

Transforming the Financial Sector: A Review of Recent Advancements in FinTech

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Abstract—The financial technology (fintech) industry has experienced rapid growth in recent years, driven by advancements in technology and changes in consumer behavior. This has led to the emergence of new trends that are shaping the future of finance. One of the most significant trends in fintech is the increased adoption of Artificial Intelligence (AI) and Machine Learning (ML) technologies. These technologies are being used to automate various financial processes, such as loan underwriting and risk assessment, leading to improved efficiency and reduced costs. Another trend is the growth of blockchain technology, which is being used to create decentralized and secure financial systems. Blockchain-based solutions are also being used to streamline cross-border payments and improve supply chain finance. The use of Robotic Process Automation (RPA) is also growing in popularity in the fintech industry. RPA is being used to automate repetitive tasks, such as account reconciliation and data entry, freeing up employees to focus on higher-value activities. Another trend is the increased adoption of cloud computing, which is being used to store and manage large amounts of financial data securely and efficiently. Finally, fintech companies are also investing in cybersecurity measures to protect against cyber threats, such as hacking and fraud. This includes the use of biometrics and other authentication technologies to secure online transactions. In conclusion, these trends are driving the growth of the fintech industry and transforming the way financial services are delivered. They are making finance more accessible, efficient, and secure for consumers and businesses alike.

Index Terms—Fintech, financial services, artificial intelligence, finance sector, emerging technologies, innovation in fintech, financial inclusion.

I. INTRODUCTION

The finance sector has been quick to adopt Artificial Intelligence (AI) technology in recent years, due to its ability to handle large amounts of data and make predictions more accurately than humans. Some of the key AI trends in the finance sector include: Robotic Process Automation (RPA): RPA automates routine and repetitive tasks in finance, reducing the workload on employees and improving efficiency [48]. Chatbots and Virtual Assistants: Chatbots and virtual assistants are being used in the finance sector to handle customer queries, provide personalized recommendations, and improve customer service. Fraud Detection and Prevention: AI algorithms are being used to detect and prevent financial fraud, by analyzing transaction patterns and identifying unusual activity. Predictive Analytics: Predictive analytics is being used in finance to analyze data and make predictions about future trends and outcomes, helping financial institutions make informed decisions. Algorithmic Trading: Algorithmic trading involves using AI algorithms to make decisions about buying and selling financial assets, based on market data and other factors. Credit Scoring and Lending: AI is being used to analyze data about potential borrowers to determine their creditworthiness and make lending decisions, reducing the time and resources needed for manual processing. Blockchain Integration: AI is being integrated with blockchain technology to improve security, reduce the risk of fraud, and streamline processes in the finance sector. These are some of the main AI trends in the finance sector. The use of AI is expected to continue growing in the future, leading to increased efficiency, improved customer experience, and reduced costs.

Financial technology, or fintech, is revolutionizing the financial services industry by providing new and innovative solutions for customers. Here are some of the key fintech innovations in the financial services industry: Mobile banking and payments: Mobile banking and payment apps allow customers to access financial services from their smartphones, making it easier to manage their finances on the go. Digital wallets: Digital wallets, such as Apple Pay and Google Wallet, allow customers to store their payment information and make transactions without the need for physical cards. P2P lending: Peer-to-peer (P2P) lending platforms connect borrowers with investors, bypassing traditional banks and financial institutions. Robo-advisors: Robo-advisors use artificial intelligence to provide personalized investment advice and portfolio management services. Blockchain technology: Blockchain technology enables secure and transparent transactions, and has the potential to disrupt traditional financial services. Open banking: Open banking refers to the practice of sharing financial data with third-party providers to enable new financial services and products. Insurtech: Insurtech refers to the use of technology in the insurance industry, providing customers with more efficient and innovative solutions. AI-powered fraud detection: AI is being used to detect and prevent fraud in the financial services industry, by analyzing patterns in financial transactions and flagging any suspicious activity. These are just a few examples of the fintech innovations that are transforming the financial services industry. As technology continues to evolve, it is likely that we will see even more innovative solutions in the future.

The financial technology (fintech) industry is rapidly evolving, and new technologies are emerging all the time. Here are some of the technology trends that are expected to shape the future of fintech: Artificial Intelligence (AI) and Machine Learning (ML): AI and

ML will continue to play a big role in the fintech industry, with new applications emerging all the time. AI and ML will be used to personalize financial services, detect and prevent fraud, and improve customer experience [5]. Blockchain Technology: Blockchain technology will continue to be adopted by the fintech industry, enabling secure and transparent transactions, and potentially disrupting traditional financial services [36]. Open Banking and Application Programming Interface (API)-driven Architecture: Open banking and API-driven architecture will make it easier for fintech companies to access customer financial data and offer new financial services and products. Biometric Authentication: Biometric authentication, such as fingerprint recognition and facial recognition, will be used to improve security and provide customers with a more convenient way to access their financial services. Virtual and Augmented Reality (VR and AR): VR and AR will be used in the fintech industry to provide customers with a more immersive and interactive experience, for example, in online banking and financial planning. Quantum Computing: Quantum computing has the potential to revolutionize the fintech industry, by enabling faster and more accurate data processing and decision making. 5G Networks: The rollout of Fifth Generation (5G) networks will provide faster and more reliable connectivity, enabling new fintech services and products. These are some of the technological trends that are expected to shape the future of fintech. As technology continues to evolve, it is likely that we will see even more innovative solutions emerge in the coming years [46]. Internet of Things (IoT): Everyday physical objects that process, send, and receive data are gaining computational capabilities and connecting to the Internet. Thus, due to their connectivity and computing power, such devices may be managed and monitored remotely [51, 46].

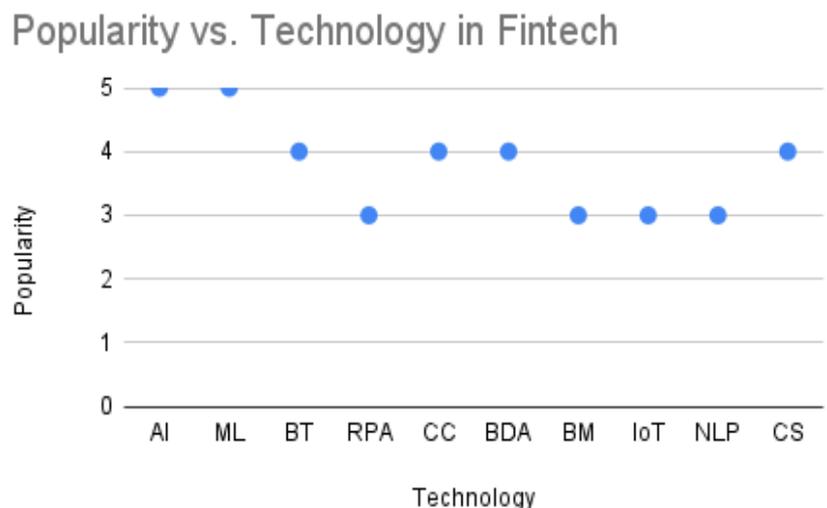
II. OBSERVATIONS

Here are some general observations about the impact of these technologies on the fintech industry: Artificial Intelligence (AI) and Machine Learning (ML) have had a significant impact on the fintech industry by enabling the automation of various financial processes, such as loan underwriting and risk assessment, leading to improved efficiency and reduced costs. Blockchain technology has provided a secure and decentralized platform for financial transactions and has been used to create new financial services, such as decentralized exchanges and digital currencies. Robotic Process Automation (RPA) has helped fintech companies automate repetitive tasks, freeing up employees to focus on higher-value activities. This has led to improved efficiency and increased customer satisfaction. Cloud computing has allowed fintech companies to store and manage large amounts of financial data securely and efficiently, enabling them to offer innovative financial services to their customers. Big Data Analytics has enabled fintech companies to gain insights into customer behavior and preferences, which has helped them to design better financial products and services. Biometrics has played a crucial role in improving the security of online financial transactions and reducing the risk of fraud [25]. Internet of Things (IoT) has enabled the development of new financial products and services, such as wearable payment devices and smart wallets. Natural Language Processing (NLP) has improved the customer experience by enabling the use of voice and chatbot interfaces for financial services. Significant number of industries are exploring and adopting the latest technologies in fintech. This includes traditional financial institutions such as banks and insurance companies, as well as non-financial industries such as retail, e-commerce, and healthcare, among others. The integration of technologies like artificial intelligence, blockchain, and data analytics in fintech is driving innovation and transforming the way businesses operate. Overall, these technologies have transformed the way financial services are delivered, making finance more accessible, efficient, and secure for consumers and businesses alike. Figure 1 and Table 1 are showing technology and its popularity.

