameworks in India's banking sector under leadership of Dr. Raghuram Rajan and Urjit

Patel (Aazhvaar, 2019). Same is the case with a country like India, having a huge population with high percentage of rural or non tech savvy population, impeding pace of implementing services powered by technology (Kurode, 2018).

## RESEARCH OBJECTIVES

This study is undertaken to focus on establishing and empowering strategy execution in India's Banking sector by leveraging Artificial Intelligence. Specific objectives of this study are:

1. The need of artificial intelligence in the Indian banking sector and how it is shifting the face of modern automated banks.
2. To inspect the state of affairs of Artificial Intelligence's application in India's banking sector.
3. To pull the focus of banking leadership from a reactive to proactive adoption of Artificial Intelligence for successful implementation of their strategies and give support to their vision.

## RESEARCH METHODOLOGY

In this study, the author attempts to study the secondary data available in published data e.g., research papers, books, websites, newspapers etc. The research design is investigative and evocative. The research undertaken is exploratory as it focuses on secondary surveys in accumulation to qualitative and quantitative investigation. It is descriptive and analytical research as the current state of artificial intelligence in banking sector is enlightened via the facts and information previously collected.

## BANKING SECTOR AND APPLICATION OF ARTIFICIAL INTELLIGENCE IN ITS STRATEGY IMPLEMENTATION

The current major events like demonetization and government subsidized initiatives of developing digital India have not only encouraged India's economy to become cashless, but also fetched in a massive amount of data in banks, demanding quick, exact and consistent updating & maintenance of records. Banking sector had made computers an integral part of its procedures and since the 1990's, automation became a basic pillar to modern banking, for example, money withdrawal, transfer of funds, arrangement of cheque books etc. (Moin & Ahmed, 2012) and now due to vast changes in economy, increased work volume, major shifts in consumer preference, new competitors, regulatory requirements and consistent need to have robust access management & secured banking setting for transactions, banking sector has started leveraging Artificial Intelligence to digitize the tedious manual tasks, determining future of economy, dropping strategy cycle, executing its strategies successfully, thus renovating traditional branch banking into mobile / online banking activities, pioneered by private sector banks of India (Sabharwal, 2014). Benefits of AI are resulting from its inter-connected working in cohesion, as summarized below:

1. Machine Learning creates clever machines which analyze data, identify patterns and bend its program / logic dynamically on its own to react in accordance with data, without being explicitly programmed. Used in Customer Service, Wealth Management, Threat Management, Fraud Discovery
2. Deep Learning creates an artificial mockup of the human brain and works with a non-linear line of analyzing data, thus enabling better decision making closer to the accuracy of the human brain. Used in: Fraud finding, identifying new business chances working within banking environment as well as on more social media platforms
3. Natural Language Processing allows machines to understand and study sentiments of humans based on their language i.e., text & speech and to respond accordingly. Used in: Feedback on products, services & offerings.
4. Speech Recognition, a sub-set of Natural Language Processing, aids machines to understand human spoken language based on Acoustic & Language modeling algorithms. Used in: Voice Banking, Confirmation based on customer's unique voice patterns
5. Natural Language Generation permits machines to generate natural language so that machines may work together with humans in their natural language. Used in: Machines can connect to human customers in human language in a smart and understandable manner
6. Passbook updation kiosks - Passbook printing kiosk is an automatic machine which enables customers to print their passbooks automatically. SBI, Bank of Baroda and Indian bank has installed this kiosks in an immense way. They have introduced self-service passbook kiosks wherein bank customers can print their passbooks on their own.

## SUMMARY OF SIGNIFICANT OPPORTUNITIES FOR THE BANKING SECTOR TO UTILIZE ARTIFICIAL INTELLIGENCE

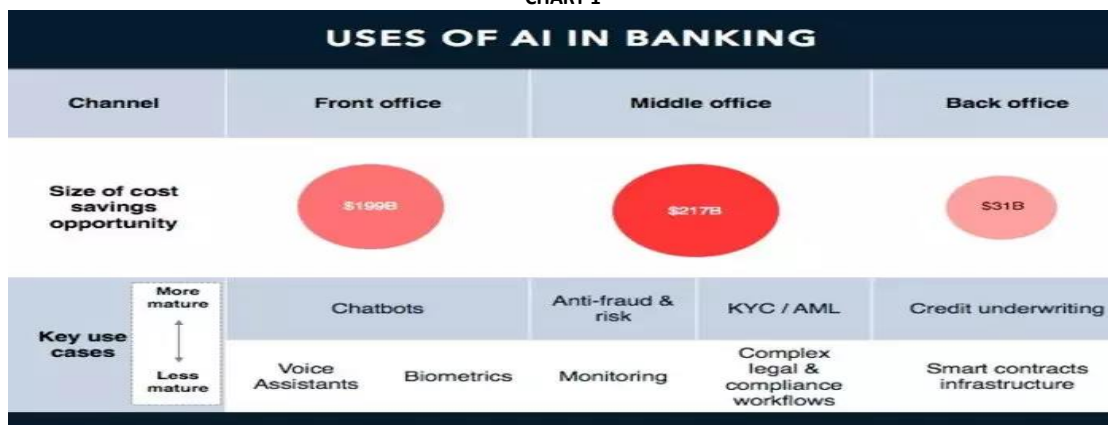
Based on the Literature reviewed, application of Artificial Intelligence in the banking sector can be summarized as follows: It is extremely important for banks to remain competitive and proactive in an Industry 4.0. They have to be dynamic, constantly taking and placing their decisions, accelerating changes in business processes with an aim to optimize the profitability as well as service delivery. This study analyzed the application of Artificial Intelligence for achieving success in executing strategies in the dynamic environment of the banking sector, considering end-to-end activities which are assigned to these intelligent machines. Summary of significant opportunities for the banking sector to utilize Artificial Intelligence are presented here-in-below:

