



## The Role of Artificial Intelligence in Banking for Leveraging Customer Experience

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### Abstract:

*Purpose:* In light of digital advancements, banks need to create customer experiences that strengthen loyalty and trust. For establishing a strong digital banking base, it is crucial for banks to make their processes efficient and fast. The purpose of the paper is to analyze the efficacy of banking functions on implementing Artificial Intelligence for enhancing customer engagement and improving customer satisfaction. It targets banks in metropolitan cities of India having tech-savvy customers, leading a fast-paced life who desire personalization and expect faultless and seamless services.

*Methodology:* The study focusses on front, middle and back-office banking processes. The data for middle and back-office processes is collected through 10 interviews of senior officials and head of IT team in major banks. Literature review and theoretical research is carried out for various international and Indian banks with respect to the integration of AI to improve customer interactions and internal banking processes. For understanding the front-office user experience with AI-Banking, data has been gathered through a survey regarding usage of Chatbots on online banking platforms. A quantitative analysis using the Relative Importance Index reveals major use-cases ranked by customers. Spearman correlation is applied to find the relationship between the two most popular use-cases.

*Findings:* The research paper reveals banking features integrated with AI. Chatbot use-cases on banking platforms are ranked based on customer experience. It is proved that there is a positive correlation (0.247) between the two most popular use-cases. The paper proposes IT Architecture and best practices for the digital banking sector.

*Practical/Theoretical implications:* Based on the complete picture of AI integration with banking operations, evolving Indian banks could focus on the most popular use-cases to attract customers. A comparison with the features developed for various banks may provide a way for growth in the digital banking sector. The correlation between Chatbot use-cases may benefit the established Indian banks to further expand business.

*Originality/value:* Implementation of AI in banking is identified for Indian Banks. It is proved that if a person uses Chatbot for assistance in customer service, they are likely to use Chatbot for recommendation regarding offers and discounts.

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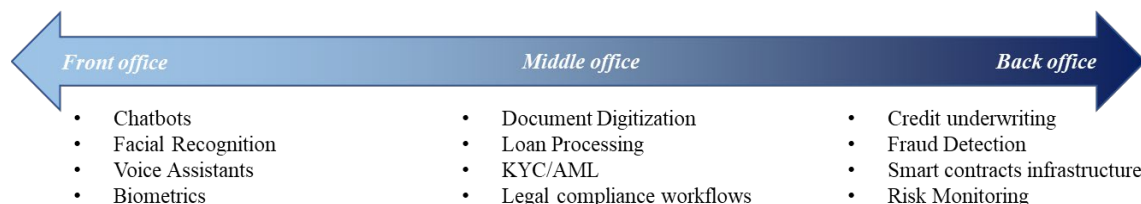
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## Introduction

Artificial intelligence (AI) is becoming more and more integrated into our daily lives, and banks must employ AI at scale to stay relevant. McKinsey forecasts that AI solutions would increase the value for the global banking industry up to \$1 trillion per year. (Biswas & Carson, 2020). AI technologies lead to increased customization of services to customers and employees, thus boosting revenues. Automation of internal processes increases efficiency and lowers the overall cost. The system minimizes errors with improved resource utilization. This unveils new opportunities for improving banking processes through valuable insights.

The purpose of the paper is to identify banking processes that could be optimized through AI integration and analyze them for enhancing customer engagement and improve sales. It targets Indian banks in metropolitan cities having tech-savvy customers, leading a fast-paced life who desire personalization and expect faultless and seamless services. The data collection is separately carried out for back-office operations and front-office customer experience.

Within a bank, many repetitive and clerical tasks are required for back-office operations. These activities become cumbersome and take a lot of time to complete. Large volumes of chained processes run on legacy systems. Often, many employees are found processing a single customer request. Also, such manual processes are costly and might lead to varied or erroneous results. In order to overcome such issues of time, cost and error, it is essential to upgrade the processes with the latest technology. (McBride, 2019) Cloud computing, Machine Learning models and processing huge amounts of data simultaneously, have marked way for AI solutions. NLP, a branch of Artificial Intelligence can help banks automate tasks such as gathering customer information and searching documents. Machine learning algorithms could reduce risk and help in financial forecasting and cross-selling.



**Fig. 1: Use-cases of Artificial Intelligence in Banking**

According to McKinsey’s global AI survey support, implementation of virtual assistants and conversational interfaces at the front-office form about 32 per cent of the total AI technologies. (Biswas & Carson, 2020) As the use of digital banking grows, so are client expectations. During the emergence of the COVID-19 epidemic, use of online channels through internet grew up to 50 percent all over the world, and this trend is projected to continue even when the pandemic has passed. In the near future, between 15 and 45 per cent customers might permanently reduce branch visits. (Euart & Ferreira, 2020) Thus, it is essential to improve and maintain a seamless digital banking platform for the customer. Assistance and Recommendations provided by Chatbots 24/7, greatly enhance the customer banking experience. Most of the queries regarding account balance, transactions and credit card payments could be resolved via text messages on banking platforms.

