

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/359106385>

Role of Artificial Intelligence and Internet of Things in Promoting Banking and Financial Services During COVID-19: Pre and Post Effect

Conference Paper · March 2022

DOI: 10.1109/ISCON52037.2021.9702445

CITATIONS

6

READS

886

2 authors, including:



Pooja Mishra
GLA University

5 PUBLICATIONS 15 CITATIONS

SEE PROFILE

Role of Artificial Intelligence and Internet of Things in Promoting Banking and Financial Services During COVID-19: Pre and Post Effect

Pooja Mishra
GLA University (Institute of Business Management),
Mathura Uttar Pradesh, India
pooja.mishra_phd.mgt20@gla.ac.in

Dr. Tatavarty Guru Sant
GLA University (Institute of Business Management)
Mathura Uttar Pradesh, India

Abstract—The covid-19 outbreak has triggered an economic crisis and severely affected the global economy. The revolution of AI and the Internet of things (IoT) is helping in reshaping the traditional financial sector by consolidating technology, finance, and economics. This paper highlights how the integration of Artificial intelligence (AI) in IoT is helping in promoting digital financial inclusion during the COVID-19. Through multiple real-life case studies, this article examines the successful implementation of AI and IoT in banking and financial institutions. The paper also explores the advantages and opportunities arising by the use of AI and IoT in the financial sector. A descriptive research approach has been followed to investigate the pre and post effect of COVID-19 and how it is leading towards economic efficiency.

Keyword—COVID-19, Economic Crisis, IoT, AI, Economic Efficiency

I. INTRODUCTION-

The COVID-19 is one of the biggest crises faced by global economies. The rapid spread of the virus has a significant impact on global financial markets. Multiple lockdowns happened to restrict the spread of the virus which have resulted in an immediate decline of GDP by 20% to 25% even in the most advanced economies [1]. Undoubtedly it has created an unprecedented level of risk to the investors in a very short period. COVID-19 caused greater depression in terms of economic, social loss and paralyzed the whole world [2]. Although, an adaptation of technology has played a crucial role in managing the circumstances during the pandemic. Digital transformation is revolutionizing the whole banking and financial sector. This is rapidly changing how services are selected, created, offered, and evaluated.

Digital servitization, leveraging digital technology to create more opportunities for value creation and revenue generation for customers and institutions respectively.

Moreover, COVID-19 has pushed industry and management over technology and transformed business forever. A survey done by [3] confirmed that responses of COVID-19 have speeded the adaptation of technology by several years. The COVID-19 pandemic has forced financial institutions and banks to make more investments in digital transformation. Digitalization is helping financial institutions in risk management, cyber-security, fraud detection, behavioral

finance, financial inclusion, etc. It is observed that social distancing is accelerating people's use of internet-enabled devices, especially mobile phones to view and manage their cash [4]. Digitalization with a combination of data analytics is offering huge benefits for corporations and industries have demonstrated that how their business models benefit from using AI [5]. Implementation of AI in banking and financial services has not only increased the revenue of the organizations but compressed the risk and cost through better customer targeting, identification of better location for branches and ATMs, etc [6].

The world bank stated that digital financial services connected with mobile phones have been launched in almost 80 countries which is helping millions of formerly excluded and underserved poor people in utilizing various services like e-payment, credit transfer, insurance, and other related facilities [7]. AI has transformed the world of the banking and financial industry as a whole and offering a smart and safe way to access, save, spend, and investment of money. According to [8], the global use of AI in finance is predicted to reach \$22.6B in 2025, with a compound annual growth of 23.37 % during 2020-2025.

Viewed through the conceptual lens our major focus is to investigate the value-in-use perception of AI and IoT-based technologies. The Internet of Things can be defined as a network of physical "things" that are embedded with sensors, software, and other technologies to exchange data with other devices with the help of the internet [9].

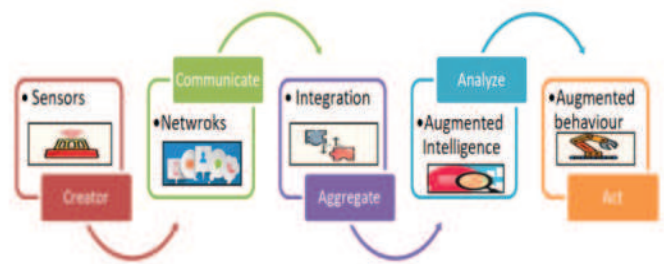


Fig. 1. Flow of IoT Process

In a very short period, there has been a drastic increase in usage of devices from millions to billions, this is also

increasing the time that people are spending in operating these devices. IoT experts are helping banking and financial institutions to develop multiple applications that will help in enhancing customers' experience and satisfaction. In the traditional banking sectors despite the popularity of e-banking among users, marketing activities that enhance and develop customer satisfaction are lacking. There is a high level of competition among individual banks and that is why banks are now pushing themselves in public relations and providing customized services to attract their users.