1. Improving Profitability by reducing Strategy cycles, reducing costs on unnecessary tasks, increasing productivity, efficiency customer's loyalty and optimizing service delivery by becoming operationally lean.
2. Generating, driving and supporting execution of strategies based on data analysis and research.
3. Framing Regulations by transforming and re-engineering banking operations.
4. Elimination of human error and up-to-date record keeping, handling some of the most challenging aspects of accounting, auditing and assurance can be managed by Artificial Intelligence.
5. Enhancing CBS (core banking solutions) by operating at a much robust pace and being agile in response to market conditions, enable banks with a better go to market approach among different assets, managing customers portfolios by analyze their profile through algorithmically sorting based on research about financial institutions, loans, investments and augmenting this data with customers' approach each customer in personalized way.
6. Track the sensitive areas by developing customized secure environment as per relevant regulatory needs, scanning transactional & non-transactional logs to find dubious activities, deformity in patterns, warning signs of fraud attempts, collecting evidences, examine data for necessary conviction and responding to that in time, thus outperforming the criminals (Ray, 2017)
7. Credit assessment and decision can be strongly managed through Personal Assistant powered by Neural Network using classification models, inspect market conditions with reference to the lifestyle, appetite for risk, financial targets, individual portfolios, structured pattern recognition in past behavior of customers and time series predict adhering to banking credit standards, thus developing successful financial strategies from banks perspective which concurrently result in fruitful investments from customer's perspective.
8. Human bias and emotional interference can be minimized by intelligent machines to avoid distortion in the decision-making process, abridge time for business processes implementation, replying customers' queries without any frustration and self-interest of earning commission, thus uplifting productivity.
9. Artificial Intelligence powered Virtual Customer Assistant & Chat Bot engages customers in speech / text in human language, learns from their activities, understands their needs and provides suggestions and takes action accordingly, handling all the tasks from customer on-boarding to various customer services. They operate not only in the intra banking domain environment but also outside it on wider social media and messaging platforms also, the platforms which are meant for news, e-commerce and entertainment and thus affect customers' behavior towards banking products by conversing intelligently. Based on the set algorithms, these bots are designed to be intelligent enough to seamlessly hand over to a customer dealing with a human at any stage when such a need arises. Learning from past data is an essential element of Artificial Intelligence, such bots become more efficient with their increased use. Concerned bank officials can keep on enriching the database, based on which these bots respond, in order to keep step with the latest information and extensive coverage of subject matter. This combination of Artificial Intelligence and correct human input by banks adds to customer delight by fulfilling requests, solving problems and predicting customers' needs.



10. Humans freed by applying Artificial Intelligence into day-to-day tasks – including payment related jobs handled by Chat Bots, can be used for more value added and human centric service functions, motivating the employees to up-skill and re-skill themselves for shouldering higher responsibilities. Added skills would be to scale up the capacity during peak or emergency scenarios offering qualitative services to the customers and bank employees will be able to feel a better work-life balance.
11. Interactive Voice Responses (IVRs) transformation may sync with customers shifting from webpage search (Google) to the voice search (Google Assistant), enabling human-like correspondence, easing the waiting queues, reducing the dependence on call centers, KPOs & BPOs.

CHART 1



**ARTIFICIAL INTELLIGENCE IN INDIA’S BANKING SECTOR**

The wide literature reviewed on this topic, this study locates the possibilities of Artificial Intelligence for clinching successful implementation of strategies in India’s banking sector because Artificial Intelligence understands the work flow of the banking sectors and restructures the activities to automate the same. Practical commencement of Artificial Intelligence in India’s banking sector which are an integral part of activity and make use of customers in the form of quasi banker chatbots are mentioned below:

**RBI**  
 NPCI National Payment Corporation of India is working to bring down the cost of electronic transactions. (IDRBT) Institute of Development and Research in Banking Technology is studying opportunities and defiance in new technology areas.