The findings from this paper may benefit the digital transformation of AI banking in India. It highlights the major banking functions in India, that could be upgraded with AI systems. With the help of survey results, it sets a priority for use-cases of Chatbot assistance and Chatbot recommendation. Additionally, it proposes the latest technological architecture along with the Fintech support for numerous evolving banks.

## **Literature Review**

This comprehensive study is conducted with the help of some existing work completed by researchers.

With the advancement of technology, banks have been pressing on to acquire digital transformation. In order to achieve this shift, it has become crucial for banks to accelerate back-office workflows and processes. It is equally important to be customer-centric and come up with better service techniques. Artificial Intelligence and Big Data Analytics have enabled data driven systems to serve the customer in a better way. This has led to an ease of customization for a wide range of features, thus enhancing customer involvement. The empirical study reveals banking functions that use AI and BDA technologies in global as well as in the Indonesian banking sector. The data collection is achieved through interviews. Enterprise architecture is proposed as the best practice. (Indriasari, Gaol, & Matsuo, 2019).

The empirical study focuses on the front-end customer experience through Chatbots on the basis of three variables namely System, Information and Service. A hypothesis testing is carried out to check if the relationship between the three quality dimensions and customer experience is moderated by perceived risk. The findings help banks to establish the consumer and brand relationship by offering chatbots that fulfill customer requirements. The data collection is performed through a survey. (Trivedi, 2019).

Another paper highlights the applications of AI attending to automation of banking functions and customer engagement. The results display an intelligent framework for banking and financial institutions which may improve their business. The theoretical study is conducted for global banks. (Agarwal, 2019).

Another theoretical study shows the capability of AI to promote new ways of connection with customers, understand their expectations, and adjust to robust services provided by firms to stay ahead of the competition. Additionally, it facilitates quick responses to customer queries and across many use-cases. This study also demonstrates that proper AI technology adoption can redefine traditional banking procedures. The research focusses on Mastercard (U.S.A.), Royal Bank of Scotland (Scotland) and Caixa Bank (Spain). (Gallego-Gomez & De-Pablos-Heredero, 2020).

A methodical study proposes a complete model using text mining of social media data based on classification methods and sentiment analysis to gauge customer expectation from services and financial advice. It uses NLP (Natural language processing) for K- clustering. The data is collected for global banks. (Sumathi & Sheela, 2017).

In order to better understand bot advisors among the customers, another empirical study is carried out. Hypothesis is developed on the usage of bot-advisor services due to personal and sociodemographic variables. It is found that that users with a higher level of familiarity with robots

are slightly more affected by customer utility and attitude; in turn, users with a reduced level of familiarity and customers from Anglo-Saxon countries are significantly more impacted by subjective norms. The paper focuses on North America, Britain and Portugal. (Belanche, Casaló, & Flavián, 2019).

A theoretical study explains banking processes combined with AI Technology for commercial banks. It is found that with the usage of AI, banks can reduce credit risk, enhance payment security, automate compliance-related operations, and boost the overall business. The paper discusses AI capabilities facilitating consumer acceptance by assuring clarity, privacy, and proper documentation. Finally, it proposes a research technique for behavioral finance. (Königstorfer & Thalmann, 2020).

Another research focusses on the usage of Chatbot technology in the educational sector. In order to enhance customer experience, it is essential to identify the factors that affect the front office Chatbot interaction with students. This quantitative study uses surveys for data collection from higher education institutes in India. The findings and outcomes benefit the students by providing a better learning experience. (Sandu & Gide, 2020).

An article examines foreign countries' experiences with both the implementation of cutting-edge AI technology in the banking industry and underlines the necessity for the Russian banking sector to shift to a more innovative model of operation as soon as possible. Also, it identifies ways for the banking industry to undergo digital transformation. (Vaganova, Bykanova, Mityushina, & Mohanad, 2019).

