

# Artificial Intelligence Transforming Indian Banking Sector

RATHNAKAR ACHARY

Associate Professor Alliance College of Engineering and Design

Alliance University, Bangalore, India

[rathnakar.achary@alliance.edu.in](mailto:rathnakar.achary@alliance.edu.in)

**Abstract:** Artificial intelligence (AI) refers to a technology that makes inference and decisions, and mimic human intelligence, which otherwise require human involvement. The application of AI is across all industries. Regarding the financial sector it is rapidly transforming the global financial services industry into a smart system. AI applications are also overwhelming due to the use of cutting-edge technologies such as natural language processing, machine learning and deep learning. The implementation of these technologies is largely facilitated by the services companies, start-ups, banking and financial institutions. It has the potential to disrupt and refine the existing banking service industry. Objective of this research is to understand AI applications and their scope of implementation in financial sector including SME banking services. This research seeks to map the AI implementation and its present state in the banking and financial sectors in India.

**Keywords:** Artificial Intelligence, AI adaptation, Machine Learning, Diffusion, S-curve, Cyber Attack.

## 1. Introduction

As India moves towards the new economy with its vision to become an economic behemoth in this sub-continent, through adopting multiple strategies to improve the performance of banking services for delivering services to its valuable customers. Technology has overall driven a persistent ultimatum for accessibility, and innovation, and being able to have convenience is going to be something that keeps changing forever. In the process of evolving forces, the other volatile parameters are also concerned as customer's expectation, regulatory requirements, technology, demography, new competitors and, shifting economics. The main challenge is the customer may move from your bank to others, where they find the ease of operation, and comfortability to operate. How to transform from the legacy method of banking to technology-enabled services to retain the customers? Many small and medium banks (SMBs) realized digitization is the game changer and take it to the next level. Digitization is empowering and engaging customers in a non-conventional way. While doing it, we will be improving the operations, which is enabled by adopting the technology.

The role of information technology in finance allows financial institutions to continually attain new info at the same rate as their competitors. The impact of information technology on financial services will enable customers to quickly complete online transactions, which creates a better exchange in finance, allowing for faster and more efficient service. The introduction of information technology and electronic fund transfers are the twin pillars of the modern banking process. On one hand, it meets

the customers' demands, like 24/7 transactions and services without any disruptions. They also expect a high degree of personalization and quick turn-around time. We also enhance the touchpoints, while doing so, the banks also expect productivity. The percentage growth is digital in transaction using electronic clearing, mWallet, mobility banking[1], debit cards at point of sale in India is shown in figure (1).

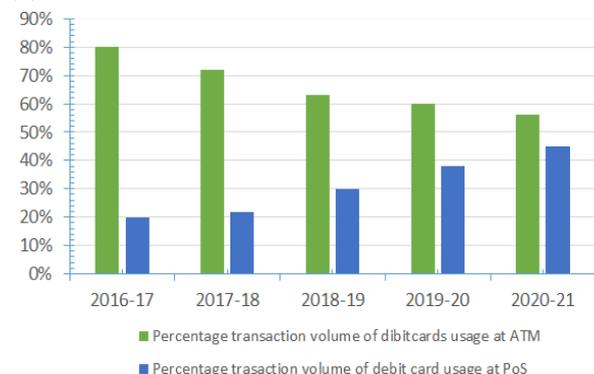


Fig.1. Technology enabled transactions  
Source: IDC 2017

On the other hand, it also improves the efficiency of the institutions by a quick bunch of products and services, better governance, risk management in place, sales and marketing efficacy, must be boosted up, and also the cost optimization. Application of artificial intelligence becomes common for building intelligence systems, and it plays significant roles in many verticals, including lending. At its core, borrowing is a Big data problem, making it a business naturally suited for machine learning. Part of the loan is tied to the creditworthiness of the individual or

company that looks out the loan. The more data you have about an individual borrower, the better you can assess their creditworthiness. AI and machine learning examine borrowers profile and creditworthiness of the customers and promises that it can analyse all these data sources together to create a coherent decision. The start-ups such as Capital Float and Monsoon Credit Tech [2][3] have designed AI based methodologies to assess the creditworthiness of SMBs to help in reducing the risk of defaulting. AI and machine learning applications uses are also reported by micro-financing companies such as Finomena (Bangalore) [4] to make lending decisions based on develop risk portfolios. For this reason, "creditworthiness" was highlighted as one of the best applications of AI in banking systems. But with all these technologies, the important one is the customer's experience. Using these technology-enabled banking services, the customers feel confident while performing the transactions without the support of any technical staff of the bank and also experience faster navigation. The bank can show the opportunities out of the problematic environment based on technology, and external partners to accomplish and create customer values to determine its success in the future. We have to consider the involvement of multiple customers in the entire supply chain, where there are corporate customers and their customers or vendors. These enablers and the collaborators are the primary entities in the value chain. The importance of IT in finance also improves data storage, file management, and data reporting, as stated earlier in this article. Cloud-based services such as Dropbox are huge roles in information technology [5], but these services play tangent roles with data reporting and analysis.

Today in many SMBs slowly and steadily, the technology has come to play a central role in reaching out to millions of customers. Technology in banking is driving efficiency and optimizing the operational cost. The total IT spend of the bank are in multiple areas to strengthen reliable infrastructure to migrate core systems, upgrade network infrastructure, business intelligence, and implement social media and Tab banking initiatives. According to Google [7] and KPMG report [6], digitally engaged SMBs grow twice in comparison to their off-line counterparts. The analysis shows that the mid-level market was growing in 2019. Millennials are expected to have the highest spending power of any generation. The small and medium banks are gradually moving towards social media, video content, influence marketing, and mobile marketing with growing strata. This digitalization enables the SMBs to adopt tactics to

access consumer's digital content. Social media helps to small and medium banks get a broader audience. They are even taken a step further to adopt analytics to help them reach out to a vast customer base with better offerings.

The early adopters of core banking systems have moved to enhanced payment offerings for customer's bulk payment like RTGS and others. Some of the modes of payment adopted by them include AEPS (Aadhar enabled payment system), and many cooperative banks live on IMPS (immediate payment service). Additional services adopted by these banks to extend the services are employing a unified payment interface (UPI). The customers of these banks can use any of the available UPI apps such as BHIM, PhonePe, Paytm, MobiKwit, and Google Pay to make transactions digitally from their cooperative bank saving accounts. The SMBs follow the RBI norms for adopting UPI [8]. Some of the most significant urban cooperative banks are the forefront in adopting the latest technology. In these banks, nearly 70% of the transactions being undertaken digitally by the customers. According to a World Economic Forum report 2018 by Bain and Company, only 1% of \$1.2 trillion digital transformation investment will achieve their set targets.