Table 1 Technology vs Popularity

Technology	Popularity
AI	5
ML	5
BT	4
RPA	3
CC	4
BDA	4
BM	3
IoT	3
NLP	3
CS	4

Fig. 1 Technology vs Popularity



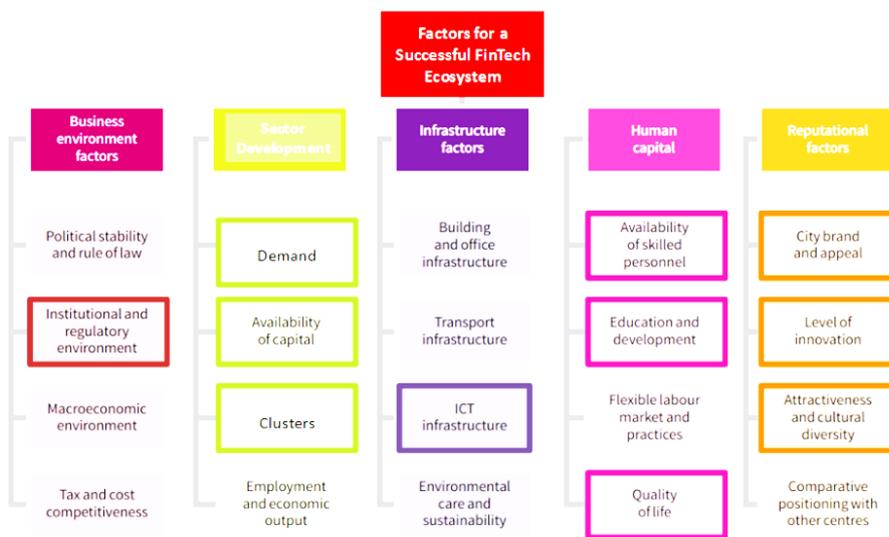
III. LITERATURE REVIEW

Financial institutions must be able to deliver an easy to navigate, a seamless digital platform that goes far beyond a miniaturized online banking offering. - Jim Marous, Digital Banking Report. It appears that users want to enhance the security measures, with the most frequent suggestion being the implementation of biometric authentication methods like fingerprints and iris scans. These options instill trust among users, regardless of their age or level of experience with online banking [1].

The banking and financial services industry has been impacted by the swift advancements in information technology, internet connectivity, and smartphone usage. The integration of financial technology (FinTech) with blockchain technology is intentionally revolutionizing digital banking services. The implementation of FinTech is expected to bring about significant modifications in investment criteria by using blockchain technology to offer customers superior and reliable information. By leveraging equity and decentralization, the combination of blockchain and FinTech in the banking industry can provide a much more efficient and better alternative to traditional banking [2].

The most affordable money transfer option with secure transactions is provided by cloud banking. Because to cloud computing, banks won't need to make huge investments in specialized gear, software, and personnel. Banks can react swiftly to shifting market, consumer, and technical needs thanks to the cloud. Technology can be scaled up or down depending on the situation. Rapid reaction time will be a crucial competitive advantage. Banks will benefit from increased operating leverage and efficiency ratios [3]. Figure 2 is reflecting the factors for a successful fintech ecosystems [4].

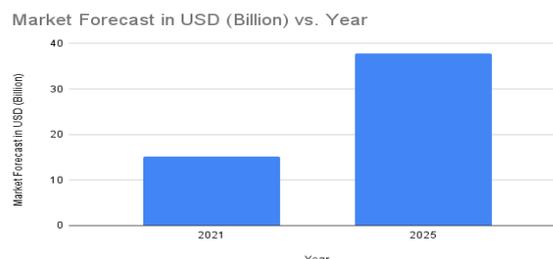
Fig. 2 Factors for a successful fintech ecosystem, Source [4]



The use of AI in finance is anticipated to increasingly help financial organizations gain a competitive edge through two primary channels: (a) by raising the firms' productivity and efficiency, which would increase profitability (e.g., through better decision-making) and reduce costs. processes, automated execution, gains from enhancements in risk management and regulatory compliance, back-office and other process optimization); and (b) by improving the quality of financial services and products provided to consumers (for example, new product offerings, high customizability of products and services). Financial consumers can gain from such a competitive edge in two ways: either by lowering the cost of the products or by improving their quality, variety, and personalization [5].

Implementing Open Banking is the key for banks to remain competitive in the new era, but it also presents both opportunities and threats to banking institutions. The threat comes from limited control over the interaction between banks and their customers. However, the trust of all stakeholders, including banks, FinTech, Technology Finance (TechFin), regulators, and users, is the most important element that should not be overlooked in the new economic landscape. The creation of an open platform between banks and FinTech will provide an advanced environment for increasing bank innovation. For instance, through Open Banking, customers can view all their accounts and transactions on a 24-hour basis regardless of the bank provider. It remains to be seen who the real winner will be between FinTech companies and banking institutions in the years to come [6]. Figure 3 is showing Open Banking market forecast in United State Dollar (USD) (billion) vs Year [55].

Fig. 3 Open Banking market forecast in USD (Billion) vs Year, Source [55]



Consensus-based verification, which is a key feature of blockchain technology, is crucial in the financial industry as it enhances trust and eliminates the requirement for third-party authentication. This makes blockchain technology a significant player in the financial sector. The use of cryptocurrencies in transactions provides only pseudonymous information, leaving room for the possibility of mapping the user's true identity by tracking blockchain activities through public account addresses. However, blockchain-based identity management offers a solution to this vulnerability, as it allows for authentication that only discloses minimal personal information, thereby safeguarding user privacy [7].

Cloud services have significant implications for management, particularly in terms of scalability, which enables the connection of high-volume consumers and producers as required. Financial institutions and regulators also benefit from unmatched flexibility, as they can obtain regulatory reports on demand in real-time. The advent of cloud services has transformed the Know Your Customer (KYC) and Identification & Verification process, resulting in a significant reduction in the workload associated with managing personal data and loan application decision-making. This process is further enhanced by the use of a Robotic Process Automation (RPA) and an AI-driven approach [8].

The addition of IoT-based devices that provide real-time, high-quality data for processing and decision-making is supporting the fintech and banking industries, allowing for scalability. The Internet of Things presents new opportunities for problem-solving and is transforming the finance and banking sectors, making it possible for end-users to conduct online transactions from anywhere and at any time. The integration of IoT has injected new concepts and breathed new life into fintech and banking. In order to take advantage of the accelerated trend towards IoT, fintech's and banks must be well-positioned to exploit this technology and offer personalized, specific services to their clients. It is worth noting that the power of IoT is a double-edged sword - while its proliferation and interdependence make it strong and effective, these same characteristics also make it vulnerable to potential risks [9].

The use of machine learning techniques and big data analytics is a key advantage of FinTech credit, particularly in promoting credit scoring. This article examines the challenges involved in assessing credit risk for small borrowers and highlights the most common machine learning techniques used for this purpose. The discussion is presented in a way that is easy for non-technical readers to understand, providing a sufficient background for analyzing the strengths and weaknesses of using FinTech to improve financial inclusion [10].

As technology continues to advance and consumers have greater access to computing power through devices such as smartphones and laptops, cybersecurity experts are reassessing traditional security models. Organizations must redesign their security architectures to adapt to these trends, as they will have implications not only for fintech but for other industries and device manufacturers as well. Consumers view security as an essential aspect of fintech solutions, with providers bearing the responsibility for ensuring it. In the future, security and data privacy will be critical factors in building consumer trust and driving the adoption of fintech. Therefore, action needs to be taken promptly [11].

There are differences in opinions among stakeholders on various aspects of biometric systems. The reasons for these disparities include a lack of experience with biometrics and different backgrounds, such as being a user or focused on fraud prevention. These discrepancies lead to a delay in the deployment of biometric systems, as evidenced by the survey's findings. It revealed that 88% of individuals are responsible for making decisions about biometric implementations, while only 36% have knowledge about biometrics. This is particularly noteworthy given that 66% of the surveyed companies plan to implement a biometric system within the next five years [12].