## **Problem Statement**

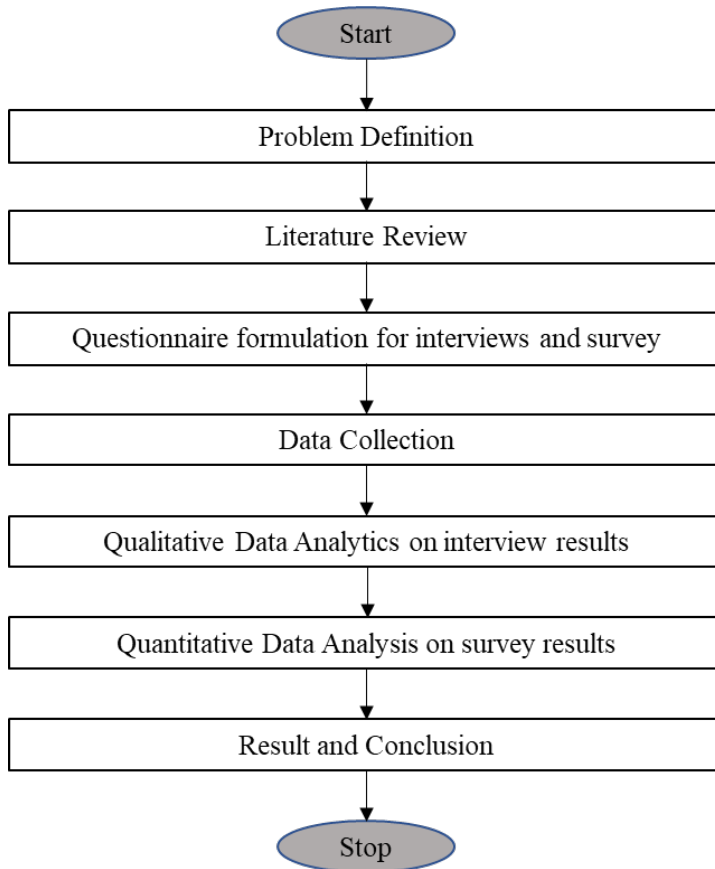
There are a lot of banks in India who have integrated AI with their banking functions. However, there are yet many banks who struggle with the idea of shifting to such a change. The idea of this study is to reiterate the need and importance of implementing AI in banks by highlighting its role in the front, middle and back-office operations in the bank to enhance customer experience and improve business.

Research questions answered in this paper:

1. Which Banking functions use AI technology?
2. What is the use-cases for Chatbot interaction in Indian Banking?
3. Is there any relationship between Chatbot Assistance and Chatbot Recommendation?
4. What are the essential elements to be embedded in the IT architecture to achieve AI integration?
5. What are the challenges faced by the banks to implement AI systems?

## **Research Methodology**

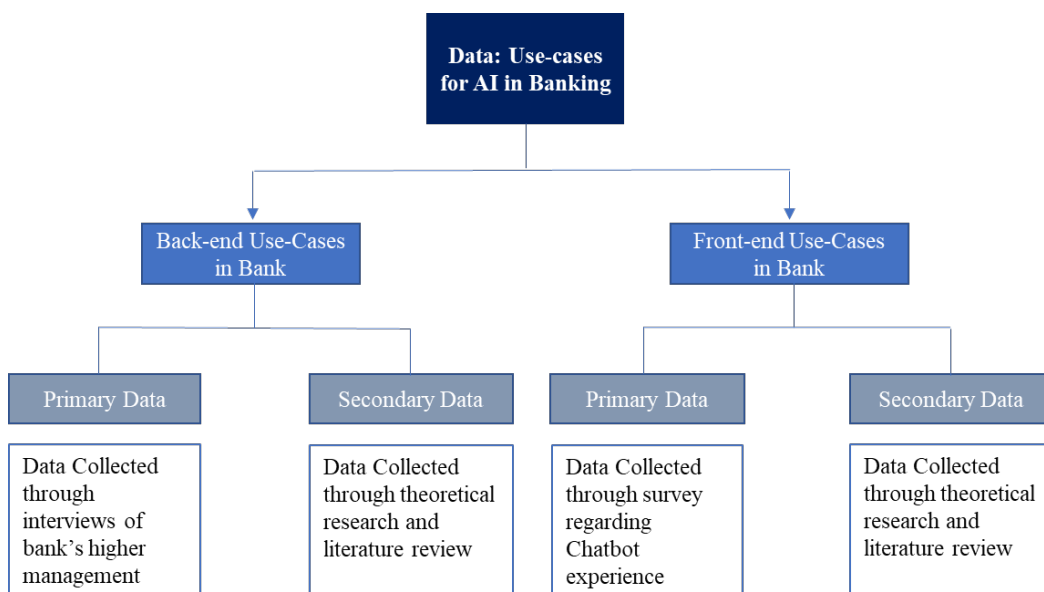
*(A) Research Process Flow Chart*



**Fig. 2: Research Process Flow Chart**

*(B) Data Collection*

The data has been gathered for both back-end and front-end operations in the bank.



**Fig. 3: Data Collection**

- *Back-office processes:* Interview Questionnaire has been created for the higher management officials, head of the IT team in various banks to collect primary data related to middle and back-office use-cases.

*Sample Size:* 10

S.No	Questions
Q1	Has your organization implemented Artificial Intelligence (AI)?
Q2	If you have implemented AI, what features have been developed?
Q3	In which banking functions are you using it?
Q4	How has the use of AI improved the customer engagement for the functions?
Q5	In your opinion, how is the use of AI leveraging customer experience?
Q6	What potential application will be prioritized to implement AI to enhance customer experience. Please describe.
Q7	Could you please describe the IT architecture of your Digital Banking that includes the implementation of AI?
Q8	What are the challenges and risks involved?
Q9	What steps have been taken by your organization to mitigate them?