This paper is more focused on the systematic review of multiple case studies of financial institutions. The review of our study provides evidence that urban financial institutions are witnessing another wave of transitions, several fintech players competing to promote banking services by way of robotics and AI to automate banking by machines. The first humanoid branch assistant launch by HDFC namely 'Ira', similarly City Union Bank's 'Lakshmi' and 'Mtra' by Canara bank are just a few examples of how banking and financial institutions are emerging into AI and IoT based services. IoT is applied for several applications in the multi-dimensions fields such as healthcare, waste management, smart grid, and intelligent shopping. Despite the emergence of AI and IoT implementation, institutions and customers are facing challenges and accepting the transformation pace. Nowadays, AI and IoT are catching the attention of researchers and financial institutions. In the best knowledge of the author, there is no further study happened on the role of AI and IoT in promoting banking and financial activities concerning the COVID-19 pandemic.

II. LITERATURE REVIEW-

AI has shown a huge stride in recent years that almost every sector using it. The amount of information gathered, selected, and interpreted by the IoT is so huge that a human can't absorb it [10]. IoT is a technology where a large number of connected devices work with internet protocol communication services and functions without a direct interruption of humans [11]. Service sectors like insurance, banking, and transport are utilizing these technologies efficiently in collecting, processing, and exchanging data immediately and automatically [12].

The whole model of banking has shifted towards a connected and digital-driven organization. The new digital trends promoting several banking functions like risk management, transactional model, customized service, and information system [13]. [10] analyzed the factor affecting the readiness of IoT applications in the banking sector and found out that security and user intention are mediating factors while efficiency is a moderating factor. [13]Mentioned that IoT is still in the infancy phase and will grow rapidly in near future.

AI and IoT also allow banks to implement customized services and increase the accessibility of the services to customers [14][15] analyzed the scope of IoT as a marketing tool and mentioned that marketing experts around the world believe that IoT has a significant impact on the marketing landscape in 2020. [16] Explained in his study, that AI swiftly

influencing financial institutions with prospective benefits, such as improvement in financial services and better regulatory.

[17] Investigated that AI is changing the working of commercial banks and their findings suggested that there is advancement in the traditional banking sector with the implementation of AI. The Indian banking sector is discovering a new path in which AI can be incorporated and as a result, it is going to improve their working efficiency and customer satisfaction. [18] In their study mentioned that modern cloud computing with AI helps in compressing the periods of business intelligence delivery which provides the quicker rollout of services with better flexibility along with improved performance, accuracy, and efficiency. Since banks and financial institutions play a crucial role in value co-creation in the mind of the customer, institutions can analyze customer behaviors and can offer value proposition services to their customer in the form of applications and transactions to them [19][20].

One of the most critical operant resources available to financial institutions and customers is their level of acceptance of new technology. For example, [21] study found that acceptance of digital platforms involves risk, perception, and complexity. Although, success in AI and IoT implementation is highly reliant on institutions and customers' level of comfort with technology. Additionally, the value of AI is highly dependent on customers' perception and attitude towards various other factors such as technology readiness, security, and trust [22]. Because the customer can control their transaction with the help of AI and IoT, does not limit the co-creation process. The use of these technologies is going to enhance customers' and institutions' experiences over time with AI tracking the individuals' needs and helping in creating unique value-in-use.

There are multiple pieces of research available in the field of AI and IoT separately and how other factors affect the behavior of the customer in acceptance of the same. This extensive literature review will focus on the cumulative impact of AI and IoT in the banking and financial sector with the help of case studies. Based on the literature review a framework is formulated which is showing the relevance of technology for customers and institutions and leading towards economic efficiency.

III. RESEARCH METHODOLOGY

In this study, a systematic literature review approach has been followed. We have collected data from various authentic and reliable sources. Based on multiple case studies, we have discussed how AI and IoT are being used by banking and financial institutions. Descriptive research was conducted to know the impact of AI and IoT on the banking industry. We have also analyzed the pre-post effect of COVID-19 on banking and financial institutions. A conceptual framework was developed to show the economic efficiency after the implementation of AI and IoT in the banking sector.