**ICICI BANK**  
 It is India’s first bank to install software robotics & automation in over 200 businesses across various functions e.g., retail banking, treasury, HRM etc. to perform repetitive, bulk tasks, reducing response time by approximately 60% with accuracy being 100%.

**SBI**  
 Propelled a national hackathon and is now using facial recognition technology based “Chapdex” developed by the winning team of the contest; chatbot “SIA” is active on the SBI website to interact with customers.

**YES BANK**  
 Yes Pay Bot, developed in partnership with Payjo – a leading AI banking platform, performs financial transactions in a personalized conversational manner on a real time basis. Chat bot “Yes Robot” is on its website.

**HDFC**  
 Chatbot EVA (Electronic Virtual Assistance) built by Sense forth AI Research, has handled the following since March, 2019: Addressed customer queries > over 2.7 million Interacted with unique users > 530,000 Held conversation > 1.2 million.

**AXIS BANK**  
 AI & NLP enabled apps to help consumers with financial and non-financial transactions, to answer FAQ and to assist customers” contextual interaction with the bank for loan and other products. Chat bot “Axis Aha!” is on its website.

**AI-BASED ALGORITHMS AND FRAUD DETECTION**  
 Algorithm is a set of programs, instructions or other problem-solving operations followed by computers. AI is very efficient in detecting patterns in real-time. It uses additional behavioral indicators to find suspicious transactions and offer solution for mitigating risk. For example, Feedzai, a data-science organization, implement algorithms to find and alert e-commerce fraud.

CHART 2: FRAUD DETECTION



**DISCUSSION AND SUGGESTION**

The first aim of this study was to find the implementation possibilities of model & application of Artificial Intelligence in India's Banking sector. Researchers have arrived at this aim and concluding that the common of data found was that Artificial Intelligence as an extremely useful technology with great potential of benefiting the Indian banking sector by boosting its implementation of its strategies. From an implementation viewpoint, it was found innovation dynamics, determinants and direction of Artificial Intelligence adoption and usage. Scholars have also delivered upon implications such as security, accuracy, privacy etc. Second objective of this study was to verify the state of affairs of Artificial Intelligence application in the Banking sector. Response to this central research question i.e. “What was the part of Artificial Intelligence in successful policy implementation in the Indian banking sector “was found” Accenture Banking Technology Vision 2017” says that 87% of India’s bankers accept Artificial Intelligence can enable banks with intelligent machines which create very human-like customer experience.

India's banking sector seem positive about Artificial Intelligence as its advantages are visible in positioning banks powerfully in multiple strategic area – Financial (decline of cost and increase in profitability), Human beings (surveillance, fraud discovery, acquittal human executives for more value add jobs), Operational (error-free, easy & automated use of resources) and Leadership (optimized alternative making, business encouragement & growth, customer pleasure). Sophisticated algorithms of Artificial Intelligence can optimize financial policy, can help in revenue creation models and can develop a host of other personalized tools for banks. As the conclusion of this study, India's banking industry is surely seen as all located to collaborate with Artificial Intelligence to attain success in its strategy execution, after all, life is all about keeping swiftness, evolving and altering with the passage of time.

Third purpose of this study was to investigate the capability of Artificial Intelligence to carry separate results for successful strategy execution in India's bank sector. This study has done deliberations, analysis, a broad review of application of Artificial Intelligence and after identify chance as per sec. 6, it evidences some vital discovery in this area, urging bank management to analysis their current state of affairs and lastly arriving at actionable opportunity where Artificial Intelligence is helpful for operations, decision making and improve efficiency of strategy execution in various vital areas of banks. Riding on speedy technological advancement, Artificial Intelligence is increasing at an exponential way, having ability to overhaul India's banking sectors amidst varying trends of present Industry 4.0 era & India's banking sector is no longer having the magnificence to apply a "wait & watch" policy about its acceptance. The RBI shortlisted seven global consultancy firms to implement artificial intelligence in Indian banks.

## CONCLUSION

Artificial Intelligence is a favorable technology, the researcher is able to gather rich data from various secondary data sources, tracking & examine its evaluation, business verticals, applications etc. and fully examined the contribution of various scholars, to find with the research aim as mentioned above, finally reaching out to the conclusions to spot the application of Artificial Intelligence with specific reference to India's Banking Sector. The researchers have drawn practical attention of banking management to various strategic aspects of the banks having span of applying Artificial Intelligence, finally resulting into improved profitability in a sustainable way, thus providing a competitive edge to them. This study has also contributed towards a knowledge storehouse which helps in quickly picking up and applying most recent Artificial Intelligence innovations in various strategic areas. Hence, the implementation of artificial intelligence, it attracts more customers, and it helps bank for expansion. Banks can implement AI to satisfy the client experience with immediate response and automated cash withdrawal, deposit, online transitions, secure and fraud detection. The automated bank can reduce the work force of satisfying customers and make more concentrate on investment part. Thus, it can be concluded that with proactive application of AI in India's banking sector, effectiveness of its strategy implementation can be improved significantly.

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