It is consequently the aim of this paper to explore how AI is as of now having and will continue having a beneficial effect in a financial domain. Since this is a somewhat unexplored field of study, this work is explorative in its inclination. Its effect is examined in the banking area of India. The fundamental explanation is that the financial service industry must be the best three industries as far as AI selection. Additionally, the banking business is encountering tremendous changes in its endeavour to automate its procedures. The three categories of AI-adopters are referring to Buhin et al., (2017) [9]. This report depicts that financial service is one of the High AI-adopters to be used for the analysis. Rest of this research paper is organised as follows; Section 2 represents the AI implication in Indian financial sectors. The diffusion of technology is analysed in section 3. The key stakeholders for the implementation of AI technologies and the Government regulations is explained in Section 4. Section 5 describes key challenges for the adoption of AI in Indian banks. Section 6 the key stockholders, section 7 provides the details about the stakeholders for the ease of implementation. In section 8 regulatory frameworks and security, conclusion and recommendation in section 9.

## 2. AI in Banking

AI is a significant step in digitizing and transforming the legacy banking business into new Indian banking systems as in figure (2). It is the adoption of computer capabilities to attain and apply knowledge without the operator's involvement. The benefits of these disruptive technologies to the financial sector are direct and quantifiable. As a result, there is greater efficiency and potential revenue growth. The implementation of AI in banking has been modest. It has been tested for many smart applications, including real-time identification and prevention of fraud in online banking as well as KYC process structurally reduce the cost in banking sectors and also increased labour productivity. Taking over the repetitive tasks into an autonomous AI-based system will lessen the demand for a less-skilled workforce.



Fig. 2. AI-adopters

Computer-based intelligence is at the highest point of-mind for financial institutions. In our research, 74% of financial institution officials said AI was incredibly or critical to the accomplishment of their organizations today, while 53% anticipated it would be vital a long time from now. The eagerness for AI is particularly extraordinary among officials who said their associations are developing a lot quicker than the regular financial institutions. Forty-eight percent of officials at more quickly growing financial institutions noted that AI was critical to their business achievement today, contrasted with 21% among administrators at more slowly developing ones.

Financial Institutions anticipate benefits in an assortment of regions. With AI holding the possibility to computerize numerous manual undertakings, approximately 75% of officials expected that their associations would increase significant or huge advantages from AI in expanded productivity/lower costs throughout the following three years. Be that as it may, cost decrease isn't the main advantage anticipated around 75% of officials foreseen that their organizations will increase significant or critical advantages from AI. As a result, over this period in expanded incomes and in the capacity to present new items/benefits or enter new organizations. About 40% of officials accepted they would increase significant advantages in every one of these zones.

## 2.1. Global Development of AI

AI systems built to observe the environment and analyses the information automatically and conclude using a large volume of data. The proliferation of the Internet has led to a vast amount of digital information being generated and stored. Last ten years, the size of the data generated worldwide is raised about 17 times and is expected to increase fivefold between now and 2025. Once cleaned and structured, this enormous volume of data is at the core of data-driven decision-making in the present high-performance computing systems.



Fig.3. AI-related Patents between the years 2010 – 2015

Leading countries around the world identified the potential economic and social benefits of developing and applying AI. By implementation of AI activities in business, China and UK estimated an increase in their GDP of 26% and 10% in 2030. US, Japan, and France have published their strategies in 2017 as in figure (3). The infrastructure required to roll-out of AI and block chain, various countries planned to invest in connecting infrastructure such as 5G full fibre network, high performance computing facilities, creation of open-source software libraries are also the strategic plans. A study from NASSCOM found that by 2022, nearly 22% of the workforces will be engaged in entirely new jobs that do not exist today [11]. It is mainly due to the rapid development of AI technologies with significant implications for economics and societies.

AI start-ups received an overwhelming investment in both east and west. In 2018 almost \$ 5 billion went to AI start-ups in US, and another \$6.5 billion went to Chinese firms. The growth of technology has a higher value for the economy, and this is possible if there is a substantial increase in the number of patents in the respective field. According to IPlytics in 2019 about 2,79,145 patent applications in AI-related

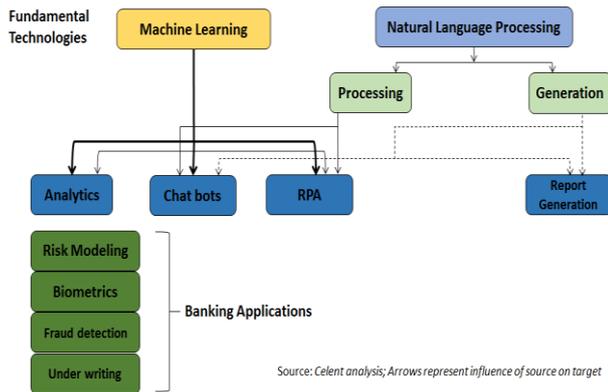


Fig. 4. AI and the fundamental technologies

Technologies has been registered. This number is very large comparing to the 2016 report [13].

The AI applications in banking, are classified into four categories.

*Customer-focused front office application* - includes credit scoring, verification of insurance policies, interactive chat-bots, and KYC check.

*The operation focused back-office application* - capital optimization, model risk management; stress testing; fraud detection – to identify the fraudulent activities.

*Trading and portfolio management* - trade execution and portfolio management.

*Regulatory compliances* – regulator technologies, macro-prudential surveillance, data quality assurances, and supervisory technologies. The number of different technologies around machine learning and natural language process support all the AI. The necessary relationship between AI and the fundamental techniques and banking applications is shown in figure (4).

**AI has the potential to revolutionize the financial service sector**

Its contribution is significant in the value chain to increase the profitability and efficiency in operation. Research conducted by Accenture provides a framework for evaluating the economic impact of AI for G20 nations. It also estimated an annual growth rate of India by 1.3% point by 2035. AI has the potential to add ~1Trillion to India's economy by 2035 [14]. For better-processed data, the leading financial institutions now embedding analytics in their products, processes, services, and many other vital activities. Once they build a relational data warehouse to store structured data from specific sources, now they are operating Data Lake with large scale distributed file systems. It captures, stores, and instantly updates the structured and unstructured data from a variety of sources and provides more comfortable and faster access. Cloud technology, on

the other end, makes the financial business more agile and innovative. The efficiency of the technology-enabled financial institutions depends on the efficient data transformation technique they adopt. A poor-quality data input with limited validation; incompetent data architecture with numerous legacy IT systems with poor executive-level participation will be an obstacle to reaping its benefits. AI adaptations in Major sectors in India is shown in figure (5).

