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## **Pre and post changes of AI, IOT & cloud computing in financial services and banking sector during pandemic COVID-19**

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**Abstract**--When the COVID-19 Pandemic hit our country in February, where southern parts of India came into contact with such a novel virus whose treatment revealed, our prime minister sanctioned a curfew on 24th March 2020 and declared a nationalize lockdown. As a result, our country's economic and financial growth came into a deep crisis. Therefore, Artificial Intelligence, cloud computing, and the Internet of things came into the picture to overcome such a crisis. Artificial Intelligence and IOT help reshape the traditional system of banking and financial institutions into technological advancement. We all know about the essential clouds in today's economy as it reaps a high value of security and confidentiality. To get benefits, the financial industry must incorporate cloud computing. Banks must exercise

caution when entering the cloud computing sector because cloud computing will provide many advantages to banking companies. Although the financial industry's the using cloud computing seems to be helpful to the company and market, the financial sector must address difficulties such as privacy preservation, security, regulatory compliance, standard interoperability, and service quality. This paper highlights the benefits of AI, IOT during COVID-19 and the data privacy of cloud computing in the Banking Sector.

**Keywords**--Banking Industry, AI, IOT, COVID-19, cloud computing, financial institutions.

## **Introduction**

When the pandemic started in 2020, it faced numerous global crises in India. Owing to the spread of the Corona Virus, the banking and economic market sector faces many challenges. Multiple Lockdowns in various parts of India raise questions about our country's economic growth. As India is an under-developed country, GDP must be in a statutory position so that if the GDP fails, it will not be a nice moment for our country. Undoubtedly the multiple cases come into various parts of India led to paralyzing the whole economic and financial growth of the Indian Market. However, AI, IOT & Cloud computing plays an essential role in the banking sector. Digital cloud computing refers to digital technologies to achieve chances for profit maximization and income development as Customers and institutions have different needs.

Business & strategic planning have been challenged through COVID-19 beyond technologies, permanently reshaping the company. A survey confirmed that COVID-19 replies accelerated technological adaption by many years. The COVID-19 outbreak has spurred financial banking institutions to step up their Digitalization. Risk management, Cybersecurity, identity verification, private equity, access to financing, and other aspects of financial institutions gain from Digitalization. It has been noticed that people's use of advanced information technologies, especially cell devices, to monitor and manage their money is increasing due to social distance. The digital revolution offers considerable advantages to businesses in collaboration with data analytics, and industries have demonstrated how AI can improve their business models. Through enhanced consumer targeting, identification of prime places for branches and ATMs, and other methods, AI has raised income and potential ramifications and expenditure in the banking and financial services industry. As per the International Finance corporation, phone banking services have been initiated in approximately 80 countries, permitting millions of previously excluded and under-served poor people to access e-payment, credit transfer, insurance, and other related services. IoT experts support banks and other financial institutions in building various services to improve client satisfaction and experience. Despite the rising popularity of e-banking among consumers, existing economic sectors' marketing efforts to promote and boost client satisfaction remain woefully inadequate. Because individual banks face fierce competition, they rely on public relations and specialized offerings to entice clients. Cloud computing has been in use for

some time. With the idea gradually gaining traction worldwide, the emergence or acknowledgment of new cloud resources is making it far more practical than in the past. With the market's evolution, it is critical to appropriately identify accessible resources and classify cloud computing elements based on newly identified patterns. Whenever cloud computing is employed, it has a more significant influence on technology and significantly impacts people. Cloud computing refers to converting several modern computing technologies and methodologies into something unique. The cloud separates applications and information resources from the underlying infrastructure and delivery systems.

### Literature Review

In recent times, AI has made breakthroughs in practically every industry. The quantity of information acquired, chosen, and processed by the IoT is so vast that it is incomprehensible to humans. The Internet of Things (IoT) is a technique where many linked devices use internet protocol communication services and operations without it being directly disrupted by humans. Service companies such as insurance, banking, and transportation effectively use these technologies by gathering, interpreting, and transmitting data in real-time and autonomously. AI and IoT also enable the bank to create more personalized services and boost client accessibility to services. Examined the extent IoT is an advertising medium, stating that marketing experts worldwide anticipate IoT will have a significant impact.