**Table 1: Interview Questionnaire**

Secondary data has been collected from the previous works of researchers and the information available on websites.

- *Front-office processes:* A survey has been conducted to collect primary data for Chatbot use-cases.
  - ❖ *Target Population:* Tech-savvy customers of various banks
  - ❖ *Sampling Frame:* Customers of Indian banks
  - ❖ *Sampling Unit:* Bank customers using online banking platforms
  - ❖ *Elements:* All individuals who meet the above three criteria
  - ❖ *Sampling Technique:* Stratified Random Sampling
  - ❖ *Sample Size:* 139

*(C) Major Concepts:*

- *Data Coding:* A method is adopted to develop codes or words from the collected data. Here, Inductive method is applied to categorize various terms and phrases present in the interview responses. It ensures that the complete interview response is captured with least amount of bias. The criterion is not pre-defined and is formed with respect to the response data. These codes are then categorized with the help of Flat Coding Frame. This frame allows to keep equal weightage for every code. Lastly, a word-cloud is obtained to check the frequency of the codes or keywords on the basis of which further analysis is carried out.
- *Relative Importance Index (RII):* The method is used on the survey data capturing customer interaction with Chatbots. This interaction is quantified as different use-cases in a Likert scale. It is crucial to identify the priority of use-cases in order to have a better digital interaction with the customer. RII on Likert scale is used to

identify the most significant use-case by establishing a ranking mechanism and thereby revealing their importance.



Fig. 4: Relative Importance Index (RII) method on Likert Scale

- *Spearman Correlation Test*: The method is used to check the existence of any relationship between the most significant use-case of Chatbot Assistance and that of Chatbot Recommendation. This test measures the strength and direction of a monotonic association between the two ranked ordinal variables.

❖ *Spearman correlation coefficient ( $r_s$ )*: This value lies between -1 and +1.

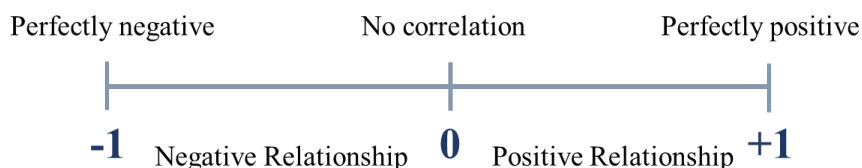


Fig. 5: Range for Spearman coefficient

❖ *p value*: This value signifies whether to reject the Null hypothesis or not.

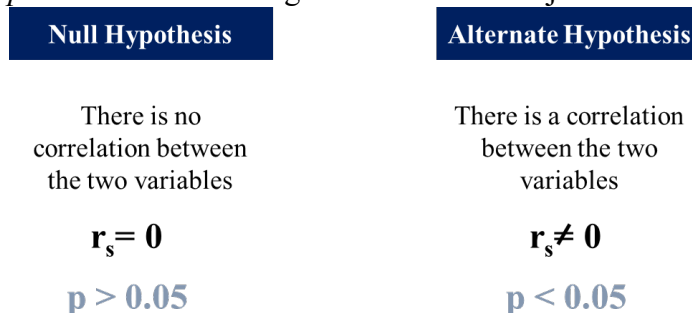


Fig. 6: Link between p-value and Spearman correlation coefficient

The probability of rejecting the null hypothesis when it is true is denoted by alpha ( $\alpha$ ). For this study, alpha is assumed to be 0.05.

## Data Analysis

- *Qualitative Analysis on Interview Data*: Identify the banking functional areas where AI technologies can be used for better efficiency leading to enhanced customer experience.
  - Inductive coding method is used to interpret the interview responses
  - Flat coding frame is used to categorize the keywords
  - A word cloud is created to check frequency of keywords
- *Quantitative Analysis on Survey Data*:
  - Descriptive Statistics
    - ❖ Demographic data is captured for the respondents
    - ❖ Names of Indian Banks are listed which provide platforms for online digital banking to the respondents
    - ❖ Likert scale responses are recorded for two use-case groups- Chatbot Assistance and Chatbot Recommendation

- ❖ Microsoft Excel and SPSS are used for ranking of the use-cases using Relative Importance Index
- Inferential Statistics
  - ❖ Check whether there is any significant relationship between the most popular use-case of Chatbot Assistance and Chatbot Recommendation
  - ❖ SPSS is used to check the Spearman correlation between variables

## Results and Discussion

### *(A) Application of Artificial Intelligence in Banks*



Fig. 7: Word cloud for Interview results

The interview results reveal major use-cases of Artificial Intelligence in the Indian banking sector. It also highlights some elements of IT infrastructure essential to implement the latest technologies. AI enabled Chatbots are widely used on online banking platforms to enhance customer engagement. They provide 24/7 support for assistance and recommendation. AI helps to create credit scores for loan applicants and ensures error detection in provided documents. With the use of Machine learning models, it is easy to predict the repayment behavior of a prospective customer. The latest technologies of Optical Character Recognition (OCR) and Natural Language Processing (NLP) allow document scrutinizing and digitization. Predictive analysis facilitates sales and cross-selling of banking products. These features also provide an assessment for customer sentiment analysis towards a particular product. Big data enables faster processing of bulk data also ensuring backup. AI- based fraud detection strengthens the security system by detecting fraudulent transactions, scams, false insurance claims and anomalies.



