Emerging Technologies in Financial Services

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ABSTRACT

The aim of using technology in the finance industry is to achieve faster transactions and improved security, convenience, and accessibility. Emerging technologies which include artificial intelligence, blockchain, Internet of things, robotic process automation, and cloud computing are transforming the financial services industry, where technological advances have skyrocketed and added complexities to an already turbulent landscape. Fintech companies, investors, traders, and other individuals can use these financial technologies to improve efficiency, productivity, and investment return. These advances can offer new services and savings to both consumers and financial institutions. In this paper, we will examine the top emerging technologies in finance industry.

KEYWORDS: technology, emerging technologies, finance, banking, financial services

INTRODUCTION

The world is rapidly changing and becoming increasingly digital. This shift has touched almost every industry, and finance is no exception. Digital transformation for banks is about embracing new technologies and changing the way businesses operate and interact with customers. New technologies such as AI, blockchain, Internet of things, and more have paved the way for advanced financial solutions shaking up the status quo. Figure 1 compares traditional with digital services [1].

The technology is beneficial to the financial services industry because of its safety and dependability. Today, technology has become a crucial part of finance, revolutionizing different aspects of this sector, whether it is data quality, analytics, accounting, investing, or trading. When technology meets finance, it is known as "fintech" or financial technology. Technological progress and innovation are the linchpins of fintech development, and will continue to drive disruptive business models in financial services. The growing adoption of advanced technologies in finance operations has shown an impressive impact. The current spectrum of emerging technologies in finance spans various industries like retail banking, education, investment management, and fundraising. Figure 2 shows the symbol of finance industry [2].

Emerging technologies have continuously changed how people interact with their money, what they anticipate from financial institutions, and how those businesses run. Financial organizations stand to gain the most from these technologies [3]. Emerging technologies in the financial services industry have consistently disrupted how consumers interact with their money, what they expect from financial institutions, and how those organizations operate. As technology rapidly evolves and revolutionizes how people interact, transact, and invest, accountants and wealth planners must stay abreast of the latest advancements to survive and deliver excellent customer experience in the digital age.

WHAT ARE EMERGING TECHNOLOGIES?

Technology may be regarded as a collection of systems designed to perform some function. It can

help alleviate some of the challenges facing business today. Emerging technology is a term generally used to describe new technology. The term often refers to technologies currently developing or expected to be available within the next five to ten years. Any imminent, but not fully realized, technological innovations will have some impact on the status quo.

Emerging technologies are shaping our societies. They continue to affect the way we live, work, and interact with one another. Emerging technology (ET) lacks a consensus on what classifies them as "emergent." It is a relative term because one may see a technology as emerging and others may not see it the same way. It is a term that is often used to describe a new technology. A technology is still emerging if it is not yet a "must-have" [4]. An emerging technology is the one that holds the promise of creating a new economic engine and is trans-industrial. ET is used in different areas such as media, healthcare, business, science, education, or defense.

The characteristics of emerging technologies include the following [5]:

➢ *Novelty:* Emerging technologies are typically new or novel, meaning they have yet to be widely adopted or used. They often represent a significant departure from existing technologies or processes.

➢ *Potential for Disruption:* Emerging technologies have the potential to disrupt existing markets, industries, or ways of doing things. They may also displace existing businesses or industries.

➢ *Uncertainty:* Because emerging technologies are still in the early stages of development, there is often a high uncertainty surrounding their future potential and impact. It can be challenging to predict how they will evolve.

➢ *Rapid Change:* Emerging technologies often evolve rapidly, with new developments and innovations emerging frequently. It can make keeping up with the latest trends and advancements challenging.

➢ *Interdisciplinary*: Emerging technologies often involve multiple disciplines or fields of study, such as computer science, engineering, and biology. They may require collaboration across different fields and industries to develop their potential fully.

Emerging technologies are worth investigating. They are responsible for developing new products or devices. As emerging technologies continue to evolve, engineering is poised for a transformative future. Emerging technologies have driven innovation and progress in today's rapidly evolving digital landscape. The collective impact of emerging technologies such as artificial intelligence, machine learning, big data, and the Internet of things is undeniably transformative. Some emerging technologies are shown in Figure 3 [6].