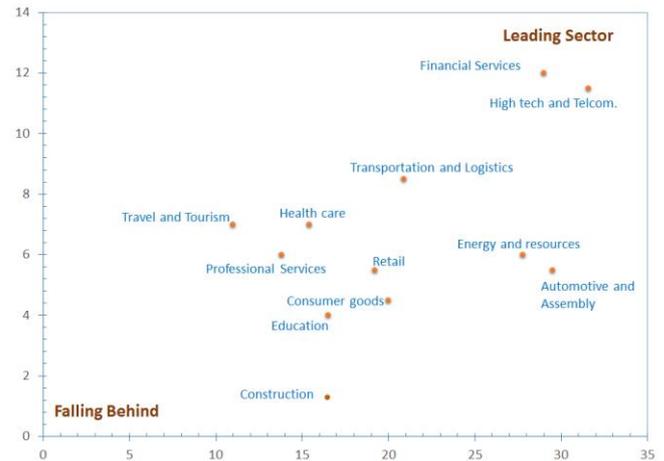


Fig. 5. AI adaptations in Major sectors in India

**2.2. Mobilize the bank to deliver value**

Adopting appropriate data architecture and data governance will be the key to successful data transformation. The banks follow an approach driven by use cases. The three criteria adopted by the banks for the implementation are;

- i. Identify the data it needed for key use cases and prioritize those data domains that include it. Generally, 20% of data empower 80% of use cases.
- ii. The bank plan for the implementation of data architecture and governance.
- iii. The banks set-up a cross functional team for each data domain.

This team includes data experts, data architect, data engineers, data-quality engineers and platform engineers as in figure (6). The team will identify the important data characteristics such as, data source, data quality, data cleansing, data dictionary and map data lineage for its instigation into data-lake.

**2.3. Power of ML to Handle Invisible Business**

In many SMB's and mid corporate companies, the relationship managers are struggling hard by dedicating their energy to identify the need of the untapped customers. The studies result reveals that 25% of a bank commercial customer usually account

for 85% of the revenue. The remaining 75% represents the long tail of untapped potential as in figure (7). These technologies enable to transforming the customer experience is drifting basic transactions to self-service channels, and complex transactions to agent essential channels. The banks investing on the technologies that enables customer service professionals to have more effective interactions with customers, which enables to Cross selling and better Client knowledge. Some of these technologies are Cogito – which provide a live feed-back about the customers to the customer care agents [15]. Application such as Verint uses speech analytics that adoptive more personalized interaction with customers. The results obtained by these technologies are also helpful to categorize the customer and assess the revenue per customer.

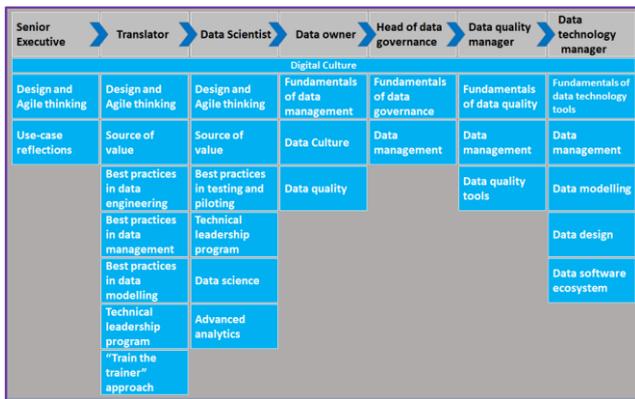


Fig.6. New role in banks to compete effectively in a data driven market

Many banks adopted the disruptive technologies like machine learning based systems for improving their commercial performance. To name a few of them; the banks in North America (US bank and TD bank), banks in UK (Barclays Bank and Lloyds), banks in Latin America (Itau and Banco do Brazil), and in Europe (ING, Banco Santander and BBVA). These advanced techniques have proven effective in diver's customer segments like SMB and large corporate customers.

Due to technological innovations in developing counties, multiple technologies enter the market and compete for the adoption. A technology before it penetrates the whole market, another technology will be released and attempts for its adoption by non-adopters. Diverse research conducted shows that adoption of a new technology increases with time. The diffusion of an innovation through a certain channel over time is described in the model below.

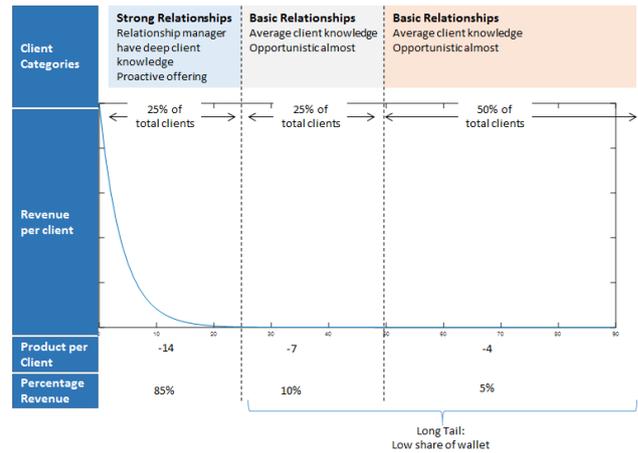


Fig. 7. Cross selling effort and Client knowledge

### 3. Diffusion

The components of innovation dissemination include development, procedures to popularize the technology propagation, time, and units of social framework. Many techniques are followed to set a path way in phases of envisioning, nurturing, illustrating, advancing and continuing technologies. Diffusion is considered as the phase after development and advancement of an innovation. Diffusion process generally goes through separating, adapting and acceptance of an innovative technology. Numerous creations might possibly arrive at the phase of diffusion. The diffusion procedure is generally represented by an S – curve as in figure (8). Three stages in this curve are initial slow growth section, a rapid take-off period and a flattening of growth signifying the near completion of diffusion.

Diffusion curve is a plot of collective adoption versus time diffusion modelling. This captures the diffusion procedure in a mathematical model that permits enumerating the diffusion parameters for additional analysis. Models can be employed to illustrate the diffusion rates and assess the parameters that measure the coefficients of diffusion in each situation. Since 1960 researchers used diverse diffusion models, to capture this diffusion pattern and their representation in mathematical expressions.

Demonstrating technology diffusion method was at first derived from the theory of evolution of biological cell in a medium. Since the development of a cell would be constrained because of restricted nutrients or space, it would decrease gradually and saturate producing an S-curve shape. Correspondingly, technology diffusion models accept that the development of technology or an advancement is reliant on the absolute potential adopters and the pace of increment in represented by

the accompanying fundamental diffusion condition alluded to as the internal effect diffusion model.

**3.1. Diffusion Model for Technology Adoption**

Now consider the different variables and parameters of diffusion model for a new technology. These parameters include the total number of adopters for time  $t$ , is,  $k(t)$  which is a variable and the number of potential adopters as  $K$ .