Features	Indian Banks
Chatbot	State Bank of India, HDFC Bank, ICICI Bank, Axis Bank, Bank of Baroda, Andhra Bank, Kotak Mahindra Bank, Canara Bank, City Union Bank, Yes Bank, IndusInd Bank
Loan Processing	Axis Bank, State Bank of India, HDFC Bank, ICICI Bank, Yes Bank, Federal Bank, South Indian Bank, Bank of Maharashtra, Central Bank of India, IDFC Bank, IndusInd Bank
Biometric Authentication and e-KYC	State Bank of India, ICICI Bank, Axis Bank, Kotak Mahindra Bank
Fraud Detection	Punjab National Bank, IDBI Bank, City Union Bank
Bulk Transaction Processes	ICICI Bank, Axis Bank, Allahabad Bank, City Union Bank
Document scrutinizing & Digitization	ICICI Bank, Axis Bank, Yes Bank, Bank of Baroda
Risk Monitoring	State Bank of India, Axis Bank, IDBI Bank, HDFC Bank
Sentiment Analysis	State Bank of India, ICICI Bank, Kotak Mahindra Bank
CRM	HDFC Bank, IDBI Bank, Allahabad bank
Customer Segmentation	State Bank of India, HDFC Bank
Sales and Cross-selling	State Bank of India, HDFC Bank
Credit Assessment	State Bank of India
International remittance	ICICI Bank
Business Reports	State Bank of India
Wealth Management	State Bank of India
Marketing	State Bank of India

**Table 2: Implementation of AI for Indian Banks**

Use of Chatbots on banking platforms and back-office loan processing are the most common use-cases in Indian banks for AI implementation. The State Bank of India appears to have maximum features integrated with AI.

Bank	Functional Area
Citi Bank	Fraud Detection, Document Digitization, Chatbot
Deutsche Bank	Credit Assessment, Insurance policies, Chatbots, Capital optimization, Risk management, Fraud Detection, Trade Booking, Portfolio management, regulatory technology, Macroprudential surveillance, data quality assurance
United Bank of Switzerland	Chatbot, Liquidity Management, Wealth Management, Investment Banking, Trade channel optimization, Trade visibility for clients
Standard Chartered Bank	Trade document processing, Document Digitization and classification
Bank of America	Chatbot, Accounts Management, track spending habits, predictive analytics, credit assessment, text mining, anomaly detection, recommend investment strategies
Wells Fargo	Chatbot, banking transactions, review account balances, provides loan information Predictive Analytics tool for Mobile Banking
JPMorgan Chase	Anomaly Detection, Intelligent pricing, Smart Documents (Coin), News Analytics, Quantitative Client Intelligence, Virtual Assistants

**Table 3: Implementation of AI for Global Banks**

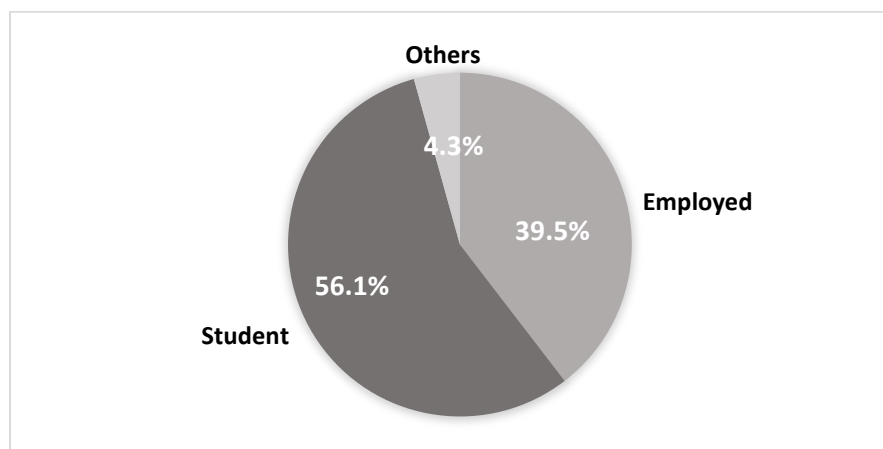
The evolution of data analytics in banks is bringing in a lot of new features for enriching customer experience and ease of business operations.