EMERGING TECHNOLOGIES IN FINANCE
Figure 4 shows some of the emerging technologies in finance industry [7]. Here we explore the top emerging technologies in finance industry [8-13].

1. *Artificial Intelligence:* The fintech industry increasingly depends on artificial intelligence (AI) and machine learning (ML) because they make life easier for both businesses and customers. As shown in Figure 5, they provide robust data analysis and quality business insights [7]. The popularity of AI has spread across various industries, having become an irreplaceable technology trend in these industries. AI applications will penetrate the entire spectrum of financial industry operations across front, middle, and back offices. AI and ML systems can detect and prevent online fraud in real-time. Chatbots and AI-powered virtual assistants have become game-changing tools for efficient management of balance inquiries, payment processing, and account updates. Advanced AI chatbots help businesses provide 24/7 customer service, suggest products and services, and answer common queries without depending completely on human support teams. Banks and other financial institutions are tipped to adopt an AI-first mindset that will better prepare them to resist encroachment onto their territory by expanding technology firms. "AI-first" banks of the future will also adopt the speed and agility enjoyed by "digital native" companies and users.

2. *Robotic Process Automation*: Early adopters in several sectors are implementing robotic process automation (RPA) to perform routine business tasks and eliminate inefficiencies. RPA software programs are designed to mimic the keystrokes humans make to complete rote processes in areas such as finance, human resources, customer service, and supply management. The finance industry uses robotic process automation (RPA) to automate operations using robotics, advanced algorithms, and software solutions. RPA is used by banks to automate routine and repetitive tasks, freeing employees to focus on more value-adding activities. This technology helps fintech companies make better business decisions, reduces manual and repetitive work, and saves resources, effort, money, and time. RPA is useful for processing payments and also automates

routine and labor-intensive finance processes to save time and effort. Banks see RPA as a means of creating greater efficiency in processes that involve many repetitive steps. They are using RPA to automate processes such as data entry, account reconciliation, and customer service. Hyper automation will replace manual work. Hyper automation refers to the introduction of AI, deep learning, event-driven software, robotic process automation (RPA), and other technologies and tools that improve decision-making efficiency and work automation capabilities. Figure 6 shows some uses of RPA [14].

3. *Cloud Computing:* Companies and government agencies increasingly are migrating their computing operations to the cloud. With the cloud, remote servers hosted on the Internet, rather than local servers, are used to store, manage, and process data. Cloud computing is a technology in the financial industry that can help fintech companies move towards digitization with ease. It provides flexible computing services and storage capacity while using fewer resources. It also provides increased data storage and analytic capacity for machine learning and artificial intelligence applications. Fintech companies can achieve better business agility and scalability by relying on the cloud. They can handle more customers and data with the help of cloud computing. Banking is among the many industries eyeing cloud computing. Cloud banking (banking-as-a-service) allows the processing and storing of financial data in several remote locations instead of just one computer. It uses technology to store and process financial data in remote locations rather than on a single server or device. Cloud computing liberates financial companies from non-core businesses such as IT infrastructure and data centers, while enabling access to flexible storage and computing services at a lower cost.

4. *Internet of Things:* The Internet of things (IoT) is poised to transform the finance industry by enabling real-time data collection and analysis. The finance industry is among the early adopters of the Internet of things (IoT). IoT refers to real-world or physical objects using software, devices, sensors, and other systems over the internet. With the use of this IoT, companies can share data easily. The Internet of things empowers financial institutions to gather real-time data from connected devices. For example, IoT-based systems can monitor driving patterns to determine car insurance premiums or track assets for better

risk management. The next evolution of IoT concept is to apply it to the financial services industry as the banking of things (BoT), one of the finance industry's next major technological advances. BoT refers to how wireless tech like radio frequency identification and Bluetooth low energy are being integrated with credit and debit cards for cardless transactions and other processes.