The number of actual adopters of the technology are  $K - k(t)$ . The non-adopters are influenced by the positive information communicated by word of mouth, by the actual adopters enables to adopt the technology. The rate of change in the number of adopters  $k(t)$  over a time  $t$  is,

$$\frac{dk}{dt} = ck(t)[K - k(t)] \dots\dots\dots (1)$$

Where  $c$  is a constant Consider  $f(t) = \frac{k(t)}{K}$

Now the equation (1) can be written as,

$$\frac{df}{dt} = c' f(1 - f) \dots\dots\dots (2)$$

By analysing this model, it is clear that,

$$k(t) \leq K(t) \quad f(t) \leq 1 \quad \frac{df}{dt} \geq 0$$

$$\frac{d^2 f}{dt^2} = c'(1 - 2f) \frac{df}{dt}$$

$$\frac{d^2 f}{dt^2} > 0 \quad \text{for } f < \frac{1}{2}$$

$$\frac{d^2 f}{dt^2} = 0 \quad \text{for } f = \frac{1}{2}$$

$$\frac{d^2 f}{dt^2} < 0 \quad \text{for } f > \frac{1}{2}$$

When  $f < \frac{1}{2}$ ,  $\frac{df}{dt}$  increases

Also  $f > \frac{1}{2}$ ,  $\frac{df}{dt}$  decreases

From the above expressions it is clear that  $f(t)$  or  $k(t)$  increases when  $k(t) < \frac{K}{2}$  and its

value decreases when  $k(t) > \frac{K}{2}$

Also, for  $f = \frac{1}{2}$  or  $k(t) = \frac{K}{2}$  there is a point of inflexion. Figure (8) S-curve represents the above changes. From equation (2)

$$\log \frac{f}{1-f} = \log \frac{f_0}{1-f_0} + c't \text{ or}$$

$$\frac{f}{1-f} = \frac{f_0}{1-f_0} e^{c't}$$

Where  $f_0$  is the value of  $f$  at  $t = 0$

In the above expression, when  $t \rightarrow \infty$ ,  $f(t) \rightarrow 1$  or when  $t \rightarrow -\infty$ ,  $k(t) \rightarrow K$

This indicates that innovation must wait for a very long time to reach all the potential adopters. Also, there is a possibility to adopt the new technologies than the old one. This behaviour of the technology adopters is clear from the asymptotic behaviour of the curve. The technological innovations release multiple technologies to the market for the same time. As a result an internal competition is developed among them. The factors influence the technology adopters is analysed by a model as below.

Consider there are five technologies entered in different time, competing in the market for adoption. The number of adopters of these technologies at time  $t$  are.

$$k_1(t), k_2(t), k_3(t), k_4(t) \text{ and } k_5(t)$$

The number of those who have not adopted till time  $t$  are.

$$K - [k_1(t) + k_2(t) + k_3(t) + k_4(t) + k_5(t)]$$

Let these technologies entering into the market in different time intervals as;

$$[0, T_1], [T_1, T_2], [T_2, T_3], [T_3, T_4], [T_4, T_5]$$

If the first technology is adopted during the time interval,  $[0, T_1]$  the model due to one technology is,

$$\frac{dk_1}{dt} = ck_1(t)[K - k_1(t)], \quad 0 \leq t \leq T_1$$

During the second time interval  $[T_1, T_2]$  there are two technologies, the model is;

$$\frac{dk_1}{dt} = ck_1(t)[K - k_1(t) - k_2(t)] - c_1 k_1(t) k_2(t)$$

$$\frac{dk_2}{dt} = c_2 k_2(t)[K - k_1(t) - k_2(t)] - c_1 k_1(t) k_2(t)$$

In the third time interval  $[T_2, T_3]$  there are three technologies, the model is;

$$\begin{aligned} \frac{dk_1}{dt} &= dk_1(t)[K - k_1(t) - k_2(t) - k_3(t)] - d_1k_1(t)k_2(t) \\ &\quad - d_2k_1(t)k_3(t) \\ \frac{dk_2}{dt} &= d_4k_2(t)[K - k_1(t) - k_2(t) - k_3(t)] + d_1k_1(t)k_2(t) \\ &\quad - d_3k_2(t)k_3(t) \\ \frac{dk_3}{dt} &= d_5k_3(t)[K - k_1(t) - k_2(t) - k_3(t)] + d_2k_1(t)k_1(t) \\ &\quad + d_3k_2(t)k_3(t) \end{aligned}$$

In the fourth time interval  $[T_3, T_4]$  there are four technologies, the model is;

$$\begin{aligned} \frac{dk_1}{dt} &= nk_1(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t)] \\ &\quad - n_1k_1(t)k_2(t) - n_2k_1(t)k_3(t) - n_3k_1(t)k_4(t) \\ \frac{dk_2}{dt} &= n_6k_2(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t)] \\ &\quad + n_1k_1(t)k_2(t) - n_4k_2(t)k_3(t) - n_5k_2(t)k_4(t) \\ \frac{dk_3}{dt} &= n_8k_3(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t)] \\ &\quad + n_2k_1(t)k_3(t) + n_4k_2(t)k_3(t) - n_7k_3(t)k_4(t) \\ \frac{dk_4}{dt} &= n_9k_3(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t)] \\ &\quad + n_3k_1(t)k_4(t) + n_5k_2(t)k_4(t) + n_7k_3(t)k_4(t) \end{aligned}$$

In the fifth time interval  $[T_4, T_5]$  there are five technologies, the model is;

$$\begin{aligned} \frac{dk_1}{dt} &= \lambda k_1(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t) - k_5(t)] \\ &\quad - \lambda_1k_1(t)k_2(t) - \lambda_2k_1(t)k_3(t) - \lambda_3k_1(t)k_4(t) \\ &\quad - \lambda_4k_1(t)k_5(t) \\ \frac{dk_2}{dt} &= \lambda_1k_2(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t) - k_5(t)] \\ &\quad + \lambda_1k_1(t)k_2(t) - \lambda_5k_2(t)k_3(t) - \lambda_6k_2(t)k_4(t) - \lambda_7k_2(t)k_5(t) \\ \frac{dk_3}{dt} &= \lambda_2k_3(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t) - k_5(t)] \\ &\quad + \lambda_2k_1(t)k_3(t) + \lambda_4k_2(t)k_3(t) - \lambda_7k_3(t)k_4(t) \\ &\quad - \lambda_8k_2(t)k_4(t) \\ \frac{dk_4}{dt} &= \lambda_3k_3(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t) - k_5(t)] \\ &\quad + \lambda_3k_1(t)k_4(t) + \lambda_5k_2(t)k_4(t) - \lambda_7k_3(t)k_4(t) - \lambda_9k_4(t)k_5(t) \\ \frac{dk_5}{dt} &= \lambda_4k_3(t)[K - k_1(t) - k_2(t) - k_3(t) - k_4(t) \\ &\quad - k_5(t)] + \lambda_3k_1(t)k_5(t) + \lambda_5k_2(t)k_5(t) - \lambda_7k_3(t)k_5(t) \\ &\quad - \lambda_{10}k_4(t)k_5(t) \end{aligned}$$

The S-curve shown in figure (8) represents the group of end users adopting a new technology. These categories are known as Roger's adopter categories, classified based on the innovativeness of the members of the society. Innovators are the members, willing to experience the new ideas. They contribute 2.5% of the system. 13.5% of the system users are the early adopters. 34% of the system users are early majority. The late majority also form 34% of the system and 16% are laggards.