H. M. K. al Duhaidahawi et. al. [13] aimed to define Fintech and evaluate the impact of Fintech variables on Cybersecurity as the dependent variable. Through statistical analysis of research variables, the authors developed hypotheses and found that there was a positive relationship between all correlation coefficients at a significance level of 0.01, leading them to accept the correlation hypotheses. The results also showed a positive effect of the independent variable of Fintech on Cybersecurity at a significance level of 0.05 across all sections of the independent variable. The authors observed that the influence of the independent variable of Fintech, when linked to all its sections with Cybersecurity, had a significant influence coefficient of 0.908, indicating complementarity between the sections of the independent variable.

The integration of innovative technologies under the FinTech umbrella has led to the development of natural language processing (NLP) as a key system. The five major technological drivers of FinTech, collectively known as "ABCDE", are Artificial intelligence, Blockchain, Cloud computing, big data, and the Internet of Things. As remote communication has become more prevalent in the latter half of the 21st century, FinTech has had to innovate to keep pace. This research explores how NLP enhances and complements other technologies in the FinTech space. The study aims to identify potential areas for financial transformation through the application of the "ABCDE" drivers in the modern world. The research findings suggest that FinTech technology has brought about many positive innovations that have reduced the world's dependence on others. This technology allows talented people to make more meaningful use of their skills through advanced services. One of the key advantages of FinTech is that it enables customers to estimate changes in the market and react accordingly. For instance, when prices of goods rise, there is an increase in demand for credit requests. This applies not only to consumers but also to suppliers who need credit during periods of excess production. Thanks to Fintech, financial institutions are now available to search for new ideas to fund and develop startups, ensuring that nobody is left behind. The study

highlights how FinTech, as a digital economy, integrates with different aspects of modern technology to create utility values. The study also identified natural language processing as one of the keys enabling technologies behind FinTech, and it aims to identify areas of the modern world that can be transformed into a source of finance using the FinTech's drivers of "ABCDE" [14].

Robotic process automation (RPA), a new technology that aims to automate repetitive, rule-based human tasks to bring benefits to organizations. However, since RPA is a relatively new technology, there is limited scientific literature on the topic. The aim of authors here is to investigate how the academic community defines RPA and to what extent it has been studied in the literature in terms of state, trends, and applications. Additionally, the literature review addresses the difference between RPA and business process management. The researchers conducted a systematic literature review using the Web of Science and Scopus databases to provide an overview of RPA definitions, practical usage, and benefits of implementation in different industries [15].

The financial industry is increasingly relying on digital channels for transactions and payments, making the relationship between FinTech and Cybersecurity a crucial concern. It is essential to assign responsibilities in information security to a dedicated education system, including cyber security, vulnerability management, information governance, and digital identity security in compliance with International Organization for Standardization (ISO) 270001 regulations. This paper proposes an additional pillar to the Cyber awareness organization, which is the level of understanding an organization has of cyber threats and the technology available to counter them. Combining FinTech approaches with cybersecurity methodologies and technologies will result in a 360-degree use of innovative technologies for new products and services, digital ecosystems, preventing and fighting cybercrime, and continued awareness. Regulations will need to be in place to create a controlled and monitorable environment for this emerging fintech-cyber system. The study concludes that there is an urgent need for a combined effort to recognize the new pillars of digital financial ecosystems, with multiple approaches such as regulatory, monitoring, and implementation while referring to classical structures that need to coexist and transform in the medium term. Although new technologies have generated trust worldwide, the threats of cybercrime and the use of Fintech technologies can create risks and uncertainties that must be addressed [16].

The future of back-office processes is being transformed by Robotic Process Automation (RPA), which uses advanced software to automate complex processes and replace humans. RPA is the next significant digital transformation that enables employees to stop working on repetitive tasks and focus on more value-adding initiatives that are essential to the company's bottom line. To investigate the current understanding of RPA, Capgemini Consulting and Capgemini Business Services joined forces and conducted a survey on perceived advantages, current sourcing and automation strategies, as well as the future outlook and implementation plans for RPA in back-office processes. The study focused on various functions such as Finance & Accounting, Human Resource Management, Customer Services, Procurement & Warehousing, Sales & Distribution, and Production Planning. Over 150 executives from companies of different sizes participated in the survey, and their answers, along with selected face-to-face interviews, were analyzed in this report. The questionnaire consisted of 34 questions, and nearly half of the participants reported revenues greater than a billion Euros per annum, while about 10% of participants reported revenues of less than half a billion. The study aimed to ensure the accuracy and applicability of trends identified in RPA by analyzing the participants' general thoughts towards RPA, implementation statuses, sourcing structures, standardization of processes, and future plans with regard to sourcing and RPA [18].

To continue advancing, the banking industry must collaborate to address the complexities of cloud infrastructure. When planning cloud computing projects in the near future, banks should select service and distribution models that enhance organizational stability, cost efficiency, and pay-as-you-use models. According to Capgemini, banks should take a cautious approach to cloud computing resources, reviewing each project depending on the type of applications and quality of data. Low-risk programs such as customer experience management and enterprise content management can be implemented first, while ventures that require central business operating structures, such as wealth management or core banking, carry more risk. Capgemini predicts that banks will eventually offer a combination of on-premise and cloud-based services through private, hybrid, and public cloud-based delivery models, with cloud services gradually increasing their share of the service mix. Private clouds are expected to become more common in the coming years, giving banks full control over their cloud systems by ownership and operations [19].

To promote the sustainable growth of financial technologies while minimizing their potential harm to consumers and investors. This can be achieved by implementing effective risk management techniques that are integrated into the technology itself to reduce the compliance burden. The article outlines the main risks associated with the development of financial technologies and proposes avenues for research in risk measurement models that can help mitigate these risks. Collaboration between academics, fintech experts, and regulators is crucial to developing fintech risk management models that encourage innovation while limiting negative impacts. The *Frontiers in Artificial Intelligence* journal, with its specialty in Artificial Intelligence in Finance, can facilitate collaboration and promote research debates on risk management practices. The ultimate goal is to share best practices in measuring fintech risks and offer automated risk management tools for Regulatory Technology (RegTech) and Supervisory Technology (SupTech) purposes, making fintech innovations competitive and sustainable [20].

The banking industry is on the brink of significant change due to the emergence of blockchain technology. This technology holds the potential to solve long-standing inefficiencies in the industry by eliminating the need for third-party intermediaries, increasing efficiency, and reducing costs. There are five areas in which blockchain technology is expected to make a significant impact: cross-border payments, trade finance, customer identification, capital markets, and regulation and compliance. With blockchain, banks can perform cross-border transactions more quickly and cost-effectively than through traditional services like Swift. By removing the need for third-party intermediaries, transactions become more efficient and transparent for customers. Additionally, blockchain

technology can facilitate more efficient and cost-effective trade finance by leveraging smart contracts to draft agreements and track trade delivery, thereby reducing risk [21].

The creation of financial technology and digital finance applications must adhere to the extensive regulations that govern the financial sector. Adhering to these regulations is mandatory for the introduction of new data-driven applications in the market. Compliance with regulations is also a crucial prerequisite for the development and deployment of big data and AI applications, as discussed in an earlier chapter of the book. To simplify the process of regulatory compliance, the INFINITECH (INFINITECH is a joint effort of global leaders in ICT and finance towards lowering the barriers for Big Data/IoT/AI driven innovation, boosting regulatory compliance and stimulating additional investments [56]) project has created a range of tools that help financial institutions and fintech's comply with the various regulatory mandates. These tools are intended to minimize the effort and costs associated with regulatory compliance, making it more feasible for financial organizations to comply with regulations [22].

The future of business, economy, and information technology lies in fintech, which also has the potential to contribute to environmental preservation. Over the past decade, research on fintech has revealed numerous significant and conceptual aspects. Through this research, we have identified some of the fundamental factors in fintech literature. It is important to note that fintech is a modern development, and research in this field has grown significantly in recent years [24].

The academic and scientific community's increasing interest in financial technology is evidenced by the rising trend in international research, as demonstrated by the growing number of articles covering current and future research in this field. This suggests that the scientific activity surrounding financial technology is taking place in a supportive environment, with a widespread desire to share the publication results and facilitate technical advancements [26].