In their article "Benefits of Cloud for Banking Sector, Kiran Bala Nayar and Vikas Kumar (2014)" noted in their article "Benefits of Cloud for Banking Sector" that the manner government operates evolved. Rather than the bank, the client now has power. This business model changes the typical business transformation. Cloud computing provides a business model for these banking requirements that provides creative consumer experiences, practical cooperation, and accelerated time to market. It is a platform for streamlining banking processes while providing customers with new offerings. Many banks are embracing this technology to expand.

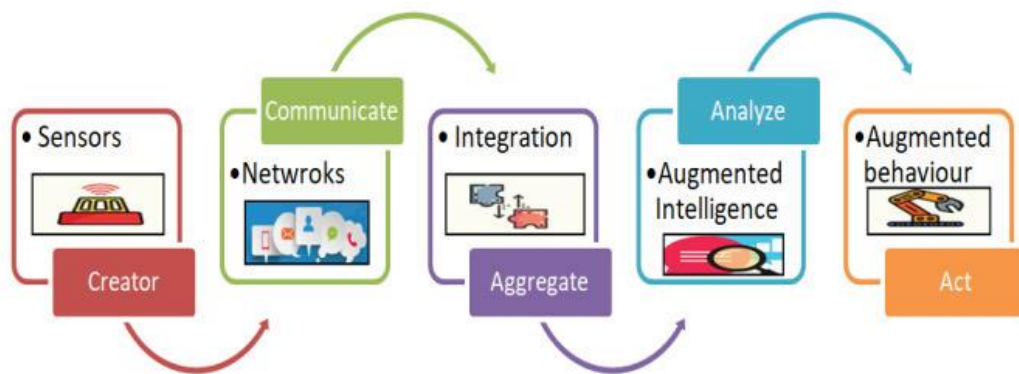


Figure 1. Flow of IOT in the Banking Sector

## Reasons for Implementing Artificial Intelligence

The amount of data created by humans and technology today far outpaces humans' right to absorb, interpret, and make complex decisions based on that data. The cornerstone of all machine learning and data mining, and the future of expert systems, is artificial intelligence. Computers efficiently analyze various ratios and variations and make the optimal option. Machine learning and AI, its logical progression of machine learning, are the underlying basis of commercial decisions.

## AI in Banking and Financial Institutions

“By 2030, automation may have saved over trillion dollars in the financial system. The banking business is one of the most recent adopters of artificial intelligence. Most financial institutions use AI to improve back-office productivity and prevent Cyber dangers. The banking sector is experimenting with automation remedies to various economic issues.”(*JCRTG020019.Pdf*, n.d.)

Issues. It could use artificial intelligence (AI) in the banking sector; it optimizes and automates activities, and AI would save the banking industry more than \$1 trillion by 2030. The banking business is among the most recent adopters of machine learning. Usage scenarios differ based on the financial institution's size, location, and nature. Banks use AI to increase customer pleasure, boost productivity, and sustain client loyalty. Many features support artificial intelligence to identify illegal operations in various settings. AI software delivers a large sample of data, including fraudulent and non-fraudulent investments. It is taught to determine if a transaction is genuinely based on data. Based on what it has already learned, the software becomes extremely good at detecting fraudulent transactions.(Kaur et al., 2020a)

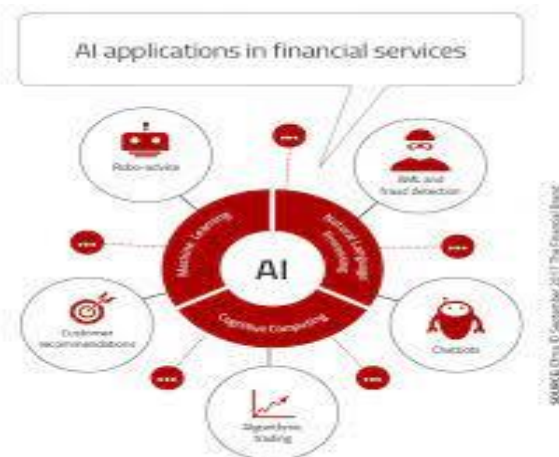


Figure 2. Applications of AI in banking

## IOT in the Banking sector

Technology has transformed the medium through which we communicate during the past several decades. Wi-Fi and sensors have changed the way we interact with our surroundings. The Internet of Things heralds a new era of connection. The term "Internet of Things" is not a new one.(Manoharan et al., 2016).