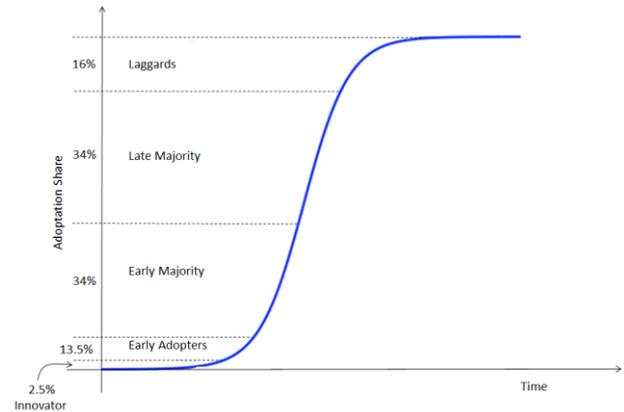


Fig. 8. S Curve – Roger's Adopter Categories

#### 4. Key Challenges for the Adaptation of AI in Indian Banks

AI tools and technologies are in transforming the banking sectors and states of Indian economy. The researchers also analysed the multiple challenges that India needs to overcome to realize the full potential of a disruptive technology like AI. Applying proper strategies for a large-scale adaptation of this sector some of the key factors to be addressed as.

- Along with the large volume of the data available, AI is viewed in the banking sector as a technique that has the potential to deliver huge analytical power. Yet many risks still need to be addressed.
- Among the many techniques developed for AI many of them remain untested and many not be ready for implementation.

The AI/ML algorithms implemented for banking applications appeared to act in ways quite unanticipated by their developers, leading to errors and flash crashes. The financial sector has introduced the fundamental AI concepts in simple time-saving functions like optical character reader (OCR), which helps to read tax returns and other financial documents. These types of AI system minimize the labour, manual data entry and costly errors by human operators. It is not limited only for the operational

level tasks; AI can perhaps replace the entire professional positions in the banking industry. A recent survey by Accenture conducted on 1300 non-executive banks staffs, 67% of them believe AI will enhance their work life balance, also 57% predicted growth in their career opportunities based on this trend [43]. AI will undoubtedly replace 1.2 million jobs in financial sectors by 2030 (autonomous researchers). The net gain in the jobs by 2022 is 14% as shown in figure (9) and there is a net gain of revenue by 34% [42].

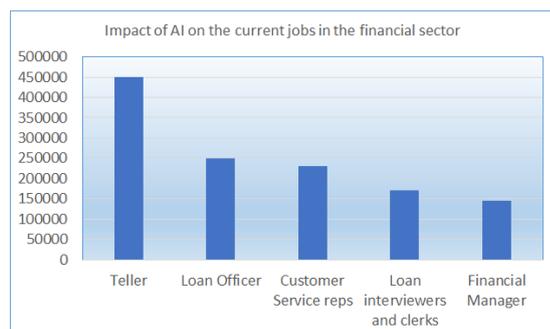


Fig. 9. Jobs that will be transformed by AI

World Bank research indicates that technology could fundamentally disrupt the pattern of traditional economic path in developing countries. It predicts automation threatens 69% of the jobs in India and 77% in China. i.e, many jobs will be lost, the mundane tasks are taken over the more efficient bots or automated. The research conducted by McKenzie Global Institute over 3000 European and American executives revealed that the early adopters of AI is expected to see an annual increase in revenue growth tapping 10%. Aggressive early adopters are also reporting elevated earning and may be forming an overwhelming advantage over their counterparts. 37% of respondents believe that Artificial Intelligence will influence the banking ecosystems in the next 5 years.

AI and its related technologies such as ML, NLP and cognitive computing offer a broad array of current and potential use cases within financial services, ranging from rob advice and next product recommendation to anti-money laundering compliance and credit card fraud protection. Most of the banks aware of the transformative potential of Artificial Intelligence. Majority of these banks are also recognized that a delay in the adaptation of AI and its related technologies, they will fall behind the competition if they don't act in the next coming years. Study indicates that as many as 15% of the financial institutions have already implanted the AI based solutions in their business. Nearly 22% of them

planning to implement in the next eighteen months. Comparing to the small financial institutions, the larger banks are faster in deploying the AI technologies.

#### 4.1. The slow pace of change

Things are changing, albeit slowly. There is a slow shift in mind-set among consumers and people compared to the movements of the banks. They are still very protective of their data. Illiteracy and poverty may be the challenges for the adoption of these technologies in the rural section of India. The other main concern is the great agility of the user to use these technology enabled services. The cooperative banks may have to address this, because they play a major role in rural India. Adopt bottom to up approach, target it first to the users who are having the smart phones to initiate the process. Experts view is, there needs to be a mind-set change at the end of the regulator as well, perhaps a push from them will make this change happen faster. State cooperative banks and district cooperative banks, which are typically located in smaller towns are slow to change. They rely more on relationships to get customers, while their urban counterparts transform faster as they compete head-on with larger private sector banks for customers. Smaller cooperative banks also face budgetary restrictions and a limited talent pool.

The community banks in the United States have already made early movements in this space, even Credit Unions in the United Kingdom are increasingly partnering with start-ups to create a better value proposition for their consumers and reach out to new ones. That is the only way available for them to remain relevant in the fast-changing times. These small banks with a customer base between 20,000 and one lakh cannot afford to have large IT teams to manage these issues. For them, transformation is possible only through a cloud service. The cloud computing is a game changer for ease of deployment and to minimize the cost of IT infrastructure investment. Many cooperative banks have directly moved their applications to the cloud, and by not using legacy IT infrastructure they have seen more savings in CAPEX and OPEX. The generally adopted techniques are in different forms like, remote deposit capture, digital wallet, and debit card, also to facilitate the cash withdrawal ATM networks are the other space identified by these banks. Technology is good and path breaking, but it comes with its own challenges on security and maintenance.