5. *Blockchain*: Blockchain is a technology in the financial industry that uses distributed ledger technology (DLT) to record, share, and synchronize data. DTL will increasingly underpin ecosystem financing by allowing the storage of financial transactions in multiple places at once. Since there is no single owner or any disturbance to the data, this technology promotes transparency and trust. In addition, the finance industry uses blockchain technology to solve identity theft and cybersecurity issues. It is useful for processing international or foreign payments with low transaction fees. One of the great advantages of blockchain is that it can be used to make data immutable and unalterable. Blockchain has numerous potential applications in regulation technology because it can provide a high degree of data security. Blockchain has the potential to radically increase the speed, effectiveness, and scope of core banking functions. Many experts believe a blockchain can become the gold standard as a fast, secure, open framework for finance, e-commerce, and other business transactions.

6. *Cybersecurity*: The banking industry handles massive amounts of sensitive customer and transactional data. This makes its IT infrastructure a popular target for cybercriminals. Cyberattacks are becoming more commonplace driven by new technologies and increased interference by state actors. AI introduces growing cyber risks, with increasingly complex threats demanding robust risk management. While financial services companies understand the importance of high-quality cybersecurity more than ever before, the average consumer has also significantly increased their awareness of data security. Cybersecurity solutions enable banks to safeguard sensitive data. They further protect banking systems from malicious hacks, viruses, data thefts, and unauthorized access. Figure 7 shows how to secure financial information with robust cybersecurity protocols [15].

7. *Embedded Finance*: Embedded finance is an ongoing hot topic in the financial services

industry. It is a technology that uses digital technology to improve the efficiency and effectiveness of financial services, such as digital payments and lending. It has the potential to revolutionize how financial services are delivered to customers and could significantly reduce costs for banks and other financial institutions by automating processes and reducing errors. Embedded finance can be implemented in many ways, ranging from automated teller machines (ATMs) with direct-deposit functionality to mobile applications allowing users to manage their finances. Another form of embedded finance involves using digital technologies in financial markets. Some perceive that embedded finance is one of the emerging technologies in finance that has failed to reach its full potential due to its difficulty with government regulations. It should achieve widespread adoption across various platforms, including e-commerce and social media. Tech giants like Uber and Shopify have transformed from mere platforms into comprehensive financial service providers, embedding payment processing, lending and insurance directly into their customer journeys.

8. *Open Banking*: Open banking has revolutionized the financial sector by enabling a more interconnected and collaborative ecosystem. It represents a new approach to banking that enables customers to share their financial data with third-party providers through secure application programming interfaces (APIs) platforms, where customers can integrate their banking data into other apps and vice-versa. An API describes the electronic messenger that provides connectivity between applications, data, and devices. The premise of open banking is it provides secure access to a customer's financial data from traditional banks and other financial institutions using APIs. Open banking allows third-party financial service providers access to consumer transactions, and other economic data from banks and financial institutions through APIs. It provides numerous benefits for the consumer. Customers can access their financial data and be able to transfer it seamlessly to other financial services, even if they are direct competitors. The use of open banking is expected to increase as customers seek to take control of who has access to their data.

9. *Immersive Technologies:* The metaverse concept is deeply intertwined with augmented reality and virtual reality (AR/VR), and without doubt, these technologies will dictate how the Internet looks in the near future. Immersive technologies bring banks into the metaverse and improve customer engagement. They allow customers to interact with banks in virtual environments. They deliver personalized and interactive customer experience. AR and VR optimize the interactions between banks and customers. VR allows banks to train employees on various banking procedures, products, and regulations in interactive environments. VR can help you educate your customers on the products and services you offer by providing an immersive virtual environment. Using AR and VR tech, you get far more data with which to project potential returns based on simulated portfolio allocations and potential market scenarios.

10. *Sustainable Finance*: Financial institutions face growing pressure to support green initiatives like renewable energy projects, recycling programs, and carbon footprint reduction. Sustainability is now highly valued by the average consumer, in finances and other industries. Customers are increasingly aware of the environmental impact of their financial decisions, prompting banks to prioritize sustainable practices and transparency. They expect their preferred banks, corporations, brand choices, etc. to adopt socially aware positions as a matter of principle. Sustainable banking can help deliver significant cost savings and efficiencies, as fewer resources consumed, especially those that are finite, leads to reduced costs overall. The term green banking refers to environmentally friendly banking practices that aim to reduce the ecological footprint of financial institutions and promote sustainable development.