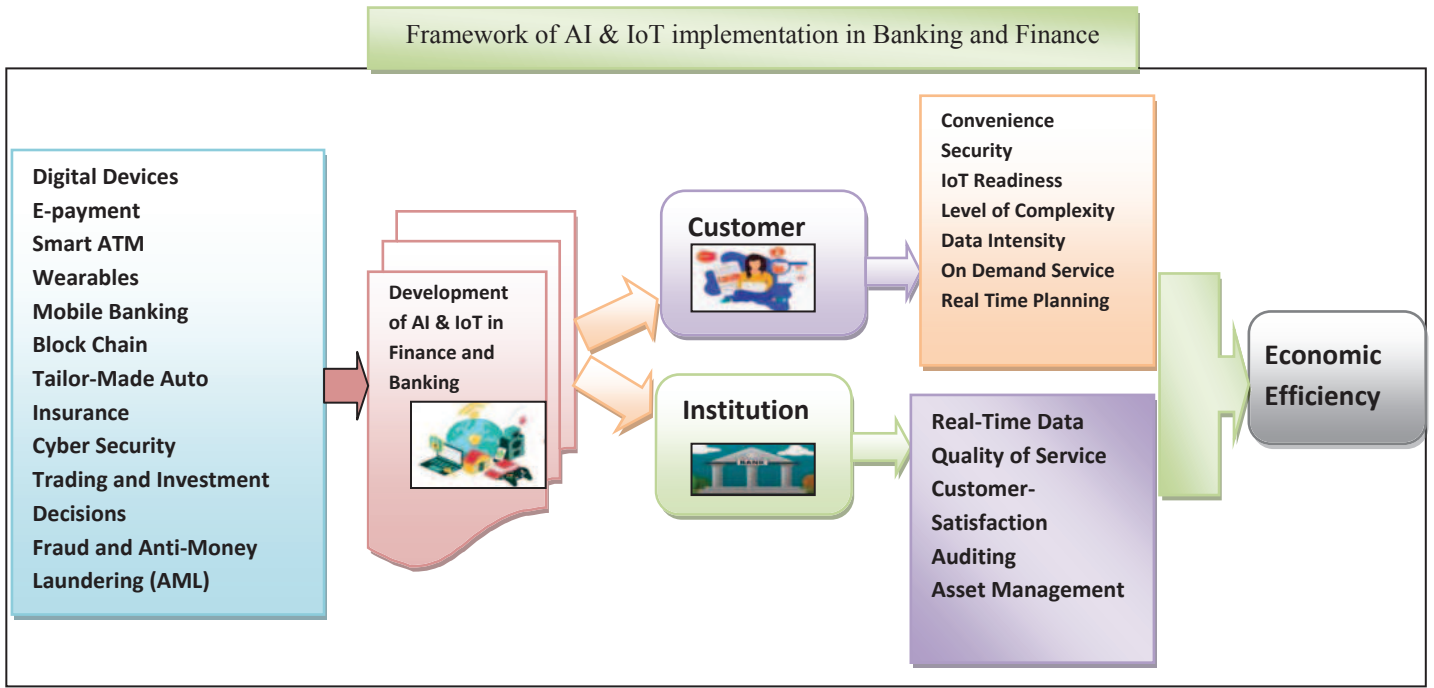


Fig. 2. Conceptual Framework of the Study

IV. THE PERSPECTIVE OF AI AND IOT IN BANKING AND FINANCIAL INSTITUTIONS-

A. Digital Banking –

The banking sector contributes significantly to the economy. In the last few decades, financial institutions are making huge investments in innovative technologies to compress their cost and enhance customers' experience. Nowadays, banks are offering multiple digital banking channels such as ATM, internet banking, m-banking, digital banking kiosks to deliver the highest quality of services to customers [23]. Moreover, digitalization is also increasing profitability and reducing operating costs [24] but the adoption rate of technology-driven banking services varies across nations [25]. To survive in the market almost all banks offer digital-based services to their customers and it becomes crucial to understand the needs of customers and design their services and strategies accordingly [26].

Digital banking includes the online transformation of all the usual banking activities and programs services that were traditionally available to a customer physically inside the banks. COVID-19 has given a significant push to the permanent digitalization of banking in India. [27] A survey showed that during pandemics customers have been moving more towards online transactions as compared to the time before the pandemic. According to the RFI group, almost 71 percent of customers are using digital banking platforms globally. Moreover, there is a sharp rise in mobile banking use monthly from 52 - 57 percent of people between 2019-2020, which is indicating that COVID-19 has accelerated the digital ecosystem [28].

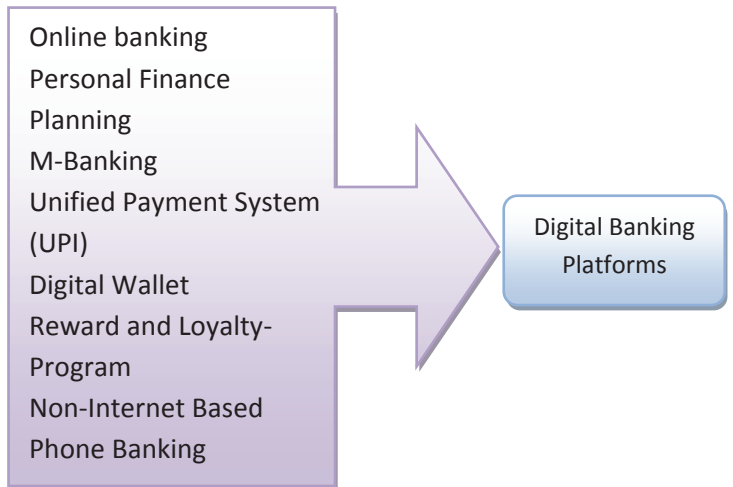


Fig. 3. AI and IoT based Digital Banking platforms

During the pandemic situation, the National Payments Corporation of India also allowed customers to transfer via messaging app such as WhatsApp. The Reserve bank of India approved onboarding the customer through video KYC also termed as VKYC, with the commencement of VKYC financial institutions and authorities make the process convenient for the customers as well as for banks. Kotak Mahindra Bank was the first Indian bank who has announced the video KYC for their customers initially with opening saving accounts [29]. The process was further followed by SBI Card, ICICI Bank, Yes Bank, and Capital Float.

