Conceptualizing Possibilities of Artificial Intelligence in Furtherance of the Banking Sector: An Effective Tool for Improving Customer Relationship, Customer Service and Public Relations

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Abstract:

Purpose: This paper is aimed to define Artificial Intelligence (AI), its related technologies, and its current and future applications in banking sector. It also focusses on how AI and machine learning will be the backbone of banking in the future. It is an important area of study because within the financial services sphere, established institutions are struggling to compete as legacy systems have become outdated, inflexible with reduced efficiency.

Design/Methodology/Approach: This is a review paper and explores various trends that could pave way for furtherenace of technological interventions through the use of AI.

Findings: Banks are trying to potentially harness the power of AI to streamline the existing processes and introduce new features that will improve the customer experience. A stage has been reached where it is potentially equipped to provide solutions to some of the existing problems in banking. It is being developed into a wide range of technologies, including robotic process automation (RPA), natural language processing (NLP), advanced data analytics, Big Data analytics and image analytics and their use will help banks improve front-office, mid-office and back-office processes.

Practical Implications: These approaches will have a landmark impact on the nature of relationship management has with the employees and banks have with their customers.

Originality/Value: There is a significant scope for application of various processes based on what has been found. It is an original content with proper references.

Keywords: Artificial Intelligence and HR management, future banking, ChatBots, loan Management AI, Artificial Super Intelligence (ASI).

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1. Introduction

General purpose technology is a term reserved for those advancements in technology that pave way for major changes in economic and social areas and bring revolution in the day to day working of people or industries. Rail roads and steam engines may be considered as a general purpose example. Rail roads and steam engines hatched a multitude of changes in various sectors, primarily in transportation. The advent of Rail roads and Steam engines radically transformed the world. Probably, electricity and information technology (IT) are the two most important General Purpose Technologies so far as they radically transformed the world (Jovanovic and Rousseau, 2005). Electricity spawned a multitude of products and sectors, including household and industry electronic appliances, trains and, of course, computers and was adopted much faster still IT seems to be technologically more dynamic and with time research has found ways to leverage the technology to create profitable new models and catalyzed trends of complementary innovations and opportunities for the human civilization. Artificial Intelligence or AI is one such manifestation of this revolution.

Artificial intelligence--particularly machine learning (ML) is the most important such technology of our era (Brynjolfsson and Mcafee, 2017). Each day we are getting more familiar with the power of AI. It manifests in the form of an IBM AI, Deep Blue ® defeating Gary Kasparov, the world champion, and regarded by some as the greatest chess player of all times (Gurkaynak *et al.*, 2016). A car can parallel park itself in different parking scenarios. Artificial Intelligence systems providing weather updates and predictions when we ask them. At the organizational level how Artificial Intelligence will affect industries in general, and how financial services will affected in particular is the big question now.

2. Artificial Intelligence

Artificial Intelligence encompasses a set of other technologies which work together to make a "human like" system that acts and reacts as per its own acquired logic. The term Artificial Intelligence was coined by John McCarthy, an American computer scientist in 1955, who defined it as "the science and engineering of making intelligent machines" (Andresen, 2002). There are varied definitions of Artificial Intelligence (Russell and Norvig, 2016) organized into four categories:

A. *Thinking Humanly:*
- "The exciting new effort to make computers think ... machines with minds, in the full and literal sense" (Haugeland, 1985).
- "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978)

B. *Thinking Rationally:*

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- "The study of mental faculties through the use of computational models" (Charniak and McDermott, 1985).
- "The study of the computations that make it possible to perceive, reason, and act" (Winston, 1992).

C. *Acting Humanly:*
- "The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990).
- "The study of how to make computers do things at which, at the moment, people are better" (Rich and Knight, 1991).

D. *Acting Rationally:*
- "Computational Intelligence is the study of the design of intelligent agents" (Poole *et al.,* 1998).
- "AI . . . is concerned with intelligent behavior in artifacts" (Nilsson, 1998).

The reason for such variation in the understanding and definition of "Artificial Intelligence" can be attributed to the reason that Artificial Intelligence is not one, but a group of related technologies, which includes among others, big data analytics, machine learning, deep learning, predictive/prescriptive analytics, virtual agents, and avatars (which understand natural language). Actually, Artificial Intelligence is all of these things. When a computer system simulates a process, such as thinking or sensing, which is one of the building blocks of human intelligence, it needs Artificial Intelligence to do so (Infosys, 2017).