Although its precise origin is uncertain, it was most likely coined in the late 1900s to refer to device connection and machine-to-machine communication. This improved connectivity allows us to tap into the collected data, opening excellent prospects for corporations and numerous personal benefits.(Alzaidi, 2018) Bankers will be crucial to facilitating the majority of that potential. Our connection with financial institutions, as well as the way they operate, will be altered. Branches will be outdated when face-to-face services are taken out. Cars, homes, and offices will begin real-time transactions with banks. Banks' roles as guardians of our money will be broadened, including management services such as budgeting, portfolio management, and even health care. More information collected through IoT can also support the bank in generating sound risk management judgments. Biometrics should assist in the verification process in all digital money transfers, ensuring safe access and integration into social media, spending, and other financial measures.(Ma et al., 2015).

Only our imagination limits the scope of transformation. Already, game-changing applications and services are being tested and implemented.(Nymi, TD and MasterCard Announce World's First Biometrically Authenticated Wearable Payment Using Your Heartbeat, n.d.) It is time for the "Internet of Things" to provide financial services. A day may come when we witness the so-called Banking of Things (BoT)

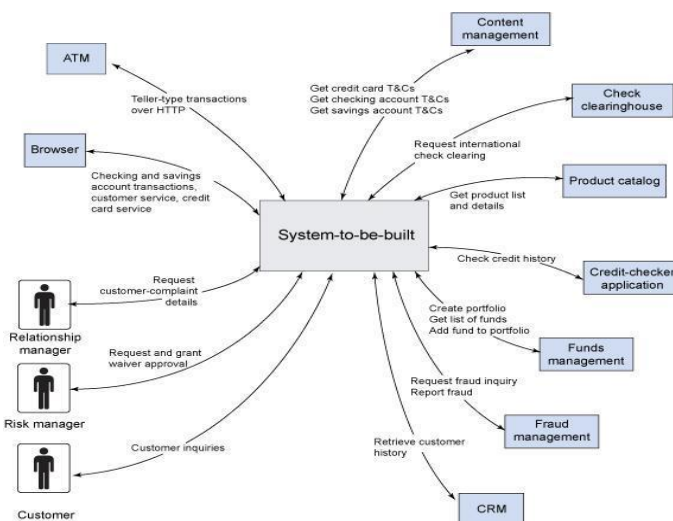


Fig. 3. IOT Application in Banking Sector

AI and IOT in banking - Applications

### Net Banking System

The banking industry makes a considerable contribution to the economy. Financial institutions have made significant investments in innovative

technologies in the last few generations to reduce costs and improve the customer experience.

To provide the most incredible quality of service to consumers, banks now offer a range of digital banking channels such as ATMs, online banking, m-banking, and online banking kiosks. Furthermore, Digitalization boosts profitability and lowers operational expenses, although the implementation rate of technology-driven financial services differs by country. To thrive in the market, practically all banks provide digital-based services to their consumers, making it critical to understand customer demands and build services and strategies appropriately.