However, India is the second-largest producer and consumer of currency after China. Both the RBI and Government keep on encouraging individuals to shift from cash to digital payments for all the transactions. Recently HDFC bank has also introduced a pre-paid mobile recharge facility, online fixed deposit, invest in mutual funds, and apply for loans and insurance digitally. [30] has defined 4 key areas for digital success- redefining the customer experience, portable devices, strong data set, and selecting the best suitable technology platforms. With the help of digitalization, banks are introducing multiple loyalty programs such as CITI bank- Citi Thankyou, Bank of America- Preferred Rewards, Wells Fargo-Go Far Rewards, Deutsche Bank- Expressed Reward and Barclays- Blue Rewards, etc. Undoubtedly, these programs are shifting customers' attention more towards digitalization.

B. Smart ATM-

The first-ever Automated Teller Machine was launched in 1967 in London by Barclays. During the initial years, the major function of ATMs was to dispense cash only. From 1967-2018 these machines have evolved exponentially in terms of technology and reach. However, in recent times, AI and IoT have completely transformed the way banking institutions use to work. After the trend of contactless payment systems which was accelerated by the COVID-19 pandemic, now smart ATMs have gradually become the second most important channel.

The web ATM system is one of the recent discoveries in flourishing financial service. Modern banking and financial institutes are considering the internet as a strong weapon, which is strongly leveraging the distribution of services and products with the same efficiency at a comparatively lower cost to more potential users [31]. Smart ATMs enable the use of technology and providing them better customer service, moreover, it is reducing the chances of fraud. One of the banks in Russia is already starting to use facial and biometrics recognition modes for accessing ATM services.

The IANS report says that Indian banks are also planning to replace the existing ATMs with multi-function ATMs in the coming years. According to [32], a prototype has been initiated by a payment organization AGS Transact technology, which will use the bank's mobile application to scan the QR code given on the ATM screen, customers just need to enter their pin code and amount on mobile application and ATM will dispense the cash. Bank of India has launched this facility in a collaboration with AGS Transact technology

C. Wearable Technology-

We are living in an era where the world is moving rapidly towards digitalization, interconnected applications, and smart devices. IoT and AI have made a tremendously good job in the implementation of wearable technology. The wearable is an example of Information Everywhere [27]. Apple has launched its very first wearable 'Apple Pay' which enabled payment through the wristwatch. Soon enough, Samsung pay and Android pay also followed the path.

According to the Infosys report, 2014 was considered as a 'year of wearables'. In India, Axis Bank has introduced its first contactless payment Wear 'N' Pay by launching its range of

wearables in collaboration with Thales and Tappy technologies. The device is available in multiple forms such as band, keychain, and watch loop; these devices are directly linked with the customer accounts for contactless transactions. In the public sector State Bank of India has also launched its payment device namely Titan Pay [33]

Moreover, as per [34] wearable's payments are growing day by day, from 2015-2020 it has been increased from \$3.1 billion to \$500 billion approximately depicting a significant growth of smart wearable's usage by developing wearable applications, providing value-added services to the customers and increasing healthy competition among banking institutions. As per the [35], the below graph is showing that from 2014 to 2021 there is a huge spike in the shipment of wearables units worldwide, that is depicting IoT is connected devices growing with each passing year. There is a huge spike in the shipment from 2018-2019 because of the COVID-19 pandemic. Business insiders have estimated that IoT devices will grow by more than 64 billion by 2025.

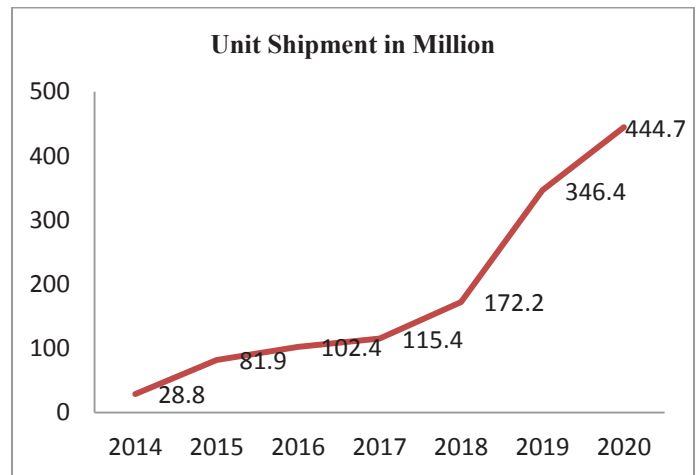


Fig. 4. Total wearable device unit shipments worldwide 2014-2020 (Source- statista.com)

D. Cyber Security-

With the advancement of technology, there are more chances of cybercrime. All the information about customers' interests and behavior can be fetched by AI techniques. In 2016, a survey exposed that the estimated cost of cybercrime was \$450 billion in the global economy (Soni, 2019), and the financial industry was targeted by around 33 percent of large attacks. Hence, it is very important to put some security mechanism to protect from these kinds of threats in banking and financial institutions.