*(B) Customer Experience and Expectations with Banking Chatbots in India*

The analysis has been carried out to understand expectation of customers regarding use of Chatbots/Virtual Assistants on the banking portals.

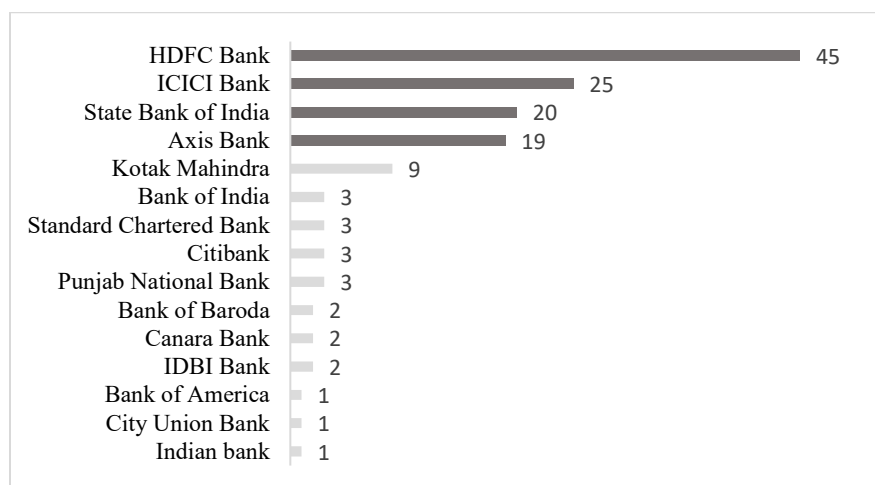
The survey is conducted for 139 respondents.

- Demographics



**Fig. 8: Use of Digital banking in India by respondents**

More than 50% of the respondents are students engaged in higher studies and conversant with digital banking. Around 40% are employed people. About 4% of the respondents consist of people who are either retired or unemployed.



**Fig. 9: Usage of Online Banking in India by respondents**

About 32% of the respondents use online banking of HDFC bank. The majority of respondents use HDFC, ICICI, SBI or AXIS bank for online banking.

- Use-cases based on Chatbot Assistance
  - *Customer Service*: Chatbots provide quick responses to the customer’s queries through sms notifications. It also records responses regarding customer feedback. The usual set of questions relate to account balance, statements, FAQs etc.
  - *Loan Decisions*: Customized information by Chatbots help borrowers to make fast decisions. Chatbots can also direct certain queries to the human agent whenever required.
  - *Financial and Securities Transactions*: Chatbots converse with customers regarding fund management and financial tasks from multiple accounts. The customer is directed to a payment page, which has auto-filled information.
  - *Bill Payment*: Chatbots help customers to pay bills pertaining to phone, water, electricity, home-rent etc. Fund transfer between accounts is another facility.
  - *Reminders about Credit card and Transaction patterns*: Chatbot sends reminder notification to the customer for credit card payment. They can analyze the historical data about spending habits, credit history and transaction history.

Use-cases for Chatbot Assistance	Highly Required(5)	Usually Required(4)	Can't Say(3)	Rarely Required(2)	Never Required(1)
Customer Service	51	50	12	25	1
Loan Decisions	23	41	30	28	17
Financial and Securities Transactions	45	43	14	33	4
Bill Payments	32	36	17	39	15
Reminders about Credit card Transaction patterns	47	39	18	26	9

**Table 4: Use-cases of Chatbot Assistance for Indian banks by respondents**

- Ranking of Chatbot Assistance use-cases using Relative Important Index
  - ❖ *Weighted score*: This mechanism is applied to quantify the response obtained in Table.4. For Example, as the weightage given to ‘Highly Required’ is 5, its corresponding weighted score for ‘Customer Service’ is calculated as (51\*5 = 255). This calculation process is repeated to obtain the below table:

Use-cases for Chatbot Assistance	Highly Required(5)	Usually Required(4)	Can't Say(3)	Rarely Required(2)	Never Required(1)
Customer Service	255	200	36	50	1
Loan Decisions	115	164	90	56	17
Financial and Securities Transactions	225	172	42	66	4
Bill Payments	160	144	51	78	15
Reminders about Credit card Transaction patterns	235	156	54	52	9

**Table 5: Weighted scores for Chatbot Assistance use-cases**

- ❖ *Calculation of RII*:

Use-cases for Chatbot Assistance	Total	Total Number (N)	A*N	RII
Customer Service	542	139	695	0.779856
Loan Decisions	442	139	695	0.635971
Financial and Securities Transactions	509	139	695	0.732374
Bill Payments	448	139	695	0.644604
Reminders about Credit card Transaction patterns	506	139	695	0.728058

Table 6: Calculation of Relative Important Index (RII) for Chatbot Assistance use-cases

Total → Sum of all weighted scores for each row calculated in Table

Total Number (N) → Number of respondents = 139

A → Total number of use-cases = 5

RII → Total/(A\*N)

- ❖ *Calculation of Rank:* The use case with the maximum RII is ranked first. From below table, Customer Service is ranked first, while Loan Decisions is ranked fifth.