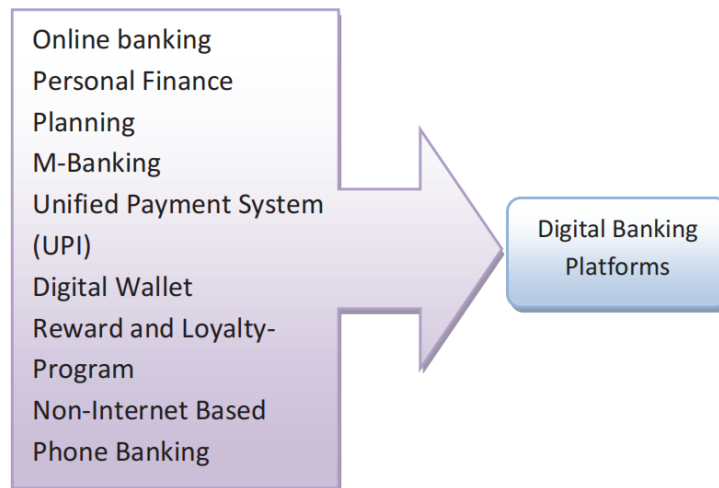


Fig. 4. Demonstration of Artificial Intelligence in the Banking Sector

During the outbreak, the “National Payments Corporation of India” allows users to send funds using messaging apps such as What’s App. “The Reserve Bank of India” has approved boarding consumers using video KYC, commonly known as KYC. With the implementation of KYC, financial institutions and authorities have made the procedure easier for both customers and banks. “Kotak Mahindra Bank was the first Indian bank to implement video KYC for their clients, beginning with establishing savings accounts. SBI Card, ICICI Bank, Yes Bank, and Capital Float followed suit. However, India is the world’s second-largest producer and user of cash, after only China” The RBI and the government continue to encourage people to switch from currency to digital payments. HDFC Bank has successfully established a pre-paid mobile recharge service, an online fixed deposit option, the opportunity to invest in mutual funds, and the capacity to apply for loans and insurance. Digitally, four critical areas for digital success have indeed been identified.

- Reinventing the feedback of Customers
- Portable devices
- A solid database
- Selecting the most appropriate technological platforms

Banks are establishing several loyalty programs resulting from Digitalization, such as “CITI bank’s Citi Thank you, Bank of America’s Preferred Rewards, Wells

*Fargo's Go Far Rewards, Deutsche Bank's Expressed Reward, and Barclays' Blue Rewards, among others.*” Without a doubt, these campaigns are directing customers' attention toward digitization.

#### Smart Automated Teller Machine

Barclays established the “*first Automated Teller Machine in 1967 in London.*” Initially, the primary function of ATMs was to deliver cash solely. In terms of innovation and scope, such technologies had advanced at an accelerating rate between 1967 and 2018. Nevertheless, in recent times, artificial intelligence (AI) and the Internet of Things (IoT) have drastically changed how banking institutions operate. After the COVID-19 pandemic boosted the development of contact-less payment systems, smart ATMs have progressively become the second biggest channel. One of the latest advancements in the thriving financial services sector is the online ATM system. Modern banking and financial institutions regard the internet as a powerful weapon that heavily leverages the delivery of services and goods with the same efficiency at a lower cost. Smart Machines enable technology while also delivering improved customer service and lowering the risk of fraud. One Russian bank has already begun to deploy face and biometric identification modes for ATM service access.

#### AI Chatbots

A chatbot is a tool backed by analytics that communicates using users in a human-like manner. It is an automation tool that offers financial assistance to bank customers via voice and text communications. The service is available 24 hours a day, seven days a week, and can conduct day-to-day transactions, allowing clients to use connection services without additional expenses associated with staffing customer support. A chatbot can ultimately operate as an answering machine, servicing consumers constantly throughout the day. It can answer simple queries from users of various banking applications and, if needed, redirect them to the company's website. Chatbots are intended to provide rapid and simple administrative tasks such as creating or canceling accounts, transferring cash, etc. (*Applications of Artificial Intelligence (AI) in Banking and Finance | Science Online*, 2019)

The chatbot may provide essential connections for completing the procedure, provide quick connectivity, and significantly decrease the strain on customer service executives. Although customer service representatives offer excellent service, their time and the number of people that can assist in a day are limited.

#### Online application for banking

A financial software (*What Are Advantages & Disadvantages of Internet Banking (Online Banking)?*, 2015) featuring Automation characteristics presents service offers and insights depending on the user's activity; the app manages to advise and communicate elements by analyzing the user's data. Banks may provide online wealth management and other services by putting AI advancements into the app. AI banking applications have the potential to do marvels, and it is simple to use AI to assist consumers with personal finances.

Financial institutions acknowledge a need to strengthen and diversify consumer connectivity; financial apps could enhance consumer experiences and attract new

consumers. That sort of AI-powered technology (*Applications of Artificial Intelligence (AI) in Banking and Finance | Science Online*, 2019) illustrates how banks always seek new and inventive methods to improve the user experience and truly comprehend consumer behaviors.

AI technology has been integrated into quantitative research. With higher data sets, any AI system can perform successfully. A customized mobile banking app with AI-powered capability may collect all relevant and essential client data to improve the learning process and overall user experience. After gathering, statistics can customize the experiences. Upon collecting data from users' mobile devices, the Automation m - banking software analyzes data utilizing automation to give relevant information or direct users to the source of information.