The integration of artificial intelligence has greatly enhanced e-finance, with formerly manual or statistically modeled tasks now being more intelligent, self-governing, and predictive. A majority of the contributions in this field focus on various areas, including decision-making processes, bankruptcy, credit ratings, creditworthiness, fraud detection, FinTech, human resources, and recommendation systems [28].

Financial service providers are increasingly utilizing blockchain technology to improve authenticity, security, and risk management. By adopting blockchain in their trade and finance systems, many institutions are building smart contracts between participants, which enhances efficiency, transparency, and offers new revenue opportunities. The unique recording capabilities of blockchain make the traditional clearing and settlement process redundant. Banks and financial entities are now using blockchain-enabled identification (IDs) to identify individuals. To capitalize on the emerging trends in financial blockchain applications, organizations need to develop blockchain functionality. Blockchain technology can clarify asset ownership and obligations for accountants, which can increase productivity. Authors examined the importance of blockchain technology for financial services and highlights various tools, strategies, and featured services in blockchain-based financial services. Furthermore, authors evaluate the significant applications of blockchain technology in financial services, including the faster, more cost-effective, and more customized issuance of digital securities. By using mutualized standards, protocols, and shared procedures, network users can access a single common source of truth. With this technology, participants in the business network can collaborate, manage data, and easily agree on how to use it. Businesses that use blockchain in finance can utilize smart contracts to upload invoices onto the blockchain. The blockchain can contain important information, such as payment due dates, amounts, and client information. Once the customer pays the bill, the smart contract will update the invoice status to "paid" and notify the business that payment has been received. Additionally, blockchain can be used in financial services to assess a client's trustworthiness before trading. It is anticipated that blockchain technology will play a critical role in managing various activities in the finance sector in the future [29].

The growth of fintech companies that use AI has led to an increase in mergers and acquisitions among financial service providers and wealth managers as they try to cope with volatility, uncertainty, complexity, and ambiguity. The main appeal of AI is its ability to reduce costs and increase differentiation, which is attractive to companies of all sizes. However, apart from fraud detection, the benefits of AI depend on the scale of the organization. There are risks associated with using AI, such as non-representative data, bias in representative data, the choice of algorithms, and human decision-making based on AI assessments. To reduce these risks, a careful division of labor between AI and humans is necessary. AI innovations can analyze big data to help cut costs, reduce risk, and increase customization, which can lead to economic growth by increasing aggregate demand and investments [30].

In the past ten years, there has been a quick advancement in technology which has led to the use of machine learning (ML) in different sectors of the economy. Financial institutions have also adopted this technology and have incorporated ML algorithms in trading, investment advising, and portfolio management. The ability of the algorithms to automate on a large scale and to save on costs make them a desirable option for both personal and corporate financial applications. Even with the best information available, both humans and machines can make mistakes in approving credit card requests. Therefore, combining human judgment with machine learning can lead to better decision-making in the field of finance [31].

Big data analytics has the potential to offer organizations certain capabilities, but it is important to take into account its various aspects and framework during the pre-adoption, adoption, implementation, or diffusion phases. The research also aims to explain the various dimensions of big data analytics as a novel technology, which should be of considerable interest to researchers, practitioners,

educators, and policymakers. Authors demonstrates a noteworthy fascination and practicality in the value of Big data analytics, which embodies the emergence of the Fintech phenomenon [32].

The financial sector has been an early adopter and a leading industry in the integration of artificial intelligence. By utilizing various AI technologies such as data mining, precise profiling, machine learning, and neural networks, significant changes have been brought about in financial products, service channels, service methods, risk management, credit financing, and investment decision-making. The rapid advancement of AI has had a profound impact on the high-end finance of the deep service value chain. The integration of AI and finance is irreversible, presenting both risks and opportunities, and the financial industry must expedite its adjustment and development. Furthermore, the financial regulatory authorities have clarified their supervisory responsibilities, employed AI technology in supervision methods and techniques, and enhanced the degree of supervision automation and intelligence [33].

Financial technology, or fintech, is rapidly gaining widespread attention and developing at a fast pace, resulting in the introduction of new regulations. Fintech refers to the use of technology in various financial activities, usually provided by companies or organizations through an application. It is important to address significant issues such as network attack security restrictions and privacy threats. Fintech integrates various cutting-edge technologies like mobile, embedded systems, mobile networks, mobile computing, cloud, big data, data analysis technology, and embedded cloud computing. Embedded Finance (EF) plays a vital role in providing seamless integration and financial services to customers' business services, just like ride-sharing companies Uber and Lyft have successfully integrated payments. Embedded finance enables financial services to be offered on the customer's terms, anywhere and anytime, eliminating the need to visit banks to access their money. In some cases, embedded finance, particularly embedded banks, may even replace traditional banks [34].

The emergence of technological innovations has brought about significant changes in the way financial services are provided, leading to disruption. Fintech has contributed to improving financial services, removing customer constraints, and lowering operating costs. However, it also poses a threat to other factors. Fintech startups already face significant competition from established financial service providers. Technological innovations are the most appealing aspect of fintech, and the financial services industry has greatly benefitted from fintech's intervention over the last two decades [35].

Blockchain is a distributed network environment with a shared ledger where all transactions are publicly available to users. Through a set of protocols and cryptographic techniques, blockchain provides privacy, security, transparency, and anonymity. Although blockchain is not currently a complete solution to problems in numerous sectors, its features offer hope for greater importance in the future years [36].

The integration of Data Science, AI, and ML with fintech provides a competitive edge to financial institutions. The revolutions and advancements in fintech are accelerating and will continue to drive innovation, creating new financial products and services. Financial institutions must adopt fintech and evolve with it to avoid being eliminated from the market and becoming history [37].

Researchers who specialize in both NLP and finance face a significant problem due to the lack of publicly accessible datasets. For example, constructing a multi-term dialogue system is a current challenge in the NLP field, and one of the key issues is automatically classifying customer intents from their initial input. Unfortunately, no publicly available dataset exists for this task in the financial domain, as far as our knowledge extends [38].

Big data technology has found significant use in the financial sector. The integration and application of financial data with other cross-disciplinary data are being strengthened, and artificial intelligence is now an emerging field of financial big data application. The trend is towards greater integration, sharing, and opening of financial industry data, which has brought about new development opportunities [39].

Blockchain is a set of protocols and infrastructure that allows computers in different locations to simultaneously propose, validate transactions and update records across a network. Financial technology (FinTech) is a form of innovation and technology that competes with traditional financial methods for the delivery of financial services, and aims to improve accessibility to financial services through the use of smartphones for mobile banking, investment services, and cryptocurrencies. However, the use of Blockchain technology in cryptocurrencies is problematic due to the high risk of debasement, lack of trust, and inefficiencies related to high electricity and human effort costs required for clearing cryptocurrency transactions. Cryptocurrencies' high volatility makes them poor means of payment and store of value, resembling fraudulent investment operations. The rapid expansion of Blockchain and FinTech has spread their potential benefits quickly, but has left unaddressed risks such as anti-money laundering, consumer protection, tax evasion, and the regulation of capital movements. The technological expansion has outpaced the regulatory measures taken so far, which means that more regulation and cross-country coordination is required [41].

At present, conventional data analysis methods are largely employed in economic analysis by both public and private sectors. However, there is a significant potential for better strategic planning in green enterprises, which requires a more comprehensive understanding of economic and ecological activities that are currently not considered in traditional data analysis, such as the shadow economy. In order to achieve this, a shift to a forward-looking approach to data analysis in green business and innovations is essential. Nonetheless, several challenges need to be addressed to implement big data analysis in both sectors: Significant investment is required

for modernizing equipment and selecting software that is compatible with existing Information Technology (IT) infrastructure. Additional staff training would also be necessary. Creating an automated system for data sharing between public and private sectors is necessary to facilitate the implementation of big data management in green business. The digitalization of the economy is heavily reliant on support from donors (countries and organizations), which is not sustainable in the long-term. There is a shortage of skilled professionals in the field of green economy analysis [42].