However, to protect against cyber-attacks and to improve customer interactions and experiences institutions are investing more in AI and developing new security measures such as voice banking, biometric authentication, AML (Anti-Money Laundering) detection, compliance monitoring, etc [36]. AI also ensures banks about the credit risk, which has a direct impact on the financial constancy of the customers. AI also helps in tracing the credit score of individual customers across the banking industry. AI is supporting the growth of IoT technologies, such as decision trees, linear regression, machine

learning, and neural networks, which have been included in IoT cyber-security applications to protect the threats and potential attacks.

Furthermore, combating money laundering activity is a crucial task, and it comes with higher costs and risk factors. Innovation in technology such as AI, machine learning, robotics, and cloud-based analysis is preventing financial institutions from anti-money laundering practices. These technologies were developed to detect customer unusual behavior by analyzing their past transactions, which can reduce the number of false-positive alerts. Robotics process automation can be merged with AI techniques to automate the Know Your Customer process effectively.

V. ANALYSIS AND FINDINGS-

Smartness in banking and finance is promoted by the digitalization of the traditional banking system. The concept of AI and IoT is already taking momentum based on the current situation of the COVID-19 pandemic. Institutions are heavily investing in creating IT infrastructure for scaling up the banking products, better customer services, and experiences. The inclusion of AI and IoT is enabling a better operational model with higher scope and efficiency in terms of services. In the past years, there has been a drastic change in the amount of data collected by financial institutions, which has developed a space for understanding and analyzing this stored data for better services. The evolution of innovative technologies such as AI and IoT has allowed solving complex problems and providing solutions in no time.

Nowadays, consumers expect a lot of innovation from banking institutions where they can connect with their interests. The development of AI and IoT-based services not only helping the customers but the institutions as well. Customers can get all the services at their convenience while it is dependent upon the factor of readiness to adopt the technology. Moreover, banking institutions are getting real-time access to all the activities which is helping them in auditing. It has been observed that the implementation of AI-based applications has improved customer satisfaction and experience.

This descriptive in-depth research found that the implementation of innovative technology is transforming the traditional banking industry into techno advanced industry. However, COVID-19 has significantly uplifted the use of digitalization in banking and financial institutions due to social distancing. According to the [30], report, there is a sharp rise of 72% in the use of AI-based applications for banking purposes. A survey was conducted by [37] and found that customers have been using online services considerably in large numbers. The survey also examined (Fig.5) that there is an increase in first-time users of online banking services during pandemic and top of that most of them found satisfactory. If we will compare the data of 2020 and 2021 there is a significant change in the usage of online services based on AI and IoT applications. People are not just using AI-based applications for payment transactions only, they are now using it for multiple services such as; security investment, taking out loans, pension schemes, and advice on bank services (robot chat), etc.