### 5. Cyber-Attack Threats

Security is the concerns of all the entity and corporation they are involved in the banking services. Online banking and transactions, and mobile payments are incredibly popular in our society today. There are a ton of vulnerabilities and it is escalating as in figure (10)(11)(12), since financial transactions are being used so much, many financial institutions have adopted the latest security mechanisms, and updated technology in order to stay up to date. Even though there are a lot of risks that are associated with the use of information technology, also there are a lot of positive aspects. Such initiatives could include digitizing the underwriting processes use of machine learning techniques and interactive risk reporting. To protect your systems and customer data from vulnerability the SMBs are adopting RBI based best practices such as Robust technology, no negligence in the early stage when there is security breach, continuous alert and mock drills related to ethical hacking is to be one.

To remain competitive in the "age of the customer" – banks must accelerate digitization across the business. Customers want accounts opened in minutes and expect banks to have access to all their data. A round the-clock availability, intuitive interfaces, real-time fulfilment and personalized treatment with global consistency and zero errors are becoming the differentiating factors, while the underlying products and services are being commoditized in cooperative banks.

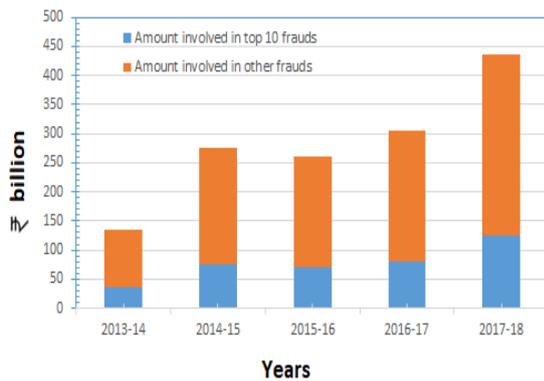


Fig. 10. Frauds reported source: RBI

The added advantages of AI based systems are to proactively monitor and prevent various instances of fraud, money laundering, and detection of potential risks in SMBs. This includes individuals spending data and behaviour to determine patterns enabling them to identify irregular transactions. The leading payment network processor MasterCard has also contributed in the development of AI enabled

technology as a part of their financial service network as a way "identifying identities". In National Stock Exchange of India Ltd. (NSE) the technology has enhanced the ability to identify market patterns and automate low complexity tasks to minimize trading risks.

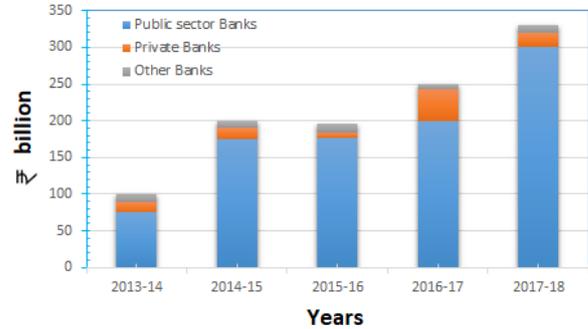


Fig. 11. Relative share of frauds Source: RBI

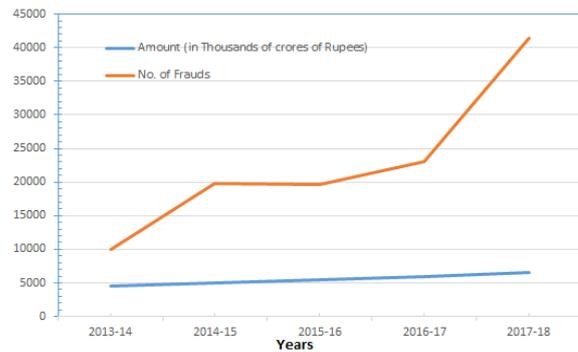


Fig. 12. Number of frauds Source: RBI

### 6. Key Stakeholders

Many stakeholders are working together for the successful adoption and the implementation of AI in banking and finance ecosystem. The stack holder ecosystem was divided into five categories as: *developers*; *government*; *investors*; *users*, *consultancy companies* and *academic institutes*. Based on the types of AI solutions provided the developers are categorized in to three types as: company, sectors and target area and AI solutions.

**Developers:** This research have identified nearly 41 domestic and 12 international AI solution developer in banking and finance. These companies are further classified based on their focus areas, to identify their key trends in AI development and their focus such as customer interface, automation of backend processes for fraud detection, and credit scoring. As a result, the segmentation is done based on their focus areas as; companies are in the field of customer interface

solution development such as virtual assistance and chatbots, four of these are the international companies; Eg. DBS bank have developed AI powered chatbots[17]. The domestic solution provider includes the start-ups such as; 3LOQ [19], Niki Ai and Jubi Ai to build payment apps to provide customer assistance [18]. Three domestic developers in the domain of risk management and fraud, in each area developed solutions. Quantx Technologies [20], NextAngels, Accuracap [21] and Fluid Ai, Thirdwatch and Instamojo respectively [22][23].

There are four domestic and international developers developed AI based personalized services to their customers. These systems perform data analytics and assist the banks based on the customer performances and provide services based on them. The contribution of the different start-ups such as MonsoonCreditTech, Earlysalary, Paymatrix and Rupeeland are significant. The role of AI in banking are many folds; they reduce manual work to enhance the efficiency, through many technologies such as creditworthiness (CreditWatch) automating approvals (Slicepay) and Credential verification (Signzy). Also, developers such as Infosys Finacle [24], Fundexpert and Yana AI developed the applications in providing business strategy insights and credit assessment.

**Government:** Government agencies play a key role in regulating financial system, capital market, insurance and other sectors. Research have identified eight key stakeholders, their impact on technology application in banking sector. Three of them have direct impact on the AI in banking systems. The financial regulation body of India RBI has established inter-regulating working group on FinTech and Digital Banking to perform research and development activities related to banking technologies and the use of AI related technologies [25][26]. Also established the Institute for development and research in banking technologies in Hyderabad [27]. The key initiative under Digital India and AI task force have promoted AI applications in banking sectors.

**Investors:** The start-ups working on the development of AI enabled banking applications funded by various investors. This encouraged the development of AI applications in banking sectors. Omidyar Network, Indian Angle Network and Sequoia are the main investors.

**Users:** Survey conducted to know about the use of AI applications, identified 24 premier financial

institutions such as banks, finance companies and payment Apps are using technologies enabled with AI. The leading banks included in this list are SBI, ICICI bank, Bank of Baroda and Kotak Mahindra Bank[29][30][31]. They are using AI in the form of chatbots as well as to automate the backend process. The finance companies such as Tata Capital and Microsec Finance are the prominent in using chatbots. The Bombay Stock Exchange started using data analytics and AI based system to track social media updates of the listed companies [32][33][34]. To improve the customer interface and fraud detection the most prominent AI enabled apps are Paytm, Oxygen Wallet and Instamojo.