11. *Biometrics:* When it comes to data safety and security, biometric technologies are the most trusted innovations of all time. This is due to the fact that they use physically unique features of a person that includes fingerprints, retina, face, voice, and other forms of recognition to improve security and identity verification that helps banks to safeguard their customers, avoid cybercrimes, and more. Biometric technologies, such as facial recognition and fingerprint scanning, are being used by banks to improve the security and convenience of their services. Banks use biometrics to identify customers, reduce the risk of fraud, and streamline processes.

12. *Big Data:* Data has always been essential for businesses. For a decade, the value of consumer data has skyrocketed. The financial sector generates vast amounts of data daily. Big data technologies harness this information, providing

actionable insights for risk management, customer behavior analysis, and product development. Joined with artificial intelligence, big data use all old and new information to find hidden designs for better fraud detection and risk management. Big data is playing an increasingly important role in the banking industry, helping banks to make informed decisions, improve customer experiences, and stay ahead of the competition. Banks are using big data to collect, store, and analyze data from various sources, including customer transactions, social media, and other sources. Big data insights help banks to understand customer behaviors and create products and services as per their needs.

13. *Hyper-Personalization:* Artificial Intelligence is fundamentally reshaping personal banking, moving beyond basic chatbots to deliver hyper-personalised financial experiences. Providing a personalized banking experience improves customer retention. That is why banks now leverage various strategies and technologies, such as buy now pay later (BNPL), omnichannel banking, and financial advisory tools, to tailor their offerings. Wealth management and financial advisory tools provide customized advice and investment guides, improving investor and customer satisfaction. Banks thus leverage AI and machine learning to provide such real-time personalized financial recommendations. Through personalized digital banking, the startup tailors customers' financial needs to fit their lifestyles.

Other emerging technologies include embedded finance, digital banking, decentralized finance, digital currencies, 5G, quantum computing, mobile and embedded devices, neobanking, regulatory technology, and central bank digital currencies.

BENEFITS

Tools such as cloud computing are likely to be more and more popular as more organizations see the benefits of a having access to infrastructure, applications, servers and more on-demand via the Internet. Emerging technologies are beginning to form powerful clusters that are collectively reshaping financial services, bringing new opportunities to firms and consumers alike. These technologies mitigate security breaches, improve customer satisfaction, and enhance regulatory compliance. Other benefits of fintech include the following [1,15]:

➢ *Automation:* Automation is a game changer for all businesses. The introduction into the workplace of artificial intelligence and machine learning, along with robotics and other cognitive tools, is ushering in a new age of industrial automation.

Through AI and these other technologies, companies are seeking greater efficiencies, reduced costs, higher profit margins, and other tangible benefits. RPA is the most common tool used for automation, simply automating fixed and repetitive processes.

➢ *Efficiency:* In a competitive industry like finance, efficiency is paramount. The advent of emerging technologies has taken continuous process improvement (CPI) to new heights. RPA is revolutionizing back-office operations by automating repetitive tasks. This not only reduces errors and operational costs but also frees up human resources for more strategic activities. Machine learning algorithms are being used to optimize workflows, predict bottlenecks, and suggest process enhancements in real time. By embracing these technologies, financial institutions can achieve higher levels of efficiency, accuracy, and reliability.

➢ *Security:* AI is playing an increasingly large role in security, risk-mitigation, and cyber-security. Because cyber-security threats and other risks are impossible to eliminate fully, AI is used for real-time analytics and monitoring, creating instant alerts when something is flagged as a threat. This allows for faster responses, reducing the likelihood of actual breaches. As they consent to sharing their data to increase flexibility, customers expect their banks and other services to provide robust security to protect their finances and personal information.

➢ *Data Quality:* The quality of data is more critical than ever because it is the bedrock of informed decision-making. High-quality data is the foundation for making informed decisions, driving innovation, and ensuring regulatory compliance. Emerging technologies are playing a pivotal role in enhancing data quality and management.

➢ *Sustainability:* A key trend is a greater focus by financial institutions on sustainability efforts. Organizations within the financial services industry will be nudged to support the investment in green initiatives more than ever before. Renewable resources, recycling and reducing the carbon footprint are among the initiatives organizations are expected to prioritize.