Enhancements in connectivity and computing technology can have a positive impact on efficiency and competition. In some instances, financial services have experienced the separation of various products and services. However, certain financial barriers and factors that were the reason for the requirement of financial intermediaries have once again become significant. The financial industry appears to be gravitating toward a barbell outcome in market structure, where large multi-product institutions coexist with smaller specialized niche institutions [43].

Collaborating with fintech companies can bring many benefits, such as cost savings, lower costs for customers, and faster services. However, fintech firms are particularly concerned with cybersecurity, and in recent years, traditional banks that have partnered with fintech firms have become more vulnerable to cyber-attacks. One possible reason for the increased number of cybersecurity incidents is that fintech services may not be fully compatible with those of financial institutions, and the operational scale of financial institutions may be too large for fintech firms to handle. The evidence suggests that financial institutions tend to report cyber-attack incidents shortly after collaborating with fintech companies, as fintech firms transfer their inherent cyber risks to their partner institutions [44].

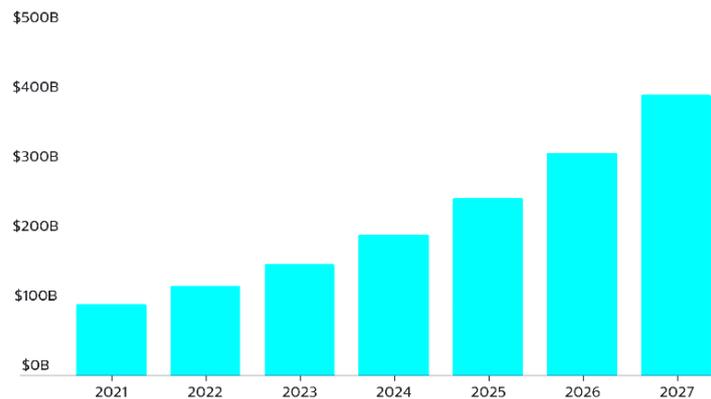
The integration of information technology with the financial industry has led to innovation in FinTech. China has played a significant role in this innovation, but there has been a lack of research that systematically summarizes FinTech innovation and development in China through patent analysis. The authors conducted an analysis of FinTech's connotation and function, along with previous research, and grouped Chinese FinTech patents into six categories: payment, lending, insurance, security, data analysis, and investment. They utilized data from all patent applications published by China's State Intellectual Property Office from 2013 to 2020 and employed traditional machine learning and deep learning methods to classify FinTech-related patents. Initially, they used text filtering and manual annotation to establish an annotated dataset for model training. Next, the training and test datasets were utilized with various machine learning and deep learning models to assess their effectiveness in text classification. The authors categorized Chinese FinTech patents into six types, namely payment, lending, insurance, security, data analysis, and investment, using machine learning and deep learning approaches. They analyzed the data to understand the current state of FinTech innovation in China. The number of payments FinTech patent applications reached its peak in 2018, indicating the high innovation intensity in mobile payments. Currently, data analytics patent applications dominate FinTech patents, reflecting the future direction of FinTech. The number of FinTech patent applications varies across regions, with developed provinces having more applications. New FinTech patent applications are increasingly concentrated in Beijing, Shanghai, and Guangzhou. The traditional banking industry in China started innovating in FinTech relatively late, but since 2019, the number of FinTech patent applications from banks has grown rapidly as they try to catch up with the FinTech challenge. [45].

Financial organizations are increasingly seeking to modernize and digitize their operations, with a focus on Financial Technology (Fintech) that leverages disruptive technologies such as AI, (Fifth generation/Sixth Generation)5G/6G, Blockchain, Metaverse, and IoT. Fintech is aimed at improving customer services by simplifying and enhancing financial services and processes such as lending, verification, fraud detection, credit scoring, and quality maintenance. However, further research and innovation is required to develop disruptive financial products and the necessary technology ecosystem. As a result, many tech giants are investing in Fintech to provide Information and Communication Technology (ICT) solutions. In order to achieve the United Nations (UN) Sustainable Development Goals (SDGs) of eradicating poverty and promoting economic growth, the future of the financial industry will rely heavily on the integration of advanced IoT technologies such as AI, IoT, 5G/6G, Metaverse, and digital twin by the year 2030. However, it is important to implement financial regulations that are both user-friendly and secure. It is also crucial to conduct research into secure, scalable, sustainable, and environmentally-friendly Fintech practices [46].

The role of financial technology (FinTech) has become increasingly important in various aspects of modern society, such as economy and technology. The next-generation FinTech, referred to as Smart FinTech, has emerged and is heavily reliant on data science and new-generation AI and data science and artificial intelligence (DSAI) techniques. Smart FinTech utilizes a wide range of DSAI techniques to transform finance and economies by enabling intelligent, automated, personalized, and whole-of-business financial services, systems, and businesses. Research in data science and AI in FinTech has led to significant advancements in various areas, including Banking Technology, Trading Technology, Lending Technology, (Insurance Technology) InsurTech, Wealth Technology, Payment Technology, Risk Technology, cryptocurrencies, and blockchain. DSAI techniques such as complex system methods, quantitative methods, intelligent interactions, recognition and responses, data analytics, deep learning, federated learning, privacy-preserving processing, augmentation, optimization, and system intelligence enhancement are among the techniques that have contributed to these advancements [47].

Robotic Process Automation (RPA) is a collection of emerging technologies that offer the potential to automate business processes by mimicking human actions. While the benefits of RPA, including time and cost savings, have been demonstrated in different contexts, we could not find any comprehensive review of the quantitative outcomes. Thus, there is a need for a thorough investigation to demonstrate the measurable advantages of RPA across various industry sectors [48].

Fig. 4 Financial technology market growth projects, Source [53]



India's FinTech adoption rate is the highest in the world at 87%, which is considerably greater than the global average rate of 64%. India is one of the fastest-growing FinTech markets globally, with over 2,000 Financial Technology (FinTech) startups recognized by Department for Promotion of Industry and Internal Trade (DPIIT) in the country and this number is rapidly increasing. In 2021, the size of the Indian FinTech industry's market is \$50 billion, projected to reach approximately \$150 billion by 2025. The FinTech sector in India is expected to manage assets worth \$1 trillion and generate revenues of \$200 billion by 2023, with Payments, Lending, and InsurTech being the most popular sectors in 2021. The Indian FinTech industry comprises several sub-segments such as Payments, Lending, Wealth Technology, Personal Finance Management, InsurTech, and RegTech, among others.

Since January 2017, the Indian FinTech market has received funding worth \$29 billion across 2,084 deals, accounting for 14% of global funding and ranking second in deal volume. In Fiscal Year (FY)22, the Indian FinTech sector secured \$8.53 billion in funding through 278 deals. As of July 2022, 23 Indian FinTech companies have achieved "Unicorn Status" with a valuation exceeding \$1 billion. Additionally, as of September 2022, 358 banks participate in India's Unified Payments Interface (UPI), which has processed over 6.8 billion transactions worth more than \$135 billion [17].

The growth of the FinTech industry in India is the result of years of preparation and implementation of key initiatives that have enabled its development, including [17]:

Jan Dhan Yojana: The "Jan Dhan Yojana" initiative, which is the world's largest financial inclusion program, has facilitated the enrolment of more than 450 million beneficiaries in new bank accounts, providing them with access to a range of financial services such as credit, insurance, pensions, and remittances. This has enabled FinTech companies to develop technology products that cater to the large consumer base in India.

Financial Literacy: Several initiatives aimed at improving financial literacy have been implemented in India, such as the establishment of the National Centre for Financial Education and the Centre for Financial Literacy project by the Reserve Bank of India (RBI), which are aimed at promoting financial education for all sections of the population.

Electronic RUPI (E-RUPI): E-RUPI is a person and purpose-specific digital payment instrument designed to enable contactless and cashless payment solutions. It is expected to play a crucial role in making Direct Benefits Transfer more seamless and effective. E-RUPI is also being adopted for cashless payments for COVID-19 vaccination.

India Stack: India Stack is a collection of APIs that provides a unique digital infrastructure for governments, businesses, startups, and developers to solve India's hard problems in presence-less, paperless, and cashless service delivery. It is one of the most important digital initiatives globally, providing a public digital infrastructure based on open APIs to support public and private digital initiatives. India Stack has played a catalytic role in the evolution of India's digital foundation and the rapid development of the FinTech industry [17].