3. Artificial Intelligence Technologies

Artificial intelligence encompasses a multitude of capabilities and technologies. Consulting firm PWC reinforces that Artificial Intelligence is "not a monolithic subject area. It comprises a number of things that all add to our notion of what it means to be 'intelligent'" (PWC, 2016). Below are a few of the most popular areas of AI:

3.1 Machine Learning

Machine learning implies programming computers to optimize a performance criterion using example data or past experience. We need learning in cases where we cannot directly write a computer program to solve a given problem, but need example data or experience. One case where learning is necessary is where human expertise does not exist, or when humans are unable to explain their expertise (Alpaydin, 2009). The algorithms learn iteratively from available data and past experiences. Machine learning enables computers to find hidden insights without being explicitly programmed where to look.

Michalski *et al.* (1984) organize the machine learning around three primary research foci:

- Task-Oriented Studies—the development and analysis of learning systems to improve performance in a predetermined set of tasks (also known as the "engineering approach").
- Cognitive Simulation—the investigation and simulation of human learning process.
- Theoretical Analysis—the theoretical exploration of the space of possible learning methods and algorithms independent of application domains.

3.2 Deep Learning

Deep learning is a form of machine learning that enables computers to learn from experience and understand the world in terms of a hierarchy of concepts. Because the computer gathers knowledge from experience, there is no need for a human computer operator formally to specify all of the knowledge needed by the computer. The hierarchy of concepts allows the computer to learn complicated concepts by building them out of simpler ones (Goodfellow *et al.,* 2017).

Deep Learning is a subset of machine learning and can be tagged under Cognitive Simulation of Machine Learning. It has facilitated object recognition in images, video labeling, and activity recognition, and is making progress in perception (including audio and speech). For example, Facebook's deep learning application DeepFace has been trained to recognize people in photos. Although deep learning is meant to simulate human brain, but it is not modelled on it.

3.3 Natural Language Processing (NLP)

Natural language processing or NLP (also called as Computational Linguistics) is the scientific study of languages from the computational perspectives. Natural language processing is a field of computer sciences and linguistics concerned with the interaction between computers and human (natural) languages. A computer will be considered intelligent if it can understand commands given in natural language (Kumar, 2011). NLP provides avenues for a computer program to understand human speech in real time. Speech-to-Text features in almost all smart phones today is an example of Natural Language processing.

However, the real challenge is to process all dialects and variations of speech. Natural Language Generation is another part of NLP wherein a computer is able to generate voice response in natural language. Text-to-speech is an example of NLG. Here again, the challenge is to generate response in the same dialect as that of the user. Research and development is shifting towards systems capable of interacting with people through dialog, not just reacting to stylized requests.

4. Types of Artificial Intelligence

Artificial Intelligence may be categorized into three types (Gurkaynak, *et al.*, 2016):

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Artificial Narrow Intelligence (ANI):

An Artificial Intelligence system that is developed and trained for a particular task and works within a limited context. ANIs are AIs specialized in a specific area, such as IBM's Deep Blue ®, the supercomputer that beat Gary Kasparov, the reigning World Chess Champion (Gurkaynak, *et al.*, 2016). ANI can identify pattern and find associations from the raw data available and respond more efficiently than humans. Other general examples of ANI are weather forecast, Google's Translation Engine. In the automobile industry, self-driving cars are examples of different ANIs working in coordination.

Figure 1. *Natural Language Processing*
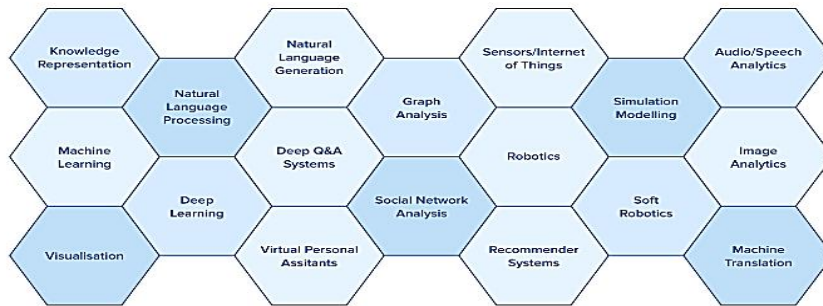
Source: PWC

Source: PWC, 2016.

However, ANIs are not able to do anything else than what they are designed to do. Playing chess was the only thing Deep Blue® could do. McCarthy was actually disappointed despite Deep Blue's achievement. Criticizing the fact that Deep Blue's success was entirely due to its sheer computational power rather than a deep understanding of chess itself. He stated, *"The fixation of most computer chess work on success in tournament play has come at scientific cost"* (Gurkaynak, *et al.*, 2016; Vardi, 2012).

Artificial General Intelligence (AGI):

Artificial General Intelligence (AGI) is a system that exhibits the broad range of general intelligence found in humans (Adams *et al.,* 2012). It is an Artificial Intelligence system one step ahead of ANIs. They have the ability to find solutions to varied tasks they comes across. It is popularly termed as strong Artificial Intelligence which can understand and reason the environment as a human would. It includes nonstop learning by the intelligence educe on it logic expression on the machines (Hussain, 2018).