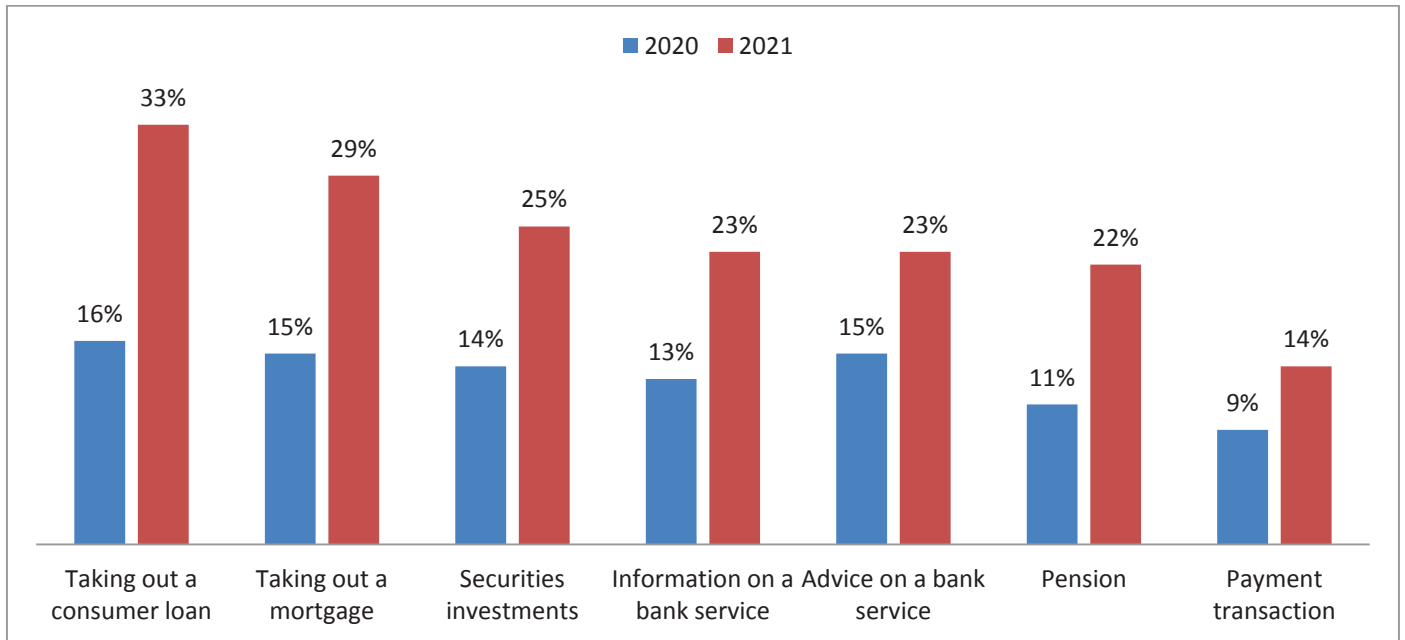


Fig. 5. First-time users of online banking for different services during the pandemic

Hence, the pandemic accelerated the growth of AI and IoT-based services and advancing the existing trend for the future. Nevertheless, the future era of banking and financial institutions will not solely focus on digitalization but is going to be on hybrid mode.

Year	Market Size (Billion)
2017	\$110
2018	\$151
2019	\$212
2020	\$248
2021	\$418
2022	\$594
2023	\$800
2024	\$1,079
2025	\$1,567

Fig. 6. Increase in Global IoT Market (2017-2025)

According to [35], the market expansion of IoT going to increase drastically in near future. Moreover, it is growing significantly after 2019 due to the COVID-19 pandemic. In addition, the revenue of the IoT sector is expected to increase \$1.6 trillion by 2025. As of July'20-August'20 the Indian AI market is valued around \$6.4 billion. Fig.7 showing that the Banking and Financial sectors following IT and Technology industry and contributing \$615.3 million in market value and 9.6% in market share [38]. Moreover, the Banking and financial sectors now implementing AI across functions including, digital service to enhance customer satisfaction, robotics, natural language processing, adoption of algorithms in investments to increase returns and compress risk.

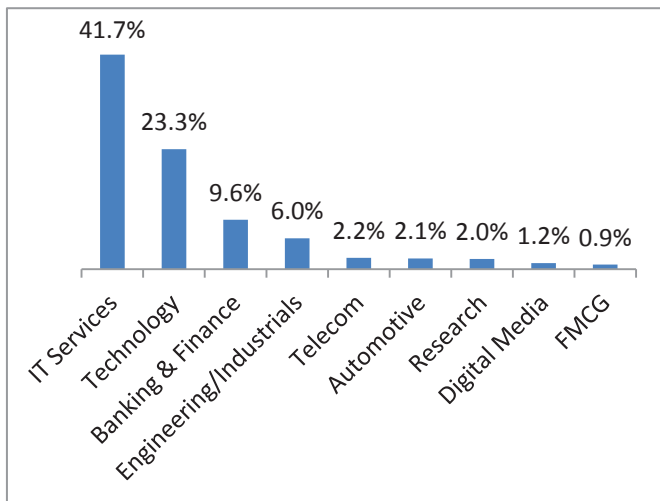


Fig. 7. Industry-wise market share of AI

VI. CONCLUSION-

As we turn our gaze backward, technology has changed all financial activities in the last two decades. Looking ahead, the parallel evolutions of AI and IoT will shape it in the decades to come. Moreover, AI and IoT leading the way in bringing a sea of changes in banking and financial institutions. Even before the current crisis, authorities were pushing customers and

banks to use technology and it had become an integral part of the banking process. The COVID-19 outbreak has now reinforced this which is likely to continue after the crisis as well. Banking and financial institutes are vulnerable to cyber-security attacks. While adoption of AI and IoT technologies is helping in decelerating the chances of these attacks and aiding in solving compliance issues as well. Policymakers and technology providers forecasted IoT will improve the economic value from US\$300 to US\$15 trillion by decades' end [39]. In addition, there has been a significant investment in AI and IoT functions over the last few years.

However, simply providing a digital solution doesn't differentiate individual banks from their competitors, as every bank is now moving towards technology and providing similar kinds of facilities to their customers. So, customers nowadays are more concerned about the extent of security and experiences banks are providing to them. Hence, future researchers can focus on the security expectation of the customers from banking and financial institutions and how much investment is done by financial institutions in AI and IoT-driven services/products to improve customer experiences and satisfaction.