➢ *Customer Experience:* One true benefit of AI-powered technology is the customer experience. New technology can analyze almost every detail of a customer's interactions, which can enhance customer loyalty and increase satisfaction over

time. Financial service providers are now capable of increasing functionality and leveling customer expectations, thanks to these new technologies.

➤ *Asset Management:* The digital transformation of traditional banking allows for offering both traditional and many other asset management with a higher degree of security and flexibility. This improved asset management also enables banks to provide better rates, lower fees, and guaranteed payouts, enhancing the overall customer experience.

➤ *Flexibility:* Customers are looking for flexibility in their banking solutions and want businesses to adapt to their needs. Whether traveling, individuals working in different countries or for foreign employers, or performing work with more than one company, consumer desires are more varied than before, and that will continue to change.

➤ *Responsibility:* People worldwide have long embraced responsibility in their consumer trends and place increasing value on ensuring the companies they use comply with environmental, social, and governmental norms or regulations.

➤ *Personability:* While customers enjoy the flexibility and ease of use of digital banking, the need for personal interaction is still relevant. Customers want to feel that their banks are invested in providing tailored products and solutions. Banks can continue offering users AI-powered recommendations and financial management to create an environment of a local bank branch with people customers can trust.

CHALLENGES

Emerging or new technology can be exciting, but it brings forth new challenges as well, especially when it comes to regulations and compliance. Many fear that AI will do their jobs. Some of the challenges with fintech and what you can do about it are as follows [1,15]:

➤ *Cost:* The primary challenge companies will face in adopting cloud technology is rising costs driven by increased demand for cloud services. Cost overruns in cloud services may occur due to unplanned cloud adoptions, improper merger and acquisition integration, and data egress fees (charges from cloud providers for moving or transferring data).

➤ *Privacy Concerns:* The security and privacy of customers' financial information and transactions are paramount. However, traditional banking systems can often be vulnerable to cyber-attacks and data breaches, compromising the security of sensitive information. AI brings about more challenges, especially when it comes to cyber risks. The growth of AI bring into question personal data and privacy concerns, which will ultimately change the regulatory requirements in financial services.

➤ *Outdated Technology:* The technology used by traditional banking systems often needs to be updated and able to keep pace with the innovations of the financial industry. This can lead to a lack of integration with new services, slow development of new features, and limited use of different assets.

➤ *Lack of Accessibility:* Traditional banking systems are often hindered by their limited accessibility. Many customers need help accessing their accounts and financial information from remote locations.

➤ *Inefficient Processes:* Traditional banking systems are often bogged down by inefficient processes, including long wait times, manual procedures, and a lack of transparency. This can lead to a negative customer experience and increase operational costs for financial institutions.

➤ *Limited Scalability:* Traditional banking systems often need help to scale operations effectively, leading to increased costs and reduced efficiency. This can also hinder their ability to expand into new markets and offer new services to customers.

➤ *Tech Expertise:* Many fintech companies lack the necessary technology and expertise to deal with financial issues. You can hire experts to keep systems updated and protected from cyber risks and enhance efficiency and user experience.

➤ *Collaboration:* As we embrace emerging technologies, the future of finance looks brighter than ever. However, realizing this potential requires a collaborative approach. Banks, fintechs, regulators, and industry bodies must work together to establish common standards and frameworks that ensure interoperability, security, and innovation. As technology evolves, so too must the skills and knowledge of those working in the financial sector. By incorporating technology and adopting more collaborative management practices, accounting firms can gain the edge in attracting talent.

CONCLUSION

Emerging technologies will drive business model reinventions while shaping the competitive landscape of the financial industry. These key technologies are

becoming increasingly intertwined and integrated, giving massive impetus to fintech and financial industry innovation. They offer new opportunities to both consumers and businesses. Today, emerging technologies make processes easier, more efficient, reduce errors, improve communication, and change how consumers see and interact with money. When applied right, each of the technologies can become a game-changer for your revenue and client experience. The fintech revolution is changing the shape of banking. Financial services firms must consider the benefits derived from the coordinated deployment of emerging technologies to unlock the full potential of these technologies [16].