#### **Consultancy companies and Academic Institutions:**

The studies also identified the other stakeholders using AI are the consultancy companies and academic institutes. Various research institutes including IIM Calcutta and IDBRT Hyderabad have published research papers on AI in banks and finance [27]. RBI also published their research on AI applicable to financial institutes. HDFC Bank started working closely with academic partnership. Infosys, Deloitte, Swissnex India, PWC and ADB are the industry agencies are also publishing the important reports related to AI in banking sectors.

## **7. Regulatory Framework**

There are not any specific dedicated policy regarding to AI in India. Some of the existing laws, which would be applicable to certain aspects of AI's application in finance. However, there are some emphasise on the regulatory framework due to the evolution of financial technologies. Banks are predominantly been the leading financial intermediary with a wider landscape under the guidelines of Reserve Bank of India. It has been seen that due to the rapid rise of alternative payment and banking services, the growth of e-Commerce and emerging digital financial services there is a significant growth and contribution to the Indian economy.

Regulatory authorities such as Securities Exchange Board of India (SEBI) and Insurance Regulatory Authority (IRDA) become the statutory bodies framed the regulations to protect the investors, regulations of the financial system and the regulations for private sector insurance companies [28]. In the finance sector Big data and AI are used for financial profiling, social profiling, behavioural profiling and location-based profiling are analysed for decision making. Such practices raise questions about traditional privacy norms. It requires to revisit

to some of these norms in the implementation of AI. *Section 43A* of the *IT Act 2000*, is restricting the inclusion of financial information for the application of AI strategies in banking systems [35]. The section directs to follow reasonable security measure during the handling of financial data of the investors. Such information being protected for unauthorized access, damage, tampering, use and disclosure. Failure to this will be liable to compensate to those affected. Many aspects like this would be revisited during the development of AI application in finance sectors.

These restrictions include the mechanisms around collection, consent, notice and disclosure. According to the data protection framework by *Srikrishna committee* "the data protection law should cover both manual and automated processing" [36]. The credit worthiness of the customers is used by the AI based automated systems for decision making. The data used and the logic of the algorithms are unclear. This definition may need to be revisited as per the guidelines of the *Credit Information Companies (Regulation) Act 2005 and 2006* [37].

The other regulations related to *Payment and Settlement Systems Act 2007*, and the *Banking Regulation Act 1949*, to provision the AI implementation need to be revisited [38]. The RBI has taken various directions to ensure data security and digital transactions. In 2011 RBI established Information Technology Risk Management and Cyber Fraud Committee and issued guidelines on nine key areas: IT Governance, Information Security, Information System Audit, IT operations, Cyber fraud, IT services outsourcing and other legal aspects [39]. Furthermore, Indian Computer Emergency Response Team (CERT\_In) directive is to forecast and alert cyber security incidents and charged with providing Information Security Assurance Service to relevant stake holders [40].

Many countries also adopted regulations for making decisions exclusively by using automated processing systems like the *General Data Protection Regulation (GDPR)* of European Union's [41]. In *article 22* of GDPR states "the data subject shall have the right not to be subject to a decision based solely on automated processing including profiling". This is a challenging for the AI based system for implementation, a human intervention is only option to make a final decision. AI decision making process is also affected by cyber-attacks. Hackers can flood fictitious data to impact the AI decision making. This can result a biased decision by an AI based system. The AI based system

must be built with high level surveillance and detection of cyber-attacks.

## 8. Conclusion

The AI is changing the entire business process to enhance its efficiency and services in banks and financial institutes in India. Its applications are in many folds for the ease of operations and decision making for the events such as fraud detection, and to analyse the credit worthiness of the customers. AI makes the whole process of automation intelligence in banking process. It leverages the human to machine capabilities to minimise the operational cost and improve the performance in delivering personalized services. Despite of multiple advantages AI implementation also have number of challenges for its implementation. The financial intuitions are partnered with start-ups and fintech companies to mitigate these challenges and innovation in AI implementation. Furthermore, existing laws and security standards are still not complied for the complete deployment of AI in banks and financial sectors in India. A successful implementation of AI solutions and enabling the research a set of recommendations listed below:

**Cognitive Automation Process:** Need of automations to minimize the human intervention in the operation. Cognitive process automation is an automation process for handling information exhaustive and error prone banking services such as climate management. The process uses machine learning to improve the performance in every iteration due to learning.

**Interactive Interface:** Customer Relationship Management systems performance is maximized by enabling it with chatbots. It can identify the context and emotions in the text chat and responds to the customer queries in a most appropriate way.

**Decision Support Systems (DSS):** Banks need decision support systems to function identical to human experts. A repository of such experts is used along with the knowledge base for making strategic decisions.

**Robotic automation process:** The objectives of robotic automation process is to enable and automate the repetitive work process. AI makes the whole process of automation intelligence in banking process. It leverages the human to machine capabilities to minimize the operational cost and improve the performance in delivering personalized services.

**Building a secure Digital Backbone:** To correctly implement AI based applications and deliver value, large amount of quality data are access and analysed to make decisions. A low latency communication channel will quickly delivers the data from its point of capture to the point of analysis. The data need to be highly secure, is vital to manage and seamless transfer between applications.

**Re-skill work force for AI:** Some of the current jobs will be taken over by AI applications in banks and financial institutes. Up-skilling of the employees will be prioritized which will enable to create more jobs for AI and employee collaboration.

**Stay connected with customers:** AI will function like a human, it still lacks emotional intelligence and empathy, which is very essential part of customer service. AI is helping customer service mangers to improve their interactions with customers. It is important to balance between the recommendation made by the AI based applications and staying in touch with customers. A periodic customer interaction and customer service surveys and help to maximize the customer facing benefits of AI.