Artificial Super Intelligence (ASI):

An artificial super intelligence (ASI) is an artificial intelligence that is significantly more intelligent than humans in all respects (Barrett and Baum, 2017). Artificial super intelligence is still a theory and has not been realized as yet. However, some scholars are apprehensive about the impact of ASI on human existence, if artificial super intelligence actually does come into existence.

5. Artificial Intelligence Currently Used in Banks

Narrow Artificial Intelligence, henceforth referred to as Artificial Intelligence or Artificial Intelligence in this paper, is already being used since many years now and is now being accepted. This owing to the fact that the data available for processing has increased multifold and we require intelligent systems to process the data and do tasks for us. Artificial intelligence (AI) is disrupting diverse industries, but banking is projected to benefit the most out of incorporating Artificial Intelligence systems in the next few years. Analysts estimate that Artificial Intelligence will save the banking industry more than $1 trillion by 2030 (Maskey, 2018).

Large banks have a huge customer success burden, so they naturally look toward improvement in customer service, process automation, Compliance, Fraud Detection and Anti-Money-Laundering and insurance companies are improving risk models with AI. On the other hand, many of the financial institutions in developing countries are still stuck on setting up data infrastructure in a way that allows them to leverage AI. And still some are not interested in joining the 'new revolution' because they are apprehensive of its utility (Maskey, 2018).

JPMorgan Chase has introduced a Contract Intelligence (COiN) platform designed to *"analyze legal documents and extract important data points and clauses"*. Manual review of 12,000 annual commercial credit agreements normally requires approximately 360,000 hours. Results from an initial implementation of this machine learning technology showed that the same amount of agreements could be reviewed in seconds. COiN has widespread potential and the company is exploring additional ways to implement this powerful tool (JPMorgan Chase and Co, 2016).

In an effort to leverage emerging technologies and help drive the enhancement of its organizational structure, Wells Fargo established an Artificial Intelligence Enterprise Solutions team which has three main goals (Sennaar, 2019):

  a. increase connectivity for the company's payments efforts;
  b. accelerate opportunities with artificial intelligence;
  c. advanced application programming interfaces to corporate banking
       customers.

The company began piloting an AI-driven chatbot through the Facebook Messenger platform with *"several hundred employees."* This virtual assistant communicates with users to provide account information and helps customers reset their passwords.

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Celebrating a decade of mobile banking this year, Bank of America Corporation made a bold push into Artificial Intelligence technology with the debut of an intelligent virtual assistant named *erica.* Officially unveiled at the 2016 Money 20/20 conference in Las Vegas, described as the world's largest payment and financial services innovation event, *erica* is a chatbot leveraging *"predictive analytics and cognitive messaging"* to provide financial guidance to the company's over 45 million customers. As an integrated component of the mobile banking experience, *erica* is designed to be accessible to clients 24/7 and perform *"day-to-day transactions"* in addition to anticipating the unique financial needs of each customer and helping them reach their financial goals by providing smart recommendations (Riess, 2016; Sennaar, 2019).

Citibank has established a succession of innovative partnerships with cutting edge tech companies to expand and improve its services. CitiBank has made a strategic investment in Feedzai, a leading global data science enterprise that works in real-time to identify and eradicate fraud in all avenues of commerce including online and in-person banking. Through its continuous and rapid evaluation of large amounts of data, Feedzai can conduct large-scale analyses. Fraudulent or questionable activity is identified and the customer is rapidly alerted (San Mateo, 2016; Sennaar, 2019).

The 233-year-old financial institution, Bank of NY Mellon Corp., is banking on *"bots"* specifically robotic process automation (RPA), to improve the efficiency of its operations and to reduce costs. RPA integrates artificial intelligence and is carried out not by physical robots but by software applications. These applications, known as web robots or Internet bots, are programmed to process automated tasks. In May 2017, the bank announced that over the past 15 months the company has rolled out more than 220 bots developed by Blue Prism for handling tasks that are often repetitive in nature and normally handled by staff (BNY Mellon, 2017; Sennaar, 2019). BNY Mellon (2017) reports that the implementation of RPA has led to the following results:

- 100 percent accuracy in account-closure validations across five systems;
- 88 percent improvement in processing time;
- 66 percent improvement in trade entry turnaround time;
- ¼-second robotic reconciliation of a failed trade vs. 5-10 minutes by a human.

By 2030, globally, the traditional financial institutions can save 22% in costs, (Sokolin and Low, 2018). The break down of those cost savings are as follows:

- *Front Office* – $490 billion in savings. Almost half of this ($199 billion) will come from reductions in the scale of retail branch networks, security, tellers, cashiers and other distribution staff.

