Impact of Technology on Financial Services

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Introduction

or centuries, technology has been a key catalyst for the growth and development of industries and the financial services industry has been no exception. Advancements in technology have created new possibilities and pathways for the delivery of financial products and services. The journey from a barter system of trade to cashless and biometric payments is marked by technological milestones that have enabled significant improvements in service efficiency, speed, security and customer experience within the financial services industry.

Indeed, the last few decades have seen financial service institutions adopt and adapt new technologies that significantly raise the level of service quality providers offer their customers. Remarkable innovations in the digitalisation of banking technology prompted and produced new service delivery models.

In more recent years, developments in the application of the internet and mobile technologies have supercharged innovation in the delivery of financial services. These technologies have been the wheels upon which new banking infrastructure, business models, platforms, channels, even new currencies and stores of value have emerged.

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Figure 1: Evolution of Financial Services

Source: Ernest and Young 2022.

Today, the application of digital technologies that seek to improve and automate the delivery and use of financial services are generally referred to as Financial Technology, better known as Fintech (Kagan, 2022). Fintech is the application of new technological advancements to products and services in the financial industry and aims at improving & automating the delivery and use of financial services (Allied Market Research, 2021).

Initially, Fintech only described the technology employed at the back-end systems of established financial institutions. However, there has been a shift to more consumer-oriented services and therefore has a more consumer-oriented definition. Fintech now includes different sectors and industries such as education, retail banking, fundraising & non-profit, and investment management, to name a few (Kagan, 2022).

Across the globe, Fintech is enabling companies, business and consumers better manage their financial operations, processes and lives using specialised software and algorithms installed on computers and smartphones. Fintech has made payments for goods and services faster, easier, more convenient, and cost-efficient as customers can now pay for various goods and services using digital money alternatives. The growth in the digital commerce market and proliferation of mobile technology has contributed to the growth of the digital payments sector.

According to the Business Research Company (2019), the global Fintech market was valued at US\$127.66 billion in 2018 and was expected to grow to

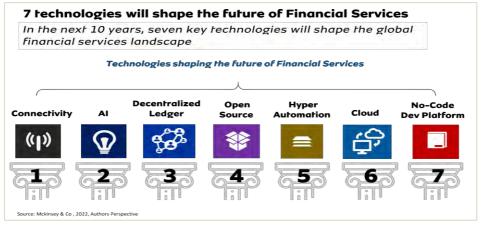
US\$309.98 billion at an annual growth rate of 24.8 per cent through 2022. Furthermore, Allied Market Research (2021) projects the global Fintech market to reach US\$698.48 billion by 2030, growing at a compound annual growth rate (CAGR) of 20.3 per cent from 2021 to 2030.

In Nigeria, investments in and impact of financial technology have been massive. Driven either by their own interests or by the implementation of cashless policies by the Central Bank of Nigeria, a rapidly increasing number of consumers and business are letting go of the traditional financial practices and adopting new digital ways to carry out their financial transactions. According to financial reports of commercial banks in Nigeria, the first half of 2022 saw 10 commercial banks spend N81.92 billion on ICT services, a 58.7 per cent increase from the N51.62 billion spent by the banks in 2021 (Jaiyeola, 2022).

This paper reviews seven emerging technologies that are shaping the future of financial services across the globe, their impact on financial services, and the implication for regulation. The seven technologies are:

- 1. Mobile Connectivity;
- 2. Artificial Intelligence;
- 3. Decentralised Ledger;
- 4. Open Source;
- 5. Hyper Automation;
- 6. Cloud Computing; and
- 7. No Code Development Platforms.

Figure 2: Seven Technologies Shaping the Future of Financial Services



Source: Mckinsey &Co (2022), Authours perspective.

II. The Impact of Mobile Connectivity on Financial Services

The rapid advancement of technology has transformed the financial industry, leading to the rise of Fintech. One of the most significant technological developments in recent years has been the widespread adoption of mobile connectivity, which has revolutionised the way we interact with financial services.