REFERENCES-

- [1] D. Wójcik and S. Ioannou, "COVID-19 and Finance: Market Developments So Far and Potential Impacts on the Financial Sector and Centres," *Tijdschr. Voor Econ. En Soc. Geogr.*, vol. 111, no. 3, pp. 387–400, 2020, doi: 10.1111/tesg.12434.
- [2] T. Linton and B. Vakil, "Coronavirus Is Proving We Need More Resilient Supply Chains," *Harvard Business Review*, Mar. 05, 2020. Accessed: Jul. 19, 2021. [Online]. Available: <https://hbr.org/2020/03/coronavirus-is-proving-that-we-need-more-resilient-supply-chains>
- [3] McKinsey, "COVID-19 digital transformation & technology | McKinsey," Oct. 2020. <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever> (accessed Jul. 19, 2021).
- [4] N. Alber and M. Dabour, "The Dynamic Relationship between FinTech and Social Distancing under COVID-19 Pandemic: Digital Payments Evidence," *Int. J. Econ. Finance*, vol. 12, no. 11, p. 109, Oct. 2020, doi: 10.5539/ijef.v12n11p109.
- [5] McKinsey, "Cutting through the noise around financial technology | McKinsey," Feb. 2016. <https://www.mckinsey.com/industries/financial-services/our-insights/cutting-through-the-noise-around-financial-technology#> (accessed Jul. 20, 2021).
- [6] F. Königstorfer and S. Thalmann, "Applications of Artificial Intelligence in commercial banks – A research agenda for behavioral finance," *J. Behav. Exp. Finance*, vol. 27, p. 100352, Sep. 2020, doi: 10.1016/j.jbef.2020.100352.
- [7] World Bank, "Digital Financial Inclusion," *World Bank*, 2020. <https://www.worldbank.org/en/topic/financialinclusion/publication/digital-financial-inclusion> (accessed Jul. 20, 2021).
- [8] L. Columbus, "The State Of AI Adoption In Financial Services," *Forbes*, 2020. <https://www.forbes.com/sites/louiscolumbus/2020/10/31/the-state-of-ai-adoption-in-financial-services/> (accessed Jul. 20, 2021).
- [9] I. Oracle, "What is the Internet of Things (IoT)?," 2020. <https://www.oracle.com/in/internet-of-things/what-is-iot/> (accessed Jul. 20, 2021).
- [10] R. El-Aziz, S. El-Gamal, and M. Ismail, "Mediating and Moderating Factors Affecting Readiness to IoT Applications: The Banking Sector Context," Social Science Research Network, Rochester, NY, SSRN Scholarly Paper ID 3751202, 2020. Accessed: Jul. 24, 2021. [Online]. Available: <https://papers.ssrn.com/abstract=3751202>