Modern banks are looking at innovative technologies not just as a means to improve their operations and services but also to fundamentally change the way they conduct their business. With the increasing demand for improved customer experience, efficiency, and security, banks are leveraging innovative technologies such as blockchain, cloud computing, AI and machine learning, big data, biometrics, and RPA to enhance their operations and services. By implementing these technologies, the financial professional of the future will have far more time and energy to dedicate to building stronger customer relationships [14]. More information about emerging technologies in the financial services can be found in the books [17-21] and the following related journals:

➢ Journal on Emerging Technologies.
➢ International Journal of Finance

REFERENCES

[1] A. Klimenko, "Digital transformation in banking and financial services," September 2024, https://maddevs.io/blog/digital-transformation-in-banking-and-financial-services/

[2] "Emerging financial technologies: Five you can expect to impact your business," https://www.mufgamericas.com/insights-and-experience/insights/emerging-financial-technologies-five-you-can-expect-impact-your

[3] J. Cox, "Top emerging technologies in the financial services industry," February 2023, https://systemssolutions.com/top-emerging-technologies-in-finance-industry/

[4] M. Halaweh, "Emerging technology: What is it?" *Journal of Technology Management & Innovation*, vol. 8, no. 3, 2013, pp. 108-115.

[5] N. Duggal, "Top 18 new technology trends for 2023," July 2023, https://www.simplilearn.com/top-technology-trends-and-jobs-article

[6] "How enterprise architects integrate emerging technologies to enhance architecture," https://www.linkedin.com/pulse/how-enterprise-architects-integrate-emerging-technologies-qdgfe/

[7] "Top financial technology trends transforming fintech in 2025," February 2025, https://acropolium.com/blog/top-financial-technology-trends-transforming-fintech/

[8] "Technologies in finance," https://www.educba.com/technologies-in-finance/

[9] P. Khropatyy, "10 Emerging technologies shaping the financial services industry in 2024," February 2024, https://intellias.com/emerging-technologies-in-financial-services-industry/

[10] D. Fong et al., "Seven technologies shaping the future of fintech," November 2021, https://www.mckinsey.com/cn/our-insights/our-insights/seven-technologies-shaping-the-future-of-fintech

[11] "4 Emerging technologies in the financial services industry: Which solutions are you taking advantage of?" https://everfi.com/blog/financial-education/emerging-tech-in-financial-services/

[12] I. Borsuk, "Explore the 10 emerging banking trends in 2025," February 2023, https://www.startus-insights.com/innovators-guide/banking-technology-trends/

[13] "Top emerging technologies transforming financial services," November 2024, https://rupeeboss.com/top-emerging-technologies-transforming-financial-services/

[14] B. Schnitzer, "What emerging technologies really mean for financial services?" April 2022, https://codeless.io/emerging-technologies-for-financial-services/

[15] "Top financial services trends of 2024," January 2024, https://www.ibm.com/think/insights/financial-services-trends

[16] D. Day, "The future is now: Embracing emerging technologies in finance," June 2024, https://www.linkedin.com/pulse/future-now-embracing-emerging-technologies-finance-douglas-day-9hrzc/

[17] R. E. Duran, *Financial Services Technology: TradFi, Fintech and DeFi.* Cengage Asia, 3rd Edition, 2024.

[18] S. Kampakis et al, *Business Models in Emerging Technologies: Data Science, AI, and Blockchain.* Business Expert Press, 2022.

[19] Y. Maleh, J. Zhang, and A. Hansali (eds.), *Advances in Emerging Financial Technology and Digital Money (Advances in Cybersecurity Management).* Boca Raton, FL: CRC Press, 2914.

[20] P. Best, *Emerging Technologies in Finance.* Kindle Edition, 2024.