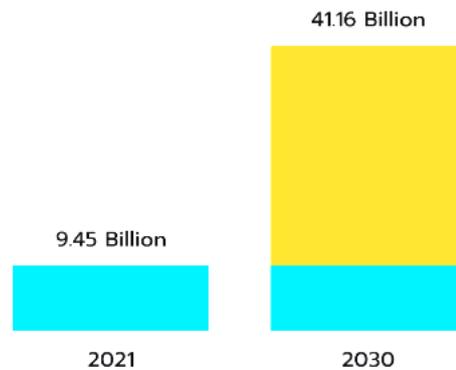
IV. IMPACT OF EMERGING TECHNOLOGIES IN FINANCIAL SECTOR

1. Artificial Intelligence

Impact of AI in fintech industry: Loan Underwriting: AI has been used to automate the loan underwriting process, reducing the time and cost required to evaluate loan applications. AI algorithms can analyze large amounts of data to assess creditworthiness and make lending decisions in real-time [5]. Risk Assessment: AI algorithms can be trained to assess the risk of a loan based on historical data, helping fintech companies to make more informed lending decisions. This can reduce the risk of loan defaults and increase the accuracy of loan pricing [30]. Fraud Detection: AI algorithms can be trained to identify patterns of behavior that are indicative of fraud. This has helped fintech companies to detect and prevent fraudulent transactions in real-time, reducing the risk of financial loss. Customer Service: AI chatbots have been used to provide customers with instant answers to their questions, reducing the workload

on human customer service representatives. AI algorithms can be trained to recognize and respond to customer requests, improving the customer experience. Financial Planning: AI algorithms can be used to provide personalized financial planning advice based on an individual's financial situation and goals. This has helped fintech companies to offer more personalized financial services, improving customer satisfaction. These are just a few examples of how AI is being used in the fintech industry. The impact of AI in fintech will likely continue to grow as more and more financial processes are automated and improved through the use of AI algorithms. Figure 5 shows that the market is predicted to experience a compound annual growth rate (CAGR) of 16.5% [53].

Fig. 5 The FinTech market's worldwide implementation of Artificial Intelligence (AI), Source [53]



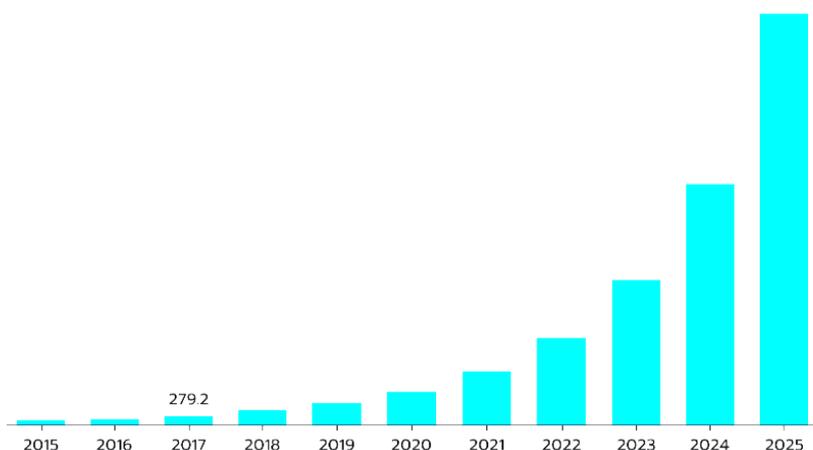
2. Machine Learning

Some of the impact of ML in fintech industry are as discussed here, Predictive Modeling: ML algorithms have been used to build predictive models that can forecast financial trends and outcomes, such as stock prices and loan default rates. These models have been shown to improve the accuracy of predictions compared to traditional statistical methods. Customer Segmentation: ML algorithms have been used to segment customers into groups based on their financial behavior and preferences. This has allowed fintech companies to tailor their marketing and product offerings to specific customer segments, improving customer engagement and satisfaction. Fraud Detection: ML algorithms have been used to detect fraudulent financial transactions in real-time. These algorithms have been trained on large amounts of historical transaction data to identify patterns of behavior that are indicative of fraud. This has led to improved accuracy in fraud detection compared to traditional methods. Credit Scoring: ML algorithms have been used to assess an individual's creditworthiness, taking into account a wide range of data points, such as income, employment history, and credit history. These algorithms have been shown to provide more accurate assessments of creditworthiness compared to traditional credit scoring methods. Portfolio Optimization: ML algorithms have been used to optimize investment portfolios, taking into account factors such as risk tolerance, investment goals, and market conditions. These algorithms have been shown to improve the performance of investment portfolios compared to traditional methods. These are just a few examples of the experimental results of ML in fintech. The use of ML in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

3. Blockchain Technology

Secure Transactions: Blockchain technology has been used to secure financial transactions by creating an immutable record of all transactions on a distributed ledger. This has reduced the risk of fraud and improved the transparency of financial transactions. Decentralized Systems: Blockchain technology has been used to create decentralized financial systems, eliminating the need for intermediaries such as banks and clearinghouses. This has reduced the cost of financial transactions and improved the efficiency of financial systems [2]. Digital Assets: Blockchain technology has been used to create and trade digital assets, such as cryptocurrencies. This has opened up new investment opportunities for individuals and institutions alike [41]. Cross-Border Payments: Blockchain technology has been used to enable fast and secure cross-border payments, reducing the cost and time required for international transfers. This has improved the accessibility of financial services for people in developing countries. Supply Chain Management: Blockchain technology has been used to track the movement of goods and materials through the supply chain, improving the transparency and efficiency of supply chain management. These are just a few examples of the experimental results of blockchain technology in fintech. The use of blockchain in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike [29]. The value of the Blockchain Distributed Ledger Technology (DLT) market in North America, measured in millions of U.S. dollars (USD) shown in figure 6 [53].

Fig. 6 Blockchain DLT market in North America, Source [53]



4. Robotic Process Automation

Some experimental results of the use of Robotic Process Automation (RPA) in fintech:

- Automated Processes:** RPA has been used to automate repetitive and time-consuming tasks, such as data entry, reconciliation, and reporting. This has improved the efficiency of financial processes and reduced the workload on employees.
- Increased Accuracy:** RPA has been used to automate processes that are prone to human error, such as data entry and reconciliation. This has increased the accuracy of financial data and reduced the risk of errors.
- Improved Customer Service:** RPA has been used to automate customer service processes, such as handling customer inquiries and complaints. This has improved the speed and accuracy of customer service, leading to improved customer satisfaction [48].
- Compliance:** RPA has been used to automate compliance processes, such as checking for compliance with regulatory requirements. This has improved the compliance of financial institutions, reducing the risk of fines and legal penalties.
- Cost Savings:** RPA has been used to automate processes that were previously performed by human employees, reducing the cost of financial services. This has improved the profitability of fintech companies and allowed them to offer lower prices to their customers. These are just a few examples of the experimental results of RPA in fintech. The use of RPA in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

5. Cloud Computing

Scalability: Cloud computing has allowed fintech companies to scale their operations quickly and efficiently, providing the necessary computing resources as their business grows.

Improved Data Management: Cloud computing has enabled fintech companies to store and manage large amounts of financial data securely and efficiently. This has improved the accuracy and accessibility of financial data.

Cost Savings: Cloud computing has reduced the costs associated with maintaining and updating in-house IT infrastructure. This has improved the profitability of fintech companies and allowed them to offer lower prices to their customers [3].

Increased Agility: Cloud computing has allowed fintech companies to quickly and easily implement new technologies and services, improving their competitiveness in the market.

Better Customer Experience: Cloud computing has enabled fintech companies to provide a better customer experience by offering fast and reliable access to financial services through the use of mobile and web applications. These are just a few examples of the experimental results of cloud computing in fintech. The use of cloud computing in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

6. Big Data Analytics

Improved Customer Segmentation: Big data analytics has allowed fintech companies to segment their customer base more accurately, providing personalized financial services to meet the specific needs of different customer groups.

Fraud Detection: Big data analytics has been used to identify and prevent fraudulent activities, such as money laundering and unauthorized transactions. This has reduced the risk of fraud and improved the security of financial transactions.

Risk Management: Big data analytics has been used to improve the accuracy of risk assessments, allowing fintech companies to make informed decisions about lending and investment activities.