- *Middle Office* – $350 billion in savings. Just simply applying Artificial Intelligence to compliance, KYC/AML, authentication and other forms of data processing will save banks and credit unions a staggering $217 billion.
- *Back Office* – $200 billion in savings. $31 billion of this will be attributed to underwriting and collections systems.

These numbers align with what other analysts and research firms have forecast. Bain and Company has pegged the savings at around $1.1 trillion, while Accenture estimates that Artificial Intelligence will add $1.2 trillion in value to the financial industry by 2035.

Figure 2. *Use of AI in Financial Services*
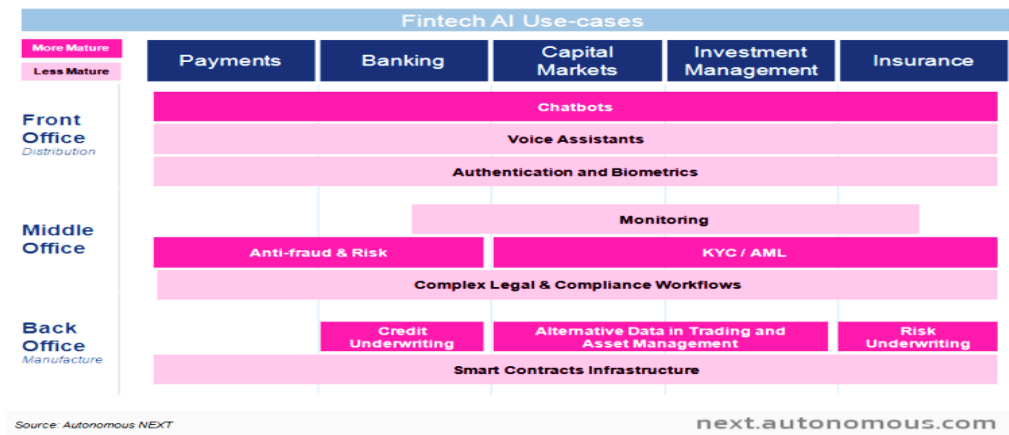
Source: *Sokolin and Low (2018).*

6. Future Scope of Artificial Intelligence in Banking

6.1 Human Resource Development

Talent Acquisition:

Using AI, you can remove tons of stressful and monotonous work from your HR managers. Namely, talent acquisition software can scan, read, and evaluate applicants and quickly eliminate 75% of them from the recruiting process (Aking, 2015). We might see which applicant characteristics have been associated with better job performance and use that to select candidates in the future (Buzko *et al.,* 2016). "Algorithmic management," the practice of using algorithms to guide incentives and other tools for "nudging" platform workers and contractors in the direction of the contractee *(Lee et al.,* 2015), is applied to regular employees (Netessin *et al.,* 2012)

This is a huge benefit as it allows the recruiter to spend more time analyzing and evaluating only a smaller group of eligible candidates. In such circumstances, HR units are drastically increasing the quality of hiring decisions. Additionally,

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companies save a lot of money this way because they don't have to pay the cost of poor hiring decisions (Wislow, 2017).

Onboarding:

Hiring the most promising talents is not the only concern of HR departments. Adaptation is the second step in the process as many prospects can't fit in the new environment due to lack of onboarding procedures. Namely, new employees demand a lot of attention and it is often impossible to dedicate enough time to each one of them. That is where Artificial Intelligence steps in – it determines customized onboarding procedures for every single position. This proved to be extremely productive in practice since new workers who went through well-planned onboarding programs had much higher retention rates than their peers who didn't have the same opportunity (Wislow, 2017).

Training:

The most difficult task in HR Development is to determine the effectiveness of training costs (Buzko *et al.,* 2011) due to its branching and sophisticated feedback caused by improved production results of staff who took part in it (Buzko *et al.,* 2016). With the advancement of technology in banking and preference to digital banking on conventional banking, the employees and banks are in a continuous pressure to improve their professionalism in these fields. However, planning, organizing and coordinating such trainings for can be managed very easily using Artificial Intelligence tools. Online courses and digital classrooms are the most common solutions in that regard. But this is not the only job of Artificial Intelligence because it also determines the best timeframe for new courses and schedules lessons so as to fit the preferences of all employees individually (Wislow, 2017).

Performance analysis:

Team work and productivity are essential qualities of a professional. It is easier to monitor the behavior of employees and analyze their key performance indicators through appraisal reports. There are many dimensions to that construct, and measuring it with precision for most jobs is quite difficult: performance appraisal scores, the most widely-used metric, have been roundly criticized for problems of validity and reliability as well as for bias, and many employers are giving them up altogether (Cappelli and Tavis, 2017). Any reasonably complex job is interdependent with other jobs and therefore individual performance is hard to disentangle from group performance (Pfeffer and Sutton, 2006).

Using Artificial Intelligence tools, HR managers are enabled to set targets for employees as individuals and as a part of a team. This type of work is easier to follow and assess and it generates better overall results. Of course, it doesn't only serve to improve productivity but also to detect team members who show lack of engagement continuously (Wislow, 2017).