[21] B. Akhgar et al., *Application of Big Data for National Security: A Practitioner's Guide to Emerging Technologies.* Butterworth-Heinemann, 2015.
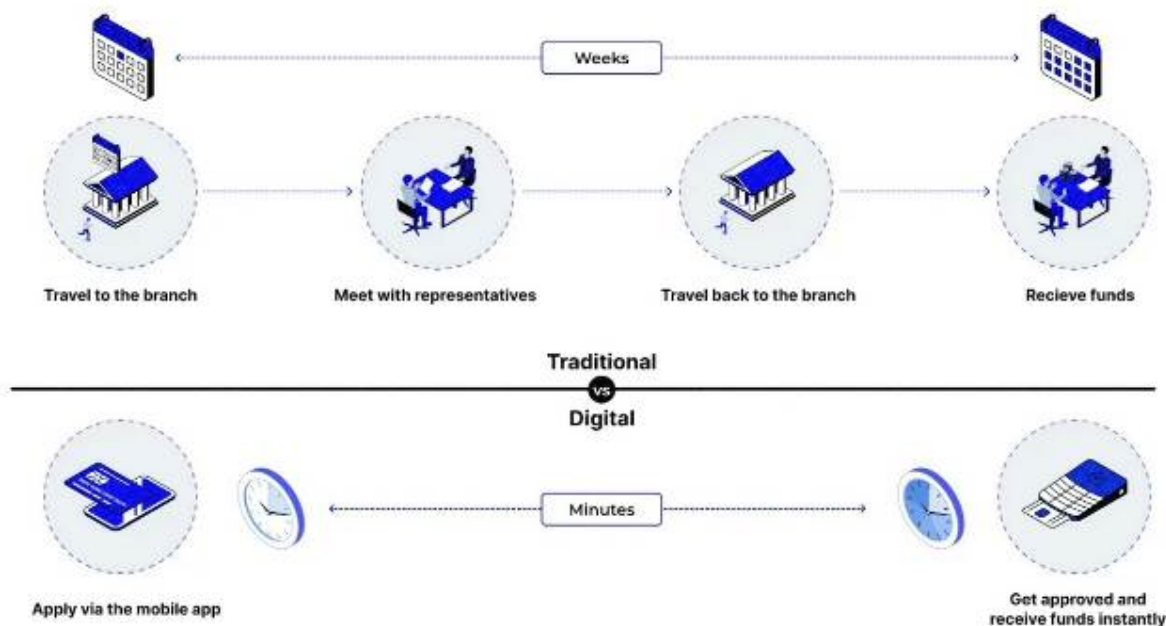

Figure 1 Comparing traditional with digital services [1].
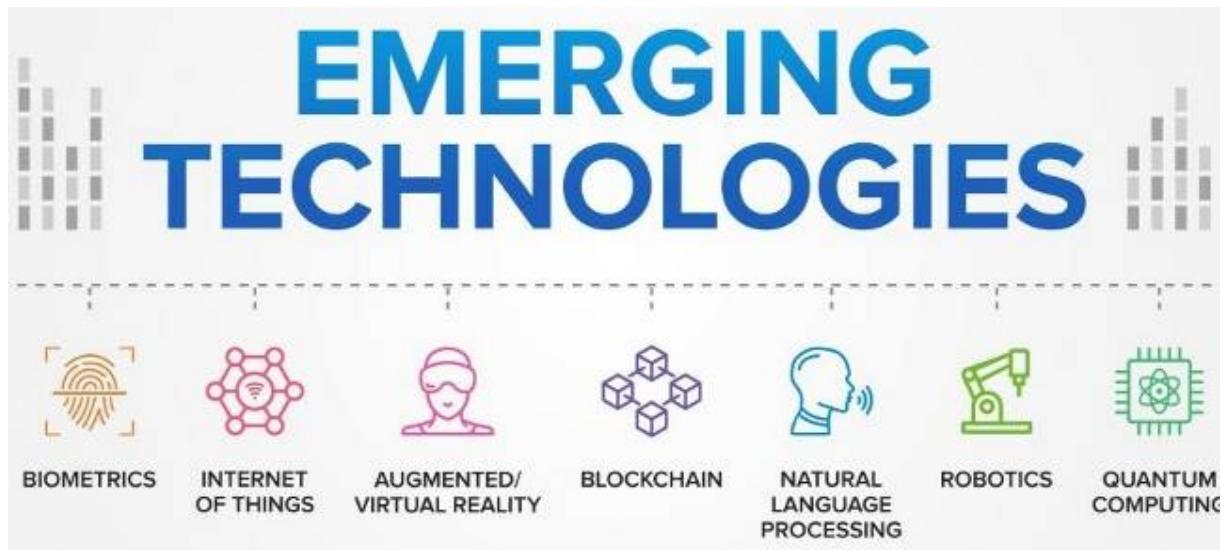

Figure 2 Symbol of finance industry [2].