Increased Efficiency: Big data analytics has been used to improve the efficiency of financial processes, such as loan processing and underwriting. This has reduced the processing time and improved the customer experience.

Improved Marketing: Big data analytics has been used to improve the accuracy of marketing campaigns, allowing fintech companies to target their marketing efforts more effectively and reach their desired audience. These are just a few examples of the experimental results of big data analytics in fintech. The use of big data analytics in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

7. Biometrics

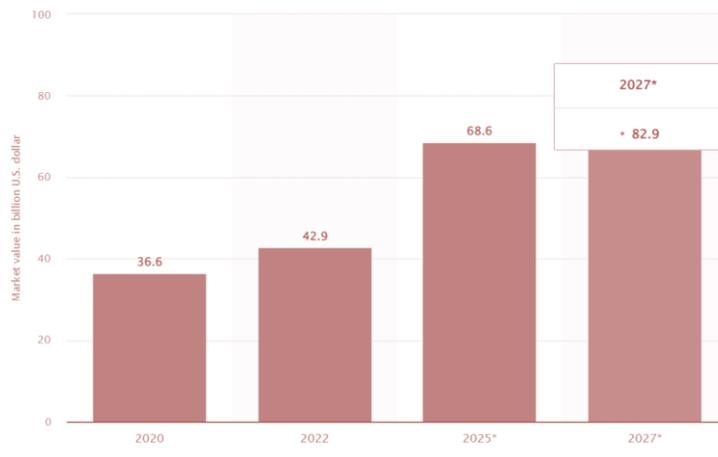
Improved Security: Biometrics, such as fingerprint recognition, iris and facial recognition, has been used to improve the security of financial transactions and prevent unauthorized access to financial information [1].

Increased Convenience: Biometrics has been used to simplify the login and authentication process for financial services, allowing customers to access their accounts more easily and quickly, nearly 94% of individuals working in the industry believe that ease of use is a top priority for users in authentication systems. [12].

Fraud Reduction: Biometrics has been used to detect and prevent fraudulent activities, such as identity theft and account takeover. This has reduced the risk of fraud and improved the security of financial transactions. Figure 7 elaborate the growth of

global market of biometric technologies (Figure 5) [49]. **Better Customer Experience:** Biometrics has improved the overall customer experience by providing a more secure and convenient way to access financial services [12, 25]. **Reduced Costs:** Biometrics has reduced the costs associated with traditional authentication methods, such as passwords and security tokens, improving the profitability of fintech companies [50].

Fig. 7 The global market for biometric technologies, Source [49]



8. Internet of Things

Here are some experimental results of the use of IoT (Internet of Things) in fintech: **Improved Financial Management:** IoT devices, such as smartwatches and fitness trackers, have been used to collect and analyze financial data, allowing customers to better manage their finances and make informed decisions. **Increased Efficiency:** IoT devices have been used to automate financial processes, such as payment processing, reducing the time and costs associated with manual processes. **Better Customer Experience:** IoT devices have provided a more convenient and accessible way for customers to manage their finances, improving the overall customer experience. **Increased Data Collection:** IoT devices have enabled the collection of large amounts of financial data, allowing fintech companies to gain valuable insights and make data-driven decisions. **Reduced Fraud:** IoT devices have been used to detect and prevent fraudulent activities, such as unauthorized transactions and identity theft. This has reduced the risk of fraud and improved the security of financial transactions. These are just a few examples of the experimental results of IoT in fintech. The use of IoT in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

9. Natural Language Processing

Improved Customer Service: NLP has been used to improve the efficiency and effectiveness of customer service, allowing financial institutions to provide quicker and more accurate responses to customer inquiries. **Automated Risk Assessment:** NLP has been used to automate the risk assessment process, allowing financial institutions to make more informed decisions about lending and investment activities [14]. **Fraud Detection:** NLP has been used to detect and prevent fraudulent activities, such as money laundering and unauthorized transactions. This has reduced the risk of fraud and improved the security of financial transactions. **Better Data Analytics:** NLP has been used to analyze large amounts of financial data, providing valuable insights and allowing financial institutions to make data-driven decisions. **Improved Customer Engagement:** NLP has been used to improve the engagement and interaction between financial institutions and their customers, providing a more personalized financial experience. NLP in Fintech can give directions to social good and have lot of open research area as of now [40]. These are just a few examples of the experimental results of NLP in fintech. The use of NLP in this industry is likely to continue to grow, leading to new and innovative financial services for consumers and businesses alike.

10. Cyber Security

Improved Data Protection: Cybersecurity measures, such as encryption and secure data storage, have been used to protect sensitive financial data from cyber threats, such as hacking and data breaches [51]. **Fraud Reduction:** Cybersecurity measures have been used to detect and prevent fraudulent activities, such as phishing attacks and unauthorized access to financial information. This has reduced the risk of fraud and improved the security of financial transactions. **Increased Customer Trust:** By implementing robust cybersecurity measures, fintech companies have been able to increase customer trust and confidence in their services, leading to increased adoption of their products and services. **Improved Regulatory Compliance:** Cybersecurity measures have helped fintech companies to comply with industry regulations and standards, such as Payment Card Industry Data Security Standard (PCI DSS) and The General Data Protection Regulation (GDPR), reducing the risk of regulatory fines and penalties. **Increased Efficiency:** By automating security processes and improving data protection, fintech companies have been able to improve the efficiency of their operations, reducing the costs associated with manual processes and increasing profitability. These are just a few examples of the experimental results of Cyber Security in fintech. The importance of cybersecurity in this industry is likely to continue to grow, as fintech companies face increasing cyber threats and the need for secure financial services becomes increasingly important.

V. COMPARISON

The table 2 is representing comparison among trending and emerging technologies of fintech on the various parameters like purpose, use cases and advantages.

Table 2 Comparison among emerging technologies in fintech based on purpose, use cases and advantages

Technology	Purpose	Use Cases	Advantages
AI (Artificial Intelligence)	AI (Artificial Intelligence) is the development of computer systems that can perform tasks that normally require human intelligence.	AI is used in a variety of applications, including fraud detection, risk assessment, and personalized marketing.	AI and ML can help improve efficiency, accuracy, and decision-making in a variety of applications.
ML (Machine Learning)	ML (Machine Learning) is a subset of AI that focuses on the development of algorithms that can learn and make predictions based on data.	ML is used in applications such as portfolio management, customer service, and fraud detection.	
Blockchain	Blockchain is a decentralized ledger technology that enables secure, transparent and tamper-proof transactions.	Blockchain is used in applications such as secure transactions, digital identities, and supply chain management.	Blockchain provides secure and transparent transactions, reducing the risk of fraud and errors.
RPA (Robotic Process Automation)	RPA (Robotic Process Automation) is the use of software robots to automate repetitive and routine tasks, reducing manual effort and increasing efficiency.	RPA is used in applications such as process automation, data entry, and customer service.	RPA reduces manual effort and increases efficiency, freeing up staff to focus on higher-value tasks.
Cloud Computing	Cloud Computing is the delivery of computing resources and services over the internet, enabling users to access data and applications from anywhere.	Cloud Computing is used in applications such as data storage, application hosting, and disaster recovery.	Cloud Computing enables cost-effective and scalable access to computing resources and data.
Big Data Analytics	Big Data Analytics is the use of advanced technologies and algorithms to analyse and extract value from large and complex data sets.	Big Data Analytics is used in applications such as market analysis, customer insights, and predictive modelling.	Big Data Analytics provides valuable insights into customer behaviour and market trends.
Biometrics	Biometrics is the use of unique biological characteristics, such as fingerprints, Iris or facial recognition, for identification and authentication.	Biometrics is used in applications such as authentication, identity verification, and access control.	Biometrics enhances security and reduces the risk of identity theft and fraud.
IoT (Internet of Things)	IoT (Internet of Things) is a network of interconnected devices, objects, and sensors that can collect and exchange data.	IoT is used in applications such as smart homes, connected devices, and industrial automation.	IoT enables the collection and exchange of data from connected devices, improving efficiency and decision-making.
NLP (Natural Language Processing)	NLP (Natural Language Processing) is a technology that allows computers to understand, interpret, and generate human language.	NLP is used in applications such as sentiment analysis, language translation, and customer service.	NLP enables natural language communication between humans and computers, improving the user experience.
Cybersecurity	Cybersecurity is the practice of protecting information systems from unauthorized access, use, disclosure, disruption, modification, or destruction.	Cybersecurity is used in applications such as data protection, fraud reduction, and regulatory compliance.	Cybersecurity protects sensitive information and reduces the risk of cyber-attacks.