Use-cases for Chatbot Assistance	RII	Ranks
Customer Service	0.779856	1
Financial and Securities Transactions	0.732374	2
Reminders about Credit card Transaction patterns	0.728058	3
Bill Payments	0.644604	4
Loan Decisions	0.635971	5

Table 7: Ranking of Chatbot Assistance use-cases using Relative Important Index

- Use-cases based on Chatbot Recommendation
  - *New Account Creation:* Chatbots recommend the type of accounts, provide step-by-step guidance for a new user on a banking platform. They help the customer to find relevant information.
  - *Budget Allocation:* Chatbots can identify patterns and trends and recommend budget based on unique spending habits.
  - *Sale Notification:* Chatbots can remember customer preferences and use historical data to suggest products. The customer is notified regarding the sale of bank products like ordering cards.
  - *Financial Advice:* Chatbots suggests users to achieve financial goals by providing investment options, tips on saving bank balance and buying stocks or mutual funds.
  - *Offers and Discounts:* Chatbots suggest customized offers and discounts to the customers like rewards and point balances.

Use-cases for Chatbot Recommendation	Highly Required(5)	Usually Required(4)	Can't Say(3)	Rarely Required(2)	Never Required(1)
New Account Creation	36	38	17	31	17
Budget Allocation	6	38	28	47	20
Sale Notifications	9	34	25	47	24
Financial Advice	39	55	15	22	8
Offers and Discounts	50	57	10	18	4

Table 8: Use-cases of Chatbot recommendation for Indian banks by respondents

- Ranking of Chatbot Recommendation use-cases using Relative Important Index
  - ❖ *Weighted score:* This mechanism is applied to quantify the response obtained in Table.4. For Example, as the weightage given to ‘Highly

Required’ is 5, its corresponding weighted score for ‘New Account Creation’ is calculated as  $(36*5 = 180)$ . This calculation process is repeated to obtain the below table:

Use-cases for Chatbot Recommendation	Highly Required(5)	Usually Required(4)	Can't Say(3)	Rarely Required(2)	Never Required(1)
New Account Creation	180	152	51	62	17
Budget Allocation	30	152	84	94	20
Sale Notifications	45	136	75	94	24
Financial Advice	195	220	45	44	8
Offers and Discounts	250	228	30	36	4

**Table 9: Weighted scores for Chatbot Recommendation use-cases**

❖ *Calculation of RII:*

Use-cases for Chatbot Recommendation	Total	Total Number (N)	A*N	RII
New Account Creation	462	139	695	0.66475
Budget Allocation	380	139	695	0.54676
Sale Notifications	374	139	695	0.53813
Financial Advice	512	139	695	0.73669
Offers and Discounts	548	139	695	0.78849

**Table 10: Calculation of Relative Important Index (RII) for Chatbot Recommendation use-cases**

Total = Sum of all weighted scores for each row calculated in Table

Total Number (N) = Number of respondents = 139

A = Total number of use-cases = 5

RII = Total/(A\*N)

❖ *Calculation of Rank:* From below table, ‘Offers and Discounts’ is ranked first, while ‘Sale Notifications’ is ranked fifth.

Use-cases for Chatbot Recommendation	RII	Ranks
Offers and Discounts	0.788489	1
Financial Advice	0.736691	2
New Account Creation	0.664748	3
Budget Allocation	0.546763	4
Sale Notifications	0.538129	5

**Table 11: Ranking of use-cases using Relative Important Index**

- Hypothesis study

The above results show that the ‘Customer Service’ is ranked the highest in the field of Chatbot assistance. Similarly, ‘Offers and Discount’ is ranked the highest in the field of Chatbot recommendation.

**H0 (Null Hypothesis):** There is no significant correlation between ‘Customer Service’ and ‘Offers and Discount’

**Ha (Alternate Hypothesis):** There is a significant correlation between ‘Customer Service’ and ‘Offers and Discount’

### Correlations

			Customer Service	Offers and Discounts
Spearman's rho	Customer Service	Correlation Coefficient	1.000	.247**
		Sig. (2-tailed)	.	.003
		N	139	139
	Offers and Discounts	Correlation Coefficient	.247**	1.000
		Sig. (2-tailed)	.003	.
		N	139	139

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 12: Spearman correlation**

The p value is 0.003 which is less than alpha value of 0.05. This implies that the null hypothesis is rejected.

There is a positive correlation of 0.247 between the two variables. This suggests that if a person uses Chatbot for assistance regarding customer service, they are likely to use Chatbots for recommendation regarding offers and discounts.