Retention:
Employee evaluation can help in attracting and retaining best talent that will boost employee morale and create healthy competitive environment. Employee evaluation is carried out by organizations for performance appraisal and rewards to be given to the employees (Macwan and Sajja, 2012). As much as it is difficult to hire talented employees, it is as difficult to keep them in your team. This is why almost 60% of organizations consider employee retention their biggest problem (Bhatia, 2017).

However, Artificial Intelligence has the ability to analyze and predict the needs of staff members. It can determine individual affinities and reveal who should get a raise or who might be dissatisfied with the life-work balance. Such analysis gives room to HR professionals to be proactive and solve the problem even before it actually occurs (Wislow, 2017).

Vacation Requests:
Employees can plan their leaves and vacations after checking the current staff leave status from the system. The employees may be informed by the Artificial Intelligence system that their leave it is likely to be rejected as many others have already applied for leave in that time frame.

Employee profile mapping:
Since Artificial Intelligence can define patterns based on data from various sources, future HR policies can be devised based on the Artificial Intelligence inputs that will update employee profile based on various factors but not limited to those stated as under:

- Employee social interactions
- Job role wise performance
- Punctuality
- Employee grievances
- Customer complaints
- Team responses
- Employee health

Transparent Transfer Policy:
Artificial Intelligence can be a very vital tool in implementation of a transparent transfer policy for a bank which has a footprint across a large geographical area. An HR system based on artificial system can take following variables into account before suggesting a new place of posting:

- Employee residential address.
- Previous places of posting
- Job role experience
- Family liabilities

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▪ Employee performance ratings at various areas of postings and at various job roles.

Business Unit Staffing:

Since Artificial Intelligence is an evolving and continuously learning system, the system can analyze and calculate the staff requirement of a Business unit based on footfall, individual employee and joint staff ratings, business areas, staff expertise in these areas, peak load, throughput of employees etc. Artificial Intelligence can also provide solution for calculating manpower requirement for a particular allotment within a particular Business Unit.

6.2 Customer Centric

Customer Support and Helpdesk:

Humanoid Chatbot interfaces can be used to increase efficiency and reduce cost for customer interactions. ChatBots to provide answers to customer queries over existing platforms viz mobile app, ebanking site, banks website. The first chatbot ELIZA, created in 1966 by Joseph Weizenbaum could recognize certain keywords and pattern and answer accordingly, mimicking conversation with a psychotherapist (Ravi and Kamaruddin, 2017).

Figure 3. *Timeline of the development of chatbots*
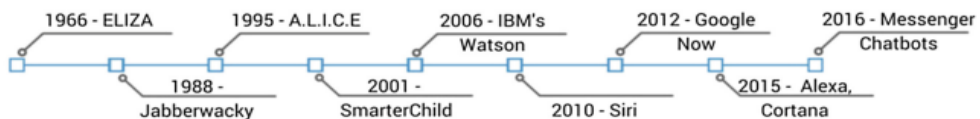
Source: Ravi and Kamaruddin (2017).

Risk Management:

Tailored investment products can be offered to clients by looking at historical data, doing risk analysis, and eliminating human errors from hand-crafted models. The suggested products would be risk rated and will show the future risk analysis against each product.

ATMs:

Artificial Intelligence (AI) techniques have an extensive application in ATM Management and can be used for the detection of fraud, failure, replenishment and crash prediction (Hasheminejad and Reisjafari, 2017). Biometric Authentication in ATMs will match a picture of the user at the ATM with a picture of the account holder in the bank's database (Dwivedi *et al.,* 2016).

Customer Information in customer Language:
India has 121 languages (Office of the Registrar General, India, 2011) with multiple dialects for each language. Applications which use speech to text or text to speech rely on natural language processing (NLP) libraries and techniques. With more and more progress in the field of Natural Language Processing, it is highly possible that in the near future, banks will be communicating with customers through Artificial Intelligence systems in their own language and dialect.

Suggest/remind payments and receipts:
Based on the transactional data and customer profile and account analysis, the system will be able remind customers of payments that are due or receipts that are expected and has been has missed in a month.

Fraud detection, prevention and mitigation:
Artificial Intelligence can study the spending data of an individual and be able to determine, based on this information, whether they performed the most recent transaction on their credit card or if someone else was using their credit card data and alert the customer before the transaction is carried out. Significant potential lies in the ability of neural networks to learn relationships from modeled data, as mentioned in World Academy of Science study (Hayati and Shirvany, 2007). Implementing this type of solution to curb cybercrime, for example, will reduce the economic losses drastically (Chinner, 2018).