Some of the benefits of Mobile Connectivity on financial services include:

- 1. Convenience and Accessibility: With the rise of mobile connectivity, financial services are becoming more accessible and convenient. Customers can now access their bank accounts, manage their investments, and make payments through their mobile devices, eliminating the need to visit a physical bank or financial institution.
- 2. Personalised Services: Mobile connectivity allows for the collection and analysis of large amounts of data, enabling Fintech companies to provide personalised financial services. This includes personalised investment recommendations, customised loan offers, and tailored insurance policies.
- 3. Increased Security: Mobile connectivity has also improved the security of financial transactions, with mobile devices equipped with secure authentication methods, such as fingerprint scanning and facial recognition. This has increased customer trust in mobile financial services and reduced the risk of fraud.
- 4. Disruption of Traditional Financial Institutions: The rise of mobile connectivity has disrupted traditional financial institutions, as Fintech companies are able to provide financial services at a lower cost and with more convenience than traditional banks. This has led to increased competition and innovation in the financial industry.

The future of Fintech is closely tied to the future of mobile connectivity. As mobile technology continues to evolve, it is likely that Fintech companies will continue to find new and innovative ways to use mobile connectivity to improve.

II.1 Considerations for Regulators

Mobile connectivity is transforming the way financial services are delivered and consumed, enabling consumers to access financial services anytime, anywhere, through their mobile devices. This is particularly important in emerging and frontier markets where mobile connectivity is the primary means of accessing financial services, and where traditional financial services are often unavailable or unaffordable.

However, the use of mobile connectivity in the Fintech sector also raises important regulatory questions, such as data privacy, security, and consumer protection that must be addressed by regulators.

Mobile Internet Connectivity will continue to enable ((1)) value creation and delivery of Financial Services I **Key Notes Use Cases Implication for Regulators** Deepening penetration of the Internet and Develop and periodically review of supporting regulations and frameworks for both global and local internet service providers – Mobile and Wearablesmobile network connectivity will continue to power the development and delivery of initiated Banking and financial services ✓ Real-time Fraud checks Whereas 3G, through the advent of mobile banking, heralded a world of possibilities for financial services, 4G and now 5G is ✓ Deep Risk Profiling catalyzing development in Fintech industry on a global scale. ✓ Smarter KYC ✓ Product Customization and Personalization Much more, the development of IoT as part Periodic review and update of Cybersecurity , Data Privacy, Protection and Sovereignty of mobile network results in many more data sources — via sensors, computers, ✓ Cybersecurity maturation via Cybersecurity-as-asmart appliances — to create the ultimate KYC for financial services providers

Figure 3: Impact of Mobile Connectivity on Financial Services

Source: Mckinsey &Co (2022), Authours perspective.

III. Impact of Artificial Intelligence on Financial Services

Artificial Intelligence (AI) is a rapidly growing field that has been changing the way businesses operate in various industries. With the rise of Fintech, AI has played a crucial role in streamlining financial services and enhancing customer experience.

Increasingly, Al is having a significant impact on the financial services industry – delivering benefits such as increased efficiency, security, and customer satisfaction. Al has made financial services more accessible, personalised, and convenient, improving the customer experience and increasing customer trust in Fintech companies.

Moreover, the use of AI in Fintech has also led to cost savings for financial institutions, as AI algorithms can perform tasks more efficiently and accurately than humans. This has allowed Fintech companies to invest in other areas of their business and expand their services.

Some of the applications of Al in financial services include:

- Fraud Detection and Prevention: Al has been widely used in the Fintech industry to detect and prevent fraudulent activities. Al algorithms analyse large amounts of data, such as transaction history and customer behaviour, to detect suspicious activities and prevent fraud. This has helped financial institutions to reduce the risk of fraudulent transactions, thereby increasing the security of customer information and funds.
- 2. Risk Assessment: Al can also be used to assess the risk associated with a loan or investment. By analysing data from multiple sources, Al algorithms can determine the creditworthiness of an individual or business, helping financial institutions to make informed decisions about loans and investments.
- 3. Customer Service: Al has revolutionised the way Fintech companies interact with their customers. Chatbots and virtual assistants powered by Al can respond to customer inquiries 24/7, providing quick and accurate responses. This has improved customer satisfaction and reduced wait times for customer service.
- 4. Portfolio Management: Al algorithms can be used to manage investment portfolios, making personalised recommendations based on an individual's financial goals and risk tolerance. This has improved the accuracy and efficiency of investment decisions and helped investors to achieve their financial goals.
- 5. Personal Finance Management: Al-powered personal finance management tools, such as budgeting and savings applications, help individuals to better understand their spending patterns and make informed decisions about their finances. This has helped to increase financial literacy and has made personal finance management accessible to a wider audience