Figure 8 is visualizing the comparison of leading Fintech software development companies based on their level of experience over the years [54].

Fig. 8 The global market for biometric technologies, Source [54]



VI. CONCLUSION

Financial technology has utilized various technologies to improve operations and services. For instance, Artificial Intelligence (AI) and Machine Learning (ML) are applied to create predictive models that analyze big data to detect fraud, identify patterns, and make real-time investment decisions. Blockchain Technology (BT) is used to develop secure and transparent ledgers for financial transactions, enabling decentralized finance systems (DeFi) without intermediaries. Robotic Process Automation (RPA) automates repetitive tasks such as account reconciliation, reducing errors and increasing efficiency. Cloud Computing (CC) creates flexible and scalable infrastructure for financial services, allowing institutions to move data and applications to the cloud. Big Data Analytics (BDA) is utilized to analyze big data sets and identify patterns that inform investment decisions and create personalized portfolios. Biometrics identifies and authenticates users using unique biological characteristics such as fingerprints, iris, or facial recognition. Internet of Things (IoT) facilitates real-time tracking of financial transactions using connected devices, leading to the creation of smart homes and cities where financial transactions are automatically processed. Natural Language Processing (NLP) is applied to create chatbots and virtual assistants that provide personalized customer support. Cybersecurity (CS) technologies such as firewalls, encryption, and multi-factor authentication protect financial data and prevent fraud, which is a crucial concern in financial technology.

Indian CAGR of Fintech market size in 2025 will be by 24.57%, Growth in number of deals from 2021 (First Half) H1 as compared to 2018 H1 is by 25%, CAGR in growth in digital payments transactions from FY19-21 is by 37%, Highest expected Return on Investment (RoI) on Fintech projects globally by 29% [17, 57].

The following are the key drivers for Fintech growth:

1. **Technology Advancements:** Technology has played a significant role in the growth of Fintech. The advancement of technologies such as Artificial Intelligence (AI), Machine Learning (ML), Blockchain, and Cloud Computing has enabled Fintech companies to develop innovative products and services that provide better customer experience, security, and efficiency.
2. **Regulatory Support:** Regulatory support and initiatives have helped create a favourable environment for Fintech companies to grow. Many countries have introduced regulatory sandboxes and frameworks to encourage innovation and investment in the Fintech industry.
3. **Changing Customer Behaviour:** The changing behaviour of customers towards digital transactions has played a significant role in the growth of Fintech. Consumers are increasingly adopting digital payments, online banking, and other Fintech products and services for their convenience and ease of use.
4. **Investor Interest:** The significant interest of investors in the Fintech industry has provided the necessary capital for Fintech companies to grow and expand. Venture capitalists and private equity firms have been actively investing in the Fintech industry, providing a much-needed boost to the sector.
5. **Collaboration with Traditional Financial Institutions:** The collaboration of Fintech companies with traditional financial institutions has helped the industry grow. Many traditional financial institutions have partnered with Fintech companies to leverage their innovative products and services and improve their customer experience.

According to various reports and analysis [17,27, 57], the following are the significant areas of Fintech that have seen substantial growth and investment:

1. **Payments:** The payments sector is the most significant area of Fintech, accounting for a significant percentage of overall investment in the industry. The rise of digital payments, mobile payments, and e-wallets has fuelled the growth of this sector.
2. **Wealth Management:** Wealth management Fintech has seen significant growth in recent years, and it is expected to continue to grow. Robo-advisors and investment management platforms have made it easier for people to invest and manage their wealth.
3. **Peer-to-Peer (P2P) Lending:** P2P lending has grown significantly in recent years, offering an alternative to traditional banking services. This sector has seen substantial investment and is expected to grow further.
4. **Insurtech:** Insurtech is a sector of Fintech that focuses on leveraging technology to improve the insurance industry. This sector has seen significant investment and is expected to grow further.
5. **Digital Banking:** Digital banking is a rapidly growing sector in Fintech, with various banks launching digital-only banks and neo banks. This sector is expected to continue growing as more consumers embrace digital banking services.

There are many innovators in the Fintech industry, and the following are some of the most notable ones:

1. **Stripe:** Stripe is a payment processing platform that provides tools for businesses to accept payments online. Stripe has revolutionized the payments industry by making it easier for businesses to accept online payments, and it has seen significant growth in recent years.
2. **Square:** Square is a payment processing company that provides payment processing solutions for small businesses. Square has made it easier for small businesses to accept card payments, and it has expanded its offerings to include other financial services such as loans and payroll.
3. **Robinhood:** Robinhood is a commission-free stock trading app that has revolutionized the investment industry. It has made it easier and more affordable for people to invest in stocks and other securities, and it has seen significant growth in recent years.

4. **Lemonade:** Lemonade is an insurtech company that uses AI and other technologies to provide homeowners and renters insurance. Lemonade has disrupted the traditional insurance industry by providing a more streamlined and affordable insurance experience.
5. **Ant Financial:** Ant Financial is a Chinese Fintech company that provides various financial services, including payment processing, banking, and insurance. It has become one of the world's most valuable Fintech companies and has helped to drive the growth of the Fintech industry in China.

Following are the top trending technologies that are being implemented in Fintech as per the demand and popularity:

1. **Artificial Intelligence (AI) and Machine Learning (ML):** AI and ML are being used in Fintech to provide more personalized and efficient services, fraud detection, and risk management.
2. **Blockchain:** Blockchain technology is being used to improve transparency, security, and efficiency in financial transactions.
3. **Cloud Computing:** Cloud computing is being used to provide more scalable and cost-effective solutions for Fintech companies.
4. **Big Data:** Big data is being used to analyse customer data and provide insights for better customer experience and risk management.
5. **Internet of Things (IoT):** IoT is being used to provide real-time data and insights for better decision-making and risk management.
6. **Robotic Process Automation (RPA):** RPA is being used to automate repetitive tasks and improve efficiency in Fintech companies.
7. **Chatbots:** Chatbots are being used to provide more personalized and efficient customer service.
8. **Virtual and Augmented Reality:** Virtual and augmented reality are being used to improve the customer experience and provide better visualization for financial data.
9. **Cybersecurity:** Cybersecurity is being implemented in Fintech to provide better protection against cyber threats and data breaches.
10. **Quantum Computing:** Quantum computing is being explored in Fintech to provide more advanced and secure financial solutions in the future.

In conclusion, the application of these technologies has led to significant improvements in financial technology, including increased efficiency, improved customer service, and greater security. However, the rapid pace of technological change also presents challenges for financial institutions to keep up with and stay ahead of the competition.

VII. CHALLENGES, LIMITATIONS AND FUTURE WORK

While the application of various technologies such as AI, ML, BT, RPA, CC, BDA, BM, IoT, NLP, and CS has significantly improved financial technology, there are also some challenges and limitations associated with their use. Some of these challenges and limitations include:

1. **Data privacy and security concerns** - The use of sensitive financial data in technology presents a significant risk of data breaches, which can cause reputational damage and loss of customer trust.
2. **High implementation costs** - The implementation of technologies such as AI, ML, and IoT requires substantial investments in infrastructure, hardware, and software. This can be challenging for smaller financial institutions.
3. **Technical complexity** - Some of these technologies require specialized technical expertise to manage and operate effectively, leading to challenges in finding skilled professionals.
4. **Lack of standardization** - Some technologies are still evolving, and there is no standardized approach or framework for implementing them, making it challenging for financial institutions to adopt and use them.
5. **Ethical concerns** - There are ethical considerations associated with the use of technologies such as AI, ML, and NLP, particularly regarding issues of bias, discrimination, and accountability.
6. **Regulatory compliance** - Financial institutions must comply with various regulatory requirements, and the use of some technologies may not be in line with these requirements, creating regulatory compliance challenges.
7. **Interoperability** - The integration of various technologies can be challenging, and there may be issues of interoperability between different systems, leading to inefficiencies and operational challenges.

Overall, while the application of various technologies in financial technology has the potential to revolutionize the industry, there are also several challenges and limitations that need to be addressed to realize their full potential.

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