6.3 Marketing
Artificial Intelligence enables marketers to create highly personalized consumer experiences that cost significantly less than traditional campaigns. Artificial Intelligence has grown in scope in terms of its use in marketing. It is the calibrated use of customer data—from online and offline sources to predict customers' digital actions or inactions (on web or mobile app platforms) that will enable the banks to intelligently target the right customers with the right content across the right channel, and at just the right time.

Dynamically create customer insight:
Insight creation includes obtaining important and actionable intelligence from ever-increasing amounts of accessible raw data. One of the actual growing disciplines of Artificial Intelligence is to manage all customer information available either directly from the customer or indirectly from call center data, communications with branch and social media activity. With Artificial Intelligence solutions, banks can know exactly what consumers are thinking, saying, and feeling about their products in real time. The secret to building a truly comprehensive profile lies in capturing data during every single consumer interaction through ebanking, ATM, mobile banking or other conventional ways. Banks can use Artificial Intelligence solutions to take these profiles a step further, refine marketing campaigns, and create highly personalized content.

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Real-Time Customer Interactions:

One of the advanced capabilities of Artificial Intelligence is its ability to analyze large blocks of open content and identify trends. This will allow banks to interact directly with consumers in real time through online conversations or events using Artificial Intelligence tools. Communicating with consumers at the precise 'decision-making moment' can help directly influence buying decisions. Artificial Intelligence will help marketers monitor these social conversations and other open forums to identify any relevant conversations.

Right Products at the Right Time:

Artificial Intelligence marketing tool may suggest a TAX saver product if a customer monthly credits that are "salary like" and no tax saver facilities have been availed by the customer. It may suggest a car loan if the latest social media interactions of the person indicate that he wants to buy a car. Based on the age of children, Artificial Intelligence may suggest products like scooty loans, laptop loans, education loans etc.

6.4 Lending and Loan Management Process

Manage Bank's Credit Portfolios:

Designing and maintaining a Bank's credit portfolio can sometimes be an extensive endeavor, as each sector has different risks associated with them. Artificial Intelligence and machine learning could streamline the process for developing a portfolio structure by assessing current market trends, Bank's existing exposure status and risk tolerance.

Artificial Intelligence can advise or maintain lending limit of lending applications in various sectors by real time assessment of exposure and market risk weightage. It can also suggest maximum magnitude of lending based on credit policy and other external dynamic factors.

Secure and fast Lending Process:

Using Artificial Intelligence in the process of lending has a vast scope ranging from reducing the costs to faster loan approval by Process Automations, Customer Assessments, Artificial Intelligence appraisals, sanctions and disbursals. Owing to its capabilities to 'learn' with time and find patterns, it has capabilities which will identify the frauds and deception in the loan processing workflow. As the system will accumulate knowledge, the possibilities of mistakes will be reduced to zero. Having the capability to analyzing thousands of documents, artificial Intelligence and Machine Learning are holding the position of an active analyst.

Customized credit ratings:

Artificial Intelligence algorithms combining cash flow metrics and social data will have abilities to check the eligibility of repaying loans from borrowers and create a

bank specific credit rating system. It has the potential for becoming an integral part in finance companies building credit scores for all types of lending loan. The system in its present form has proven its effectiveness by reducing this risk factor behind selecting the safe person so as to save lots of bank efforts and assets. This is done by mining the Big Data of the previous records of the people to whom the loan was granted before and on the basis of these records/experiences the machine was trained using the machine learning model which give the most accurate result (Arun *et al.,* 2016).

Assistance in Loan Recovery:
Debt collection in finance will be simplified by artificial intelligence due to the availability of extensive amounts of past records of customers in the bank database and other information from other sources and available systems. Banks can combine the Artificial Intelligence with traditional system to facilitate the recovery team.

Calculate Creditworthiness:
Artificial Intelligence methods can support banks decide which consumers or companies are safe to grant loans to and which are not. Artificial Intelligence methods are capable to search through extensive amounts of consumer data e.g. credit records, social media pages, news reports etc. and present data regarding creditworthiness of customers for evaluation.

6.5 Reduces Overall Investment
To increase the profitability, it is imperative that the expenditures be reduced to least possible levels and increase productivity. Artificial Intelligence provides vast scope of improvement in both these areas. The overall investment is reduced by automated processes and significantly condensed the price of serving customers. The productivity is increased by 24x7 availability of the system. Artificial intelligence has the advantages of interacting with customers in creative ways that allow vital cost profits, by implementing smarter decision-making based on customer response models.

Bank of NY Mellon Corp. is investing heavily in this technology, rolling out more than 200 bots to handle tasks such as transferring funds. As a result, BNY Mellon reported an 88 percent improvement in processing time and its funds transfer bot saved the company $300,000 alone (BNY Mellon, 2017).