Figure 3 Some emerging technologies [6].

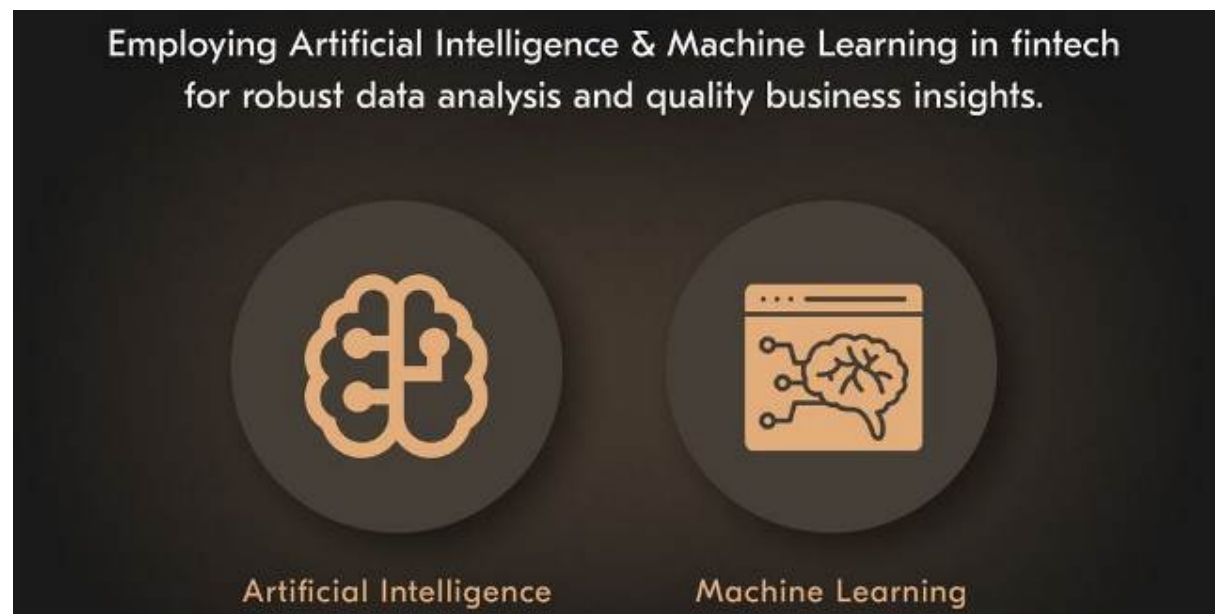**Figure 4 Some emerging technologies in finance industry [7].**

Figure 5 AI and ML provide robust data analysis and quality business insights [7].
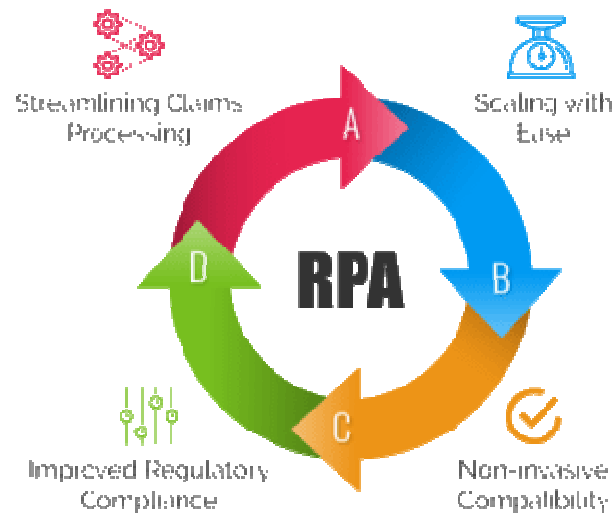
Figure 6 Some uses of RPA [14].

Figure 7 Securing financial information with robust cybersecurity protocols [7].