### References

- [1]. <https://teknospire.com/mobile-wallets-in-india-2020>.
- [2]. <https://capitalfloat.com/online-checkout-finance>
- [3]. AI in Banking and Finance REPORT BY Saman Goudarzi, Elonnai Hickok, Amber Sinha EDITED BY Shyam Ponappa MAPPING BY Shweta Mohandas RESEARCH ASSISTANCE BY Pranav M Bidare, Sidharth Ray, and Aayush Rathi The Centre for Internet and Society, India Artificial Intelligence: Literature Review (2017, December 16). Retrieved January 5, 2018, from <https://cis-india.org/internet-governance/blog/artificial-intelligence-literature-review>.
- [4]. Microfinance in India – adoption of machine learning is still underway. (2017, January 30) Analyticas India. <https://analyticsindiamag.com/microfinance-india-adoption-machinelearning-still-underway>.
- [5]. National Payments Corporation of India and the Remaking of Payments in India May 2019 [https://www.npci.org.in/product\\_overview/rupay-product-overview](https://www.npci.org.in/product_overview/rupay-product-overview)
- [6]. FINTECH100 Leading Global Fintech Innovators, H<sub>2</sub> Ventures-2018
- [7]. Real-Time Payments Systems & Third Party Access A perspective from Google Payments, November 2019, RTP Systems & Third Party Access
- [8]. The design of digital financial infrastructure: lessons from India by Derryl D'Silva, Zuzana Filková, Frank Packer and Siddharth Tiwari Monetary and Economic Department December 2019, ISSN 1682-7651 (online) ISBN 978-92-9259-324-7
- [9]. Sulaiman AlSheibani , Yen Cheung , Chris Messom, Artificial Intelligence Adoption: AI-readiness at Firm-Level, Twenty-Second Pacific Asia Conference on Information Systems, Japan 2018
- [10]. Artificial Intelligence the Next Digital Frontier. McKinsey & Company 2017
- [11]. NASSCOM Vision and Priorities, Everest Research
- [12]. Study on the Interplay between Standards and Intellectual Property Rights (IPRs) Tender No ENTR/09/015 (OJEU S136 of 18/07/2009), Berlin, Utrecht, Paris, Geneva, Oslo, April 2011
- [13]. WIPO Technology Trends 2019 Artificial Intelligence, WIPO Director General, Francis Gurry
- [14]. Accenture. (n.d.). Rewire for growth: Accelerating India's Economic Growth with AI. Aneja, U. (2018). Artificial Intelligence apps risk entrenching India's socio-economic inequities. The Indian Express.
- [15]. <https://www.cogitocorp.com/company/news>
- [16]. REDEFINE BANKING with Artificial Intelligence, Russell, Stuart J.; Norvig, Peter (2003) Artificial Intelligence: A Modern Approach
- [17]. DBS. (2018, April 12). Retrieved from <https://www.dbs.com/in/index/default>
- [18]. Niki AI. (2018, April 12). Retrieved from <https://www.niki.ai>
- [19]. 3LOQ. (2018, April 12). Retrieved from <https://3loq.com>
- [20]. QTX Robo Trading. (2018, April 12). Retrieved from <http://www.quantxindia.com/products/qtxrobo-trading>
- [21]. AccuraCap. (2018, April 12). Retrieved from <http://www accuracap.com/>
- [22]. Fluid AI. (2018, April 12). Retrieved from <http://fluid.ai/>
- [23]. Instamojo. (2018, April 12). Retrieved from <https://www.instamojo.com> Early Salary. (2018, April 12). <http://earlysalary.com/#why-early>
- [24]. Infosys launches Finacle 11E. (2018, April 12). <https://www.infosys.com/newsroom/features/Pages/advanced-universal-banking-solution.aspx>

- [25]. Report of the Working Group on FinTech and Digital Banking. (2018, February 8). <https://www.rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=892>
- [26]. Nag, A., & Mitra, A. (1999). Neural networks and early warning indicators of currency crisis. Reserve Bank of India Occasional Papers, 20(2), 183-222.
- [27]. Institute for Development and Research in Banking Technology. (2018, April 12). <http://www.idrbit.ac.in/>
- [28]. SEBI constitutes 'Committee on Financial and Regulatory Technologies (CFRT)'. (2017, August 3). <https://www.sebi.gov.in/media/press-releases/aug-2017/sebi-constitutes-committeeon-financial-and-regulatory-technologies-cfirt-35526.html>
- [29]. Maru, P. (2017, October 17). ICICI Bank's AI chatbot iPal empowers customers with information and financial services. Economic Times. <https://cio.economictimes.indiatimes.com/news/enterprise-services-and-applications/icici-banks-ai-chatbot-ipal-empowers-customers-withinformation-and-financial-services/6111845281>
- [30]. SBI launches chatbot to help customers in banking services. Mint. (2017, September 25). Retrieved from <https://www.livemint.com/Industry/68ipadKiLQwxGUKTxXd3pL/SBI-launches-chatbotto-help-customers-in-banking-services.html> 82
- [31]. Urs, A. (2017, August 13), Banks exploring use of artificial intelligence in operations. Business Line. Retrieved from <https://www.thehindubusinessline.com/money-and-banking/banks-exploringuse-of-artificial-intelligence-in-operations/article9816427.ece>
- [32]. Tata Capital launches artificial intelligence-based online chatbot. (2017, April 18). Retrieved from <http://www.tata.com/company/releasesinside/tata-capital-ai-online-chatbot>
- [33]. Chowdhary, S. (2017, March 8). Fashion e-retailers get AI-powered boost, courtesy Staqu. Financial Express. Retrieved from <http://www.financialexpress.com/industry/fashion-e-retailers-get-ai-powered-boost-courtesy-staqu/578723/>
- [34]. BSE implements artificial intelligence mechanism for rumour detection. (2016, November 21). Retrieved from <https://www.bseindia.com/markets/marketinfo/DispMediaRels.aspx?page=d3784583-0810-4bef-8754-087b60832bfa>
- [35]. Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules, 2011.
- [36]. Paul, Y. Hickok, E. Sinha, A. & Tiwari, U. (2018, January 26). Artificial Intelligence in the Healthcare Industry in India. Centre for Internet and Society. <https://cis-india.org/internet-governance/files/ai-and-healthcare-report>
- [37]. Section 9.5.1, Credit Information Companies (Regulation) Act (2006).
- [38]. Master Circular – Policy Guidelines on Issuance and Operation of Pre-paid Payment Instruments in India. (2016, July 1). Retrieved from [https://www.rbi.org.in/Scripts/BS\\_ViewMasCirculardetails.aspx?id=10510](https://www.rbi.org.in/Scripts/BS_ViewMasCirculardetails.aspx?id=10510)
- [39]. Working Group on Information Security, Electronic Banking, Technology Risk Management and Cyber Frauds- Implementation of recommendations. (2011, April 11). <https://www.rbi.org.in/scripts/NotificationUser.aspx?Id=6366&Mode=0>
- [40]. The Information Technology (The Indian Computer Emergency Response Team and Manner of Performing Function and Duties ) Rules, 2013. [http://meity.gov.in/writereaddata/files/G\\_S\\_R%2020%20%28E%292\\_0.pdf](http://meity.gov.in/writereaddata/files/G_S_R%2020%20%28E%292_0.pdf)
- [41]. Artificial Intelligence and Data Protection How the GDPR Regulates AI Centre for Information Policy Leadership (CIPL) March 2020
- [42]. <https://www.americanbanker.com/news/how-artificial-intelligence-is-reshaping-jobs-in-banking>
- [43]. How AI is reshaping jobs in banking by American banker, May 7, 2018) <http://www.americanbanker.com/news/how-artificial-intelligence-is-reshaping-jobs-in-banking>