6.6 Fraud Detection and Prevention
Artificial Intelligence is being utilized to proactively monitor and prevent various instances of fraud. For example, firms draw on individual's spending data and behaviour to determine patterns, enabling them to identify irregular transactions (Gordon, n.d.). Mastercard has also worked to include Artificial Intelligence technology as a part of their financial service network as a way *"identifying identities"* (Gupta and Elias, 2017). The technology's enhanced ability to identify market patterns and automate low complexity tasks have been highlighted by The

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National Stock Exchange of India Ltd (NSE) as significant to their goal of trading risk minimization (D'Monte, 2018). The Bombay Stock Exchange has been using AI-assisted solutions for rumour detection since the November of 2016 as a means of detecting risk and reducing information asymmetry (BSEIndia, 2016).

6.7 Regulatory Compliance

As regulatory compliance (or compliance governance) becomes ever more challenging, attempts to engage IT solutions and especially artificial intelligence (AI) are on the rise. Regulatory compliance can be enhanced by employing an AI model trained to identify penalty clauses in the regulations (Goltz and Mayo, 2017). There is drastic increase in the regulatory requirements with which businesses must comply, not only in sheer number but also in complexity, confronting businesses with the need to adapt to a complex and evolving regulatory environment *(Giblin et al.,* 2005). Assessing compliance demands for an interpretation and translation of the requirements provided in natural language in an actionable rule description (especially in the case of principle-based regulations) (Giblin, Müller and Pfitzmann, 2006). Therefore, artificial intelligence may be suitable for this task (Goltz and Mayo, 2017). Artificial Intelligence based products are already in the market that can be used for enhancing the regulatory compliance performance. Artificial Intelligence can contribute to compliance efficiency and effectiveness include:

- *Know your customer:*
  Artificial Intelligence's ability to collect great quantity of data, search the web and analyze this data to find patterns can be employed to strengthen and streamline KYC processes. The system can check the details of the new customer and find all possible entities pertaining to the customer that might be utilized to create a sturdy KYC database.
- *Money laundering detection:*
  Artificial Intelligence systems in place for Anti-Money Laundering continuously check for unusual patterns in transactions, scan news items, monitors reports and regulatory alerts. Based on algorithms and the tolerance thresholds defined therein, the system can raise an alert and those indicating the greatest exposures can be subject to further analysis.
- *Employee error detection:*
  Artificial Intelligence software could alert employees opening accounts using same mobile number, email, address etc.
- *Transaction monitoring:*
  Using Artificial Intelligence to learn customer personalities and behavior can increase the precision of suspicious transactions, helping avert costly false alarms.

In addition to strengthening safeguards, Artificial Intelligence can help banks apply and stay abreast of regulatory requirements:

- *Law and regulation parsing:*
  Artificial Intelligence systems deployed for the purpose of regulatory compliance can parse all the regulatory documents issued from time to time and compile a categorized regulatory guidelines list for easy comprehension of employees.
- *Identification of units, products and processes affected by compliance requirement:*
  Artificial Intelligence systems can analyze the newly issued regulatory documents and identify people, products and processes affected by legal and regulatory changes. The concerned departments will be notified regarding the change.

6.8 Anti-Money Laundering

Current AML processes are dominated by high levels of manual, repetitive, data-intensive tasks that are both inefficient and error prone. Common AML pain points for organizations are typically the high caseloads and human effort involved in customer due diligence, screening and transaction-monitoring controls. Incumbent transaction-monitoring controls typically generate high levels of false positive alerts and significant operational workloads. The cost issue is often further amplified by inefficiencies in the investigation process, which create a low return on the effort employed versus the impact of transaction-monitoring controls (Craig and Gregory, 2018).

One such Artificial Intelligence solution for AML uses unsupervised learning approaches encapsulated in Topological Data Analysis (TDA), a technique developed in Stanford's mathematics department with funding from DARPA and the National Science Foundation (NSF). TDA and machine learning automatically assemble self-similar groups of customers and customers-of-customers. Artificial Intelligence software makes the selection of the appropriate algorithms to create candidate groups and tune the scenario thresholds within those groups until the optimal ones are identified. These groups are then put through a tuning process with additional algorithms to identify optimal groupings. The next step uses supervised learning to predict future behaviors that allow subject matter experts to create new rules and thresholds that accurately detect potential launderers (Singh, 2017). The Artificial Intelligence systems for Anti-Money Laundering have the ability to:

- Drive insight and value from large volumes of complex data that are often involved in due diligence, risk assessment and monitoring activities, leading to better risk outcomes.
- Learn from and adapt to changing environments and inputs, helping firms to keep up with the rapidly changing financial landscape and risk profile.
- Automate repetitive tasks that are currently handled by humans, operate at scale and take decisions at speed to reduce costs and focus human engagement where there is the highest value added.

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- Reduce error and improve consistency in processes and decision-making (Craig and Gregory, 2018).