- [11] E. Irmak and M. Bozdal, "Internet of Things (IoT): The Most Up-To-Date Challenges, Architectures, Emerging Trends and Potential Opportunities," *Int. J. Comput. Appl.*, vol. 179, no. 40, pp. 20–27, May 2018, doi: 10.5120/ijca2018916946.
- [12] N. V. Wunderlich, F. V. Wangenheim, and M. J. Bitner, "High Tech and High Touch: A Framework for Understanding User Attitudes and Behaviors Related to Smart Interactive Services," *J. Serv. Res.*, vol. 16, no. 1, pp. 3–20, Feb. 2013, doi: 10.1177/1094670512448413.
- [13] F. Khanboubi, A. Boulmakoul, and M. Tabaa, "Impact of digital trends using IoT on banking processes," *Procedia Comput. Sci.*, vol. 151, pp. 77–84, Jan. 2019, doi: 10.1016/j.procs.2019.04.014.
- [14] A. Kostyuk and D. Govorun, *conference book*. 2020. doi: 10.22495/cgiowp.
- [15] W. Gong, "The Internet of Things (IoT): what is the potential of the internet of things (IoT) as a marketing tool?," Jun. 22, 2016. <http://essay.utwente.nl/70018/> (accessed Jul. 24, 2021).
- [16] J. Truby, R. Brown, and A. Dahdal, "Banking on AI: mandating a proactive approach to AI regulation in the financial sector," *Law Financ. Mark. Rev.*, vol. 14, no. 2, pp. 110–120, Apr. 2020, doi: 10.1080/17521440.2020.1760454.
- [17] D. S. Jewandah, "How Artificial Intelligence Is Changing The Banking Sector –A Case Study of top four Commercial Indian Banks," vol. 8, p. 6, Jul. 2018.
- [18] M. Xue, G. Xiu, V. Saravanan, and C. E. Montenegro-Marin, "Cloud computing with AI for banking and e-commerce applications," *Electron. Libr.*, vol. ahead-of-print, no. ahead-of-print, Jan. 2020, doi: 10.1108/EL-07-2020-0207.
- [19] J. Cambra-Fierro, L. Pérez, and E. Grott, "Towards a co-creation framework in the retail banking services industry: Do demographics influence?," *J. Retail. Consum. Serv.*, vol. 34, pp. 219–228, Jan. 2017, doi: 10.1016/j.jretconser.2016.10.007.
- [20] S. L. Vargo and R. F. Lusch, "Evolving to a New Dominant Logic for Marketing," *J. Mark.*, vol. 68, no. 1, pp. 1–17, Jan. 2004, doi: 10.1509/jmkg.68.1.1.24036.
- [21] S. H. Akhter, "Impact of Internet Usage Comfort and Internet Technical Comfort on Online Shopping and Online Banking," *J. Int. Consum. Mark.*, vol. 27, no. 3, pp. 207–219, May 2015, doi: 10.1080/08961530.2014.994086.
- [22] A. Shankar, "Factors Affecting Mobile Banking Adoption Behavior in India," *J. Internet Bank. Commer.*, vol. 21, Apr. 2016.
- [23] D. N. Kaur, S. L. Sahdev, D. M. Sharma, and L. Siddiqui, "Banking 4.0: The Influence of Artificial Intelligence on the Banking Industry & How AI Is Changing the Face of Modern Day Banks," Social Science Research Network, Rochester, NY, SSRN Scholarly Paper ID 3661469, 2020. Accessed: Jul. 24, 2021. [Online]. Available: <https://papers.ssrn.com/abstract=3661469>
- [24] D. Sarel and H. Marmorstein, "Marketing online banking services: The voice of the customer," *J. Financ. Serv. Mark.*, vol. 8, no. 2, pp. 106–118, Dec. 2003, doi: 10.1057/palgrave.fsm.4770111.
- [25] S. Takieddine and J. Sun, "Internet Banking Diffusion: A Country–Level Analysis," *Electron. Commer. Res. Appl.*, vol. 14, Jun. 2015, doi: 10.1016/j.elerap.2015.06.001.
- [26] S. K. Roy, M. S. Balaji, A. Kesharwani, and H. Sekhon, "Predicting Internet banking adoption in India: a perceived risk perspective," *J. Strateg. Mark.*, vol. 25, no. 5–6, pp. 418–438, Sep. 2017, doi: 10.1080/0965254X.2016.1148771.
- [27] Deloitte, "Wearable banking | Deloitte US," *Deloitte United States*, 2020. <https://www2.deloitte.com/us/en/pages/consulting/articles/wearable-banking.html> (accessed Jul. 27, 2021).
- [28] HSBC, "How banking will change after COVID-19 | Insight | HSBC Holdings plc," *HSBC*, Nov. 2020. <https://www.hsbc.com/insight/topics/how-banking-will-change-after-covid-19> (accessed Jul. 27, 2021).
- [29] IBS Intelligence, "5 big Indian companies that successfully deployed Video KYC solutions," *IBS Intelligence*, Sep. 10, 2020. <https://ibsintelligence.com/ibsi-news/5-big-indian-companies-that-successfully-deployed-video-kyc-solutions/> (accessed Jul. 27, 2021).
- [30] EY, "How COVID-19 has sped up digitization for the banking sector," 2020. https://www.ey.com/en_gl/financial-services-emeia/how-covid-19-has-spiced-up-digitization-for-the-banking-sector (accessed Jul. 27, 2021).
- [31] D. Stamoulis, "How Banks Fit in an Internet Commerce Business Activities Model," *J. Internet Bank. Commer.*, vol. 5, Jan. 2000.
- [32] Time of India, "Banks to install contactless ATMs to cut down on touch - Times of India," *The Times of India*, Jun. 2020. <https://timesofindia.indiatimes.com/business/india-business/banks-to-install-contactless-atms-to-cut-down-on-touch/articleshow/76203355.cms> (accessed Jul. 27, 2021).
- [33] PRABHJOTE GILL, "After SBI, Axis Bank launches its own line of wearable payment devices that only cost \$10 a piece," *Business Insider*, 2021. <https://www.businessinsider.in/tech/gadgets/news/after-sbi-axis-bank-launches-its-own-line-of-wearable-payment-devices-that-only-cost-10-a-piece/articleshow/81443297.cms> (accessed Jul. 28, 2021).
- [34] Infosys, "Wearable devices in banking," p. 8, 2020.
- [35] Statista, "Wearables shipments worldwide 2020," *Statista*, 2021. <https://www.statista.com/statistics/437871/wearables-worldwide-shipments/> (accessed Jul. 28, 2021).
- [36] V. D. Soni, "ROLE OF ARTIFICIAL INTELLIGENCE IN COMBATING CYBER THREATS IN BANKING," no. 1, p. 8, 2019.
- [37] Deloitte, "Digitalisation of banking," *Deloitte Switzerland*, 2020. <https://www2.deloitte.com/ch/en/pages/financial-services/articles/digitalisation-banking-online-covid-19-pandemic.html> (accessed Jul. 27, 2021).
- [38] S. Thomas, "Report: State of Artificial Intelligence in India - 2020," *Analytics India Magazine*, Sep. 08, 2020. <https://analyticsindiamag.com/report-state-of-artificial-intelligence-in-india-2020/> (accessed Aug. 06, 2021).
- [39] K. Dandapani, "Electronic finance – recent developments," *Manag. Finance*, vol. 43, no. 5, pp. 614–626, Jan. 2017, doi: 10.1108/MF-02-2017-0028.