#### *(C) Challenges for AI Implementation*

Below are the challenges of AI implementation in Indian banks:

1. Many people are apprehensive of the shift from physical to digital
2. The thought of a high cost in deployment of AI technologies delays the project
3. Unskilled human resource needs training to understand the latest technology
4. Unavailability of data does not allow AI systems to perform
5. Poor quality of data may be misleading in case of fraud detection
6. To be aligned with regulatory standards of government to ensure data privacy
7. Incorrect data sources linked with e-KYC compliance AI systems may lead to security breaches
8. Unavailability of human resource with the required data science skills

Cost and technology related issues are often resolved in case of an alliance with FinTech companies.

#### *(D) Collaboration with FinTech Companies*

Today, Fin Techs carry the complete AI enterprise architecture required by banks. They provide an environment with in-built AI embedded features that can directly be used by banks.

Features	FinTech	Headquarter in India
Video KYC, OCR, Facial Recognition	HyperVerge	Bengaluru
Video KYC, Fraud Detection	IDfy	Mumbai
Video KYC, Customer Onboarding, Fraud Detection, Automation for back-office operations, decision making	Signzy	Bengaluru
Video KYC, Customer Onboarding	Syntizen	Hyderabad
Video KYC, Customer Onboarding	WorkApps	Pune

**Table 13: Startup Fin Techs in India**

*(E) Proposed IT Infrastructure for Digital Banking*

Although every bank has its own functionalities and specifications, the following points could provide an edge for growth:

- *Cloud Infrastructure:* With the increase in number of features and applications in modern banking, associated IT architecture becomes complex and costly. Banks may prefer to shift to public cloud services, private clouds built by a FinTech company or even go for hybrid architecture. This provides a cost-effective storage and flexibility of operations.
  - *On-Premise:* The licensed solution allows customization, new integrations and multiple functionalities. The customer has full control over storage, maintenance, and other safety activities, including IT staff and expenses. It is opted for long term and requires a higher budget.
  - *Software as a Service (SAAS):* It includes in-built modules and allows mild customizations. All the data is collected on a service provider's cloud server. The price of a monthly bill generally includes security support and maintenance.
- *Big Data (Hadoop):* The feature of Distributed parallel processing quickly processes large volumes of data. Hadoop makes it possible to detect fraud, monitor risks and strengthen the security system. HDFS (Hadoop Distributed File System) is capable of storing large files in separate clusters. Elements like map-reduce enables efficient data processing at nodes. Information is stored in more than one cluster which can be maintained as a backup. Data can also be obtained from social media, emails, complaint registers, forums and can be analyzed to understand the bank customers. The overall insights can also be used for cross-selling and to improve the business. Hadoop can also be used in banking for customer segmentation and credit assessment for the customers.
- *Tesseract – OCR:* Optical Character Recognition (OCR) is a technology that converts scanned, handwritten or printed text into the machine encoded text. It is useful for document scrutiny and digitization in banks. Instead of performing manual checks, OCR integrated with AI powered engine processes the documents in a faster and efficient manner. To simply construct a customer repository, the

industry is increasingly adopting OCR to archive client-related documentation, such as onboarding material. This reduces the time required to get started and improves the user experience. Banks also use OCR to extract information from cheques such as account number, amount, and cheque number for faster processing. Optical Character Recognition technology is used to extract MICR (Magnetic Ink Character Resolution) from manual bank checks. (Bhandari, 2020) Tesseract OCR is an open-source software library that can be readily installed in a python framework.

- *Spacy Library*: Another open-source software library can be used for performing Natural Language Processing (NLP) tasks. It allows connection with many statistical machine learning models suitable for workflows. It is beneficial in document processing, text mining and sentiment analysis which helps to understand customers and thus improve business.

## Conclusion

AI technologies have the capability to transform both employee and customer experience from physical to digital. It is imperative to integrate banking functions with the latest AI solutions. As identified by the word cloud, The major use-cases in middle and back-end banking are related to Loan Processing, Bulk transactions, CRM and Risk Monitoring. Most of the Indian banks have started the usage of Chatbots for customer interaction on their respective online banking platforms.

While navigating through banking sites, customers frequently tend to ask a set of common questions which can be answered in a more effective way. Customer service is found to be the most popular use-case for Chatbot assistance. Similarly, Offers and Discounts is an important topic under Chatbot recommendations. Catering to the exact requirements of the customer would not only increase their engagement but also increase brand value of the bank.

There is a significant relationship between Customer service and Offers and Discounts. It is proved that if a person uses Chatbot for assistance regarding customer service, they are likely to use Chatbots for recommendation regarding offers and discounts. Improving the Chatbot functionality in these two areas could not only increase the customer's interest but also improve business of the bank.

Banks may follow different strategies of implementing Artificial Intelligence within their processes. Some essential elements like Cloud infrastructure, big data, python libraries have been suggested for IT architecture. Collaboration with FinTech companies could also help to enable digital banking in a cost-effective and efficient way.

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