6.9 Process Automation

Process Automation using Artificial Intelligence is being done using software robots is termed as Robotic Automation Process or RPA. These software robots are software applications designed to run automated tasks. In banking, the RPA will provide the following benefits:

- 24X7 availability, with highest accuracy at lowest cost. They can complete task by themselves or finish one initiated by human.
- Highly scalable. The RPA administrator can add more robots on a click during peak hours of your business.
- Robotic Process Automation also generates complete audit trails for each process to help you achieve process compliance and reduce business risk.

RPA can be deployed in following processes:
- Account Opening and KYC
- Fund Transfers
- Loan Document processing
- Loan processing
- Chequebook issuance
- Customer service
- Credit Card Processing
- Reports Automation
- Account Closure Process etc. (AutomationEdge, 2016)

Cyber Security:

Artificial intelligence and machine learning present a significant opportunity in providing cyber security to banks. Today, new machine learning methods can vastly improve the accuracy of threat detection and enhance network visibility due to the greater amount of computational analysis they can handle. They are also heralding in a new era of autonomous response, where a machine system is sufficiently intelligent to understand how and when to fight back against in-progress threats (DarkTrace, 2019).

Artificial Intelligence platform uses unsupervised machine learning to analyze network data at scale, and makes billions of probability-based calculations based on the evidence that it sees. Instead of relying on knowledge of past threats, it independently classifies data and detects compelling patterns. The success rate of those methods exceed more than 99% (DarkTrace WhitePaper, 2018).

6.10   Hedge Fund Management

Globally, hedge funds prefer AI-based models. It is because AI-related tools can fetch real-time data from various financial markets across the world. Also, Artificial Intelligence models can analyze the mood or sentiments of different financial markets and come up with an accurate prediction. These inputs and sophisticated algorithms make Artificial Intelligence models capable of assisting the users to take decisions quickly.

Hedge fund trading and management can be done on the move with the help of AI-based mobile app solutions for the banking sector. These solutions help the banks to mitigate the risks associated with overexposure and user intervention in the market.

In brief, Artificial Intelligence can provide the next-gen security to the banking sector. AI-based mobile applications can make the transaction quicker and safer. Banks can handle the customer-oriented operations with ease while reducing the cost of hiring additional employees (Sloane, 2018).

6.11   Risk Management
Credit Risk:

Credit scoring was originally evaluated subjectively according to personal experiences, and later it was based on 5Cs: the character of the consumer, the capital, the collateral, the capacity and the economic conditions. But with the tremendous increase of applicants, it is impossible to conduct the work manually. Application of artificial intelligence has led to better performance of credit scoring models (Ghodselahi and Amirmadhi, 2011).

Market Risk:

Artificial Intelligence and machine learning may also be useful in managing market risk, and especially trading-model risk. Researchers (Evans *et al.,* 2013) created an algo-trading model for intra-day foreign exchange speculation. Their statistical tests confirmed with a significance of more than 95% that the daily FOREX currency rates time series are not randomly distributed. They were also able to achieve 72.5% prediction accuracy and this model produced 23.3% Annualized Net Return (Evans *et al.,* 2013).

This has created opportunities for services such as yields.io, which use machine learning to monitor, validate, and adjust trading models, constantly checking millions of variables to identify errant testing results that might warrant further investigation.

Operational Risk:

Operational risk is often harder to manage than financial risk, given that it involves human decision-making. Artificial Intelligence and machine learning can help by

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handling atypical data – textual descriptions of transactions, network relationships, phone and messaging conversations – and have proven effective in detecting money laundering and fraud (Aziz and Dowling, 2019).

7. Conclusion

Banking sector has begun discovering the immense potential of Artificial Intelligence in improving services, cost cutting and customer satisfaction. By its capabilities of faster and accurate data capture, data analysis and data categorization, the Artificial Narrow Intelligence has already penetrated the most critical processes in banking through process automation. As newer facets of Artificial Intelligence get unveiled, more and more utilization of this technology in banking sector is expected.

However, the real scope of Artificial Intelligence in banking is through the use of Artificial General Intelligence. In the last few years, great achievements have been made in this field of study and within a few years we will find decision making in banking entrusted to Artificial Intelligence. Intelligent systems will handle Human Resource Management, Marketing, Asset and Liability Management, Regulatory Compliance, Security Management, Risk Management and other aspects of banking.

With progress in Natural Language Processing (NLP) and Natural Language Generation (NLG), the digital banking will enter a new era. Customers will be able to interact with systems in their own language and dialect. Marketing and customer service will be precise. The banking will become easy and will, thus, reach all sections of society. Artificial Intelligence will enable banks to operate through staff-less branches and virtual banking nodes. There are significant opportunities for developing effective public relations of banks with their constituents through use of AI. The scope of Artificial Intelligence is limited by the extent of human imagination.

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