Wealth management and asset management can always be effectively managed by artificial intelligence. It encourages 'banking at your fingertips' for consumers who detest visiting banks; online payment supports the administration of essential banking services, enabling users to conduct electronic and secure transactions. They are requested to inform of any odd actions due to their processes and adjustments.

AI delivers a card management system that automates and protects the credit and debit card management program. It assists clients in ignoring a long and complex verification system in the event of a losing card. The AI system helps in saving customers' time and energy even while improving mobile banking services.

#### *Offerings and Incentives Which Are Unique*

Financial institutions compensate customers using credit/debit cards or other payment methods with cashback that may redeem in a precise situation. These incentives may not be appealing to all types of clients, rendering these incentive programs ineffective in most cases. Consumers may be lured using IoT-based data by providing relevant redeemable alternatives according to their purchase behavior and ethnicity. For example, a customer expected to spend most of her money on clothing should be given reward points that may redeem for clothing discounts. Other customers who spend more money on meals, on the other hand, should be given points that they may save at restaurants. As a consequence of such individualized benefits, consumer engagement and commitment will improve.

#### *Fraud Protection*

It can avoid misuse of debit/credit cards by installing IoT-enabled security systems at usage sites, such as ATMs, which incorporate more personal and secure authentication mechanisms. Citigroup is testing ATMs that authorize transactions using eye-scanning technology.

#### *Management of Capacity*

Banks are constantly striving to grow their network of branches and ATMs while also managing the current units as effectively as possible. The average wait time may be determined using Integrated software surveillance to count the number of client units per day and establish the optimum number of people and counters at

each branch. Decisions on new extensions can also be aided by analyzing the customer distribution information based on geography.

### *The Influence of IoT on Banking*

IoT, when coupled with a creative layout, can completely alter banking. Interface IoT, the world's largest initial IoT financial platform, helps customers save money by connecting their bank accounts to IoT-capable items. It may also benefit from combining IoT interconnection with Blockchain to create a reliable and secure network. Wearable technologies are the second significant development brought about by IoT in finance. Wearables have been the primary target for banks worldwide because of their popularity and reach. Most watches are now linked to a phone. However, there have been several advances that allow for autonomous wearables. Wearables have become a hotbed of financial innovation as a result of this.

## **Challenges of IOT in the Banking Sector**

### Providing Value to Customers

The clarity with which the concern description is established correlates to the efficacy of IoT deployment. Most IoT service providers, however, ignore this. Professionals should comprehend that these approaches affect long-term productivity, client happiness, and production. This entire cycle requires extensive self-reflection. There is no more major IoT implementation stumbling block than this interpretation of the client issue description. As a result, IoT experts must build key performance indicators to monitor and improve an IoT system's efficacy. (Vijay kumar, 2019).

### Difficulties with Device Interoperability

Data collection is accomplished mainly by using different sensors, PLCs, and other devices connected to IoT networks for data collection and transmission to the cloud based on their objectives and business objectives; organizations must painstakingly identify the equipment, hardware, and existing legacy machines. IoT implementation becomes more challenging when outdated equipment lacks the PLCs and sensors indicated above. Adding external sensors to old equipment is a straightforward fix, but it is incomplete, making it a complicated procedure.

## **Impacts of AI on the Banking Sector**

### Positive Impacts

AI could aid a bank in detecting a customer's spending habits, developing a personalized investment strategy, and helping clients with budgeting. Banks can also send notifications regarding recommendations for keeping track of costs and investments based on data. It may track the customer's behavior and preferences using transactional and other data sources to optimize their experience. Artificial intelligence can filter through large volumes of data and spot patterns that humans would miss. Many financial service providers use artificial intelligence and machine learning technologies to detect fraud in real-time, which is one area where this capability is significant. (Kaur et al., 2020b)

### Method to evaluate risk

Automation can manage and simplify this procedure by considering important info about a prospective lender. Artificial intelligence can combine and analyze information related to the most recent money transfers, trend analysis, and financial activity to detect potential dangers in lending.

### Scam Detection

The financial sector has recognized and eliminated fraud challenges with the growing increase in fraudulent activity. Numerous banks sought but failed to spot the ingredients and successful solutions. Automation, on either side, supports authorities by rendering it more straightforward and can locate embezzlement characteristics. It enhances financial expertise by utilizing sophisticated identity theft protection procedures. While exposed to stressful conditions and techniques, artificial intelligence serves as simple fraudulent solutions for the financial system. AI can identify corruption by analyzing anomalous activities based on improved data analysis. It also feeds back into the customer's profile, increasing the environment's security.

### Increased efficiency and effectiveness

Artificial intelligence improves the effectiveness, reliability, and speed of arithmetic operations while also handling massive volumes of data. Banks, for example, can calculate the optimum first margin minimizing transactions at any particular moment based on the degree of minimum reserve decrease experienced previously under varying configurations of those deals.

### Removing responsibilities from individuals

The financial institution has software programs that conduct repetitive movements ranging from automated processes to responding to queries to accountants. Artificial intelligence may delegate jobs from people to AI, lower expenses, increase reaction time, keep individuals up to date on the latest regulatory developments, and save time by generating reports.

### Negative Impacts

#### Expensive

Because they are incredibly complicated computers, the creation and upkeep of artificial intelligence necessitate a significant investment. Automation is mainly up of related software applications that must be scheduled initially to satisfy the needs of the changing situation. In the case of a catastrophic malfunction, rebooting the platform and retrieving erased credentials might require an excessive deal of time and money. (Alzaidi - 2018 - *Impact of Artificial Intelligence on Performance o.Pdf*, n.d.)

#### Irrational choices

Especially because Automation can understand and improve, it cannot decide things. Financial status and snap decisions are encouraged to come up to make decisions. Anything Technology will never be possible to accomplish. Combining efficient social actions with Automation in sentient systems could lead to asinine activity.

### Power Distribution

There is a perpetual concern about AI supplanting or supplanting humans. Artificial intelligence can offer a small set of individuals an amount of energy. As a result, AI can take away people's power while denigrating conduct in various methods.

### Employment Issues

Employment levels might result from the substitution of humans with technologies. Additionally, while Technology emerges increasingly widespread, humans would become excessively reliant on Technology, squandering its creative abilities. A recession is an immoral and unethical problem. Humans who want nothing to do with time may misapply their beliefs under challenging situations. Artificial intelligence can significantly raise poverty incidence in banking or any other industry.

### **Cloud Computing**

Digitization implies making transactions more accessible and convenient for users in the financial sector. The widespread use of digital banking has grown in recent years. Most commercial and government sector institutions focus on delivering new technology-based services to their consumers, such as mobile banking, mobile banking applications, and e-wallets. The most significant benefit of digital channels in banking is its potential to create future initiatives, adjustments, and customer-specific business models by analyzing banking patterns that significantly improve consumer value. Due to the fast advancement of technology, Indian banks are experiencing significant changes in their banking procedures. Banks of all sizes in India have realized the value of cloud-based financial services and how they can help them solve problems.

Previously, banks had to approach an IT staff to supply extra apps and computing capacity, which was time-consuming and delayed decision-making. As a result, IT is no longer recognized as a problematic issue, and banks have begun to realize the promise and reach of cloud computing technology.

### **Definition of Cloud Computing**

Cloud computing is on delivery of computing, storage, software, and other IT infrastructure with consumption billing. Cloud computing is a new Internet-based computational technology. Many devices are linked together via public or private networks to provide continuous infrastructure services for applications, data, and file storage. Cloud computing is one of today's most exciting technologies. Its capacity to lower service costs while boosting flexibility and scalability for computer operations is widely established. Banks and financial institutions all around the globe are embracing Cloud Computing to streamline processes ranging from consumer service delivery models to risk management, laying the groundwork for long-term development and innovation. Cloud computing provides access to a diverse consultancy network, technological allies, and business solutions that maximize performance. Banks may increase personnel resources as required and pay for what they use, eliminating the need for significant upfront capital investments.(Pravin, 2021)

## Need for Cloud Computing in Finance department

The financial system is experiencing a unique issue, as it has the opportunity to provide banking access to millions of banked individuals while also being challenged by cloud-native fintech startups. The financial industry embraces digital transformation and assures its long-term survival in a new competitive and collaborative environment to maximize its potential. The financial sector must manage and extract data, sometimes in conjunction with cloud-native startups, while also assuring long-term operational reliability. Cloud adoption helps to achieve these aims, making it essential to the operations of every developing digital firm and giving benefits not only to incumbents but also to entrants, customers, and the economy as a whole. It delivers infrastructures and actionable insights at the pace demanded by Digitalization and at a level that the financial sector cannot match with its in-house IT support. Cloud adoption in the financial industry is still in its initial stages. A majority of financial institutions, 61 percent, are implementing a cloud strategy within their business. The most prevalent approaches include private, public, and hybrid cloud systems. The specific deployment models' companies use is connected to developing their cloud initiatives. Only 9% of respondents with cloud technology policies stated a preference for private clouds. Financial institutions that leverage the cloud utilize public clouds. At the same time, many other organizations use both private and public clouds, with a massive amount actively merging in-house services with public cloud environments. Companies creating cloud strategies do not want to rely as heavily on public clouds. Companies were most concerned about security, compliance, privacy, data retention and deletion, and data residency.

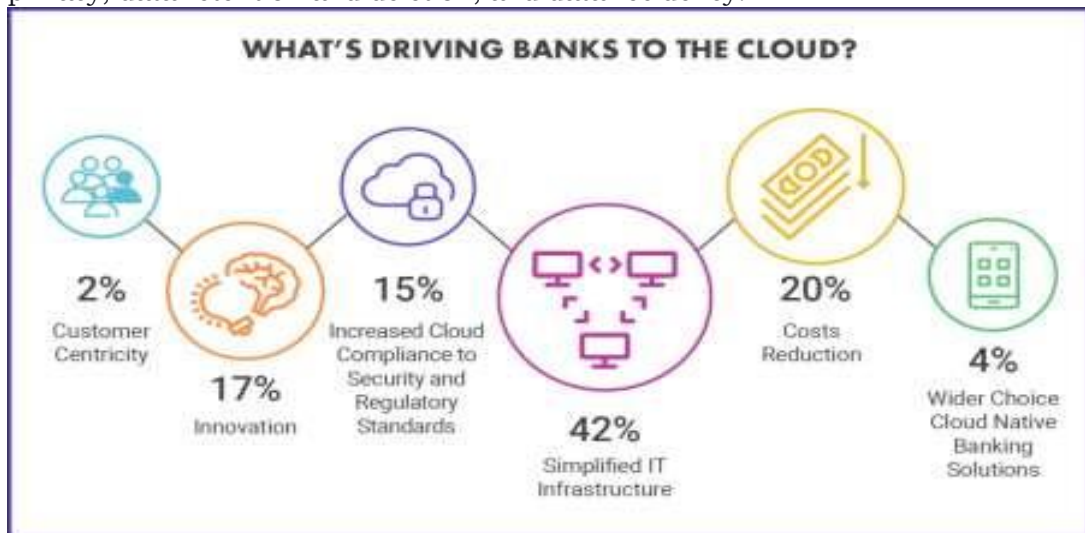




Fig. 5 Application of Cloud Computing in Banking

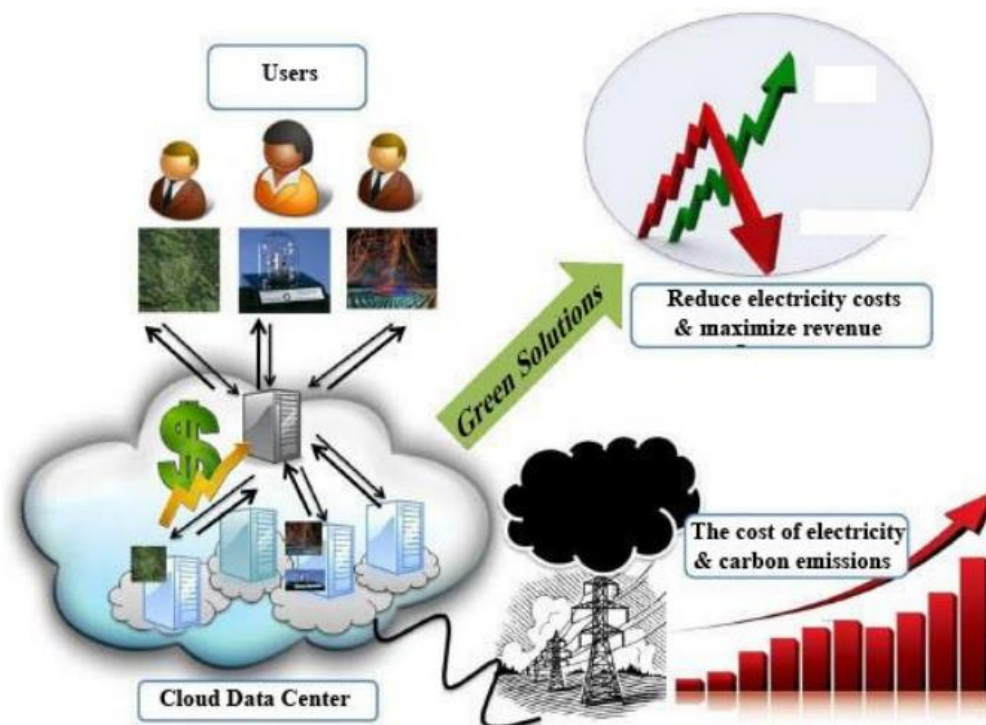


Figure 6. talks about Cloud Data Transfer in Banking Sector

## Cloud computing in the Banking Sector

### Banking Fundamentals

A core banking system is a software that supports a bank's most typical transactions. A central banking system handles everyday transactions and modifications to accounts and other financial information. In layman's terms, core banking refers to the mechanisms that enable almost every transaction for a bank. It entails Creating new accounts. Cash deposits and withdrawals are processed. Payments and checks are processed—interest Calculation.

### **Know Your Customer (KYC) Electronic (EKYC)**

Electronic Know Your Client, or e KYC is a method of resident authentication used by banks and other financial. Aadhaar allows communities to digitally submit it for a verification purpose, which is as valid as a Xerox copy. It enables people to interconnect their mobile phone number to their bank account without visiting the bank, open a bank account without visiting the bank, repay the money, and many other services. ((PDF) *Benefits of Cloud for Banking Sector*, n.d.)

### **Barriers to cloud computing**

#### **Failing to grasp obligations**

In a start-up environment, data security is primarily the responsibility of a business that possesses the data. The cloud computing system is split into two actors: the cloud provider and the client. Assuming cloud service providers don't disclose the extent to which security procedures are implemented, the consumer is unaware of which activities need to be established. There is a considerable likelihood of making inaccurate risk management judgments in that circumstance. Additionally, the various cloud services imply performance can be assessed by both the service provider and the consumer. If a public cloud model is employed, the provider is responsible for physical security, environmental security, and virtualized protection, whereas the customer is responsible for everything else.

#### **Data confidentiality problems**

The challenge of preserving information confidentiality and privacy is among the significant security legitimate concerns that shifted to the cloud. Numerous relevant issues start in this scenario, like who may create data, where it can store the information, who can access and update data, what happens when data is erased, how recoveries are conducted, how data transfers take place, and so on.((PDF) *How Cloud Computing Is Transforming and Benefiting Financial Institutions*, n.d.)

### **Conclusion**

AI is progressively permeating the banking business to strengthen financial services. People are more inclined to use digital to keep up with their bank accounts and execute transactions in times of social separation and isolation. With these advantages, it might well be that most financial institutions would be using AI to compete and provide better service to customers. A machine learning algorithm, on the other hand, has some disadvantages. As it continues to develop new skills, the judgment capabilities could present problems shortly.

End users will be able to perform almost leisurely, from anywhere and anytime, thanks to the internet. It provides a new opportunity to solve issues and provide value to financial services and its consumers - no aspect of life is left unaffected. The Internet of Things is changing the face of money and banking.

Our creativity only limits the notion of the Internet of Things. A tremendous quantity of innovation has already been introduced to the market. But keep in mind that the Internet of Things is not a goal; instead, it is a means to an end.

### Figure Legends

1. Figure 1 describes about the Role of IOT in banking sector
2. Figure 2 describes about the Role of AI in banking sector
3. Figure 3 describes about the Various chain of applications of IOT in banking sector
4. Figure 4 describes about the demonstration of Artificial Intelligence in banking sector
5. Figure 5 describes about the Various chain of applications of cloud computing in banking sector
6. Figure 6 describes about the Cloud Data Transfer in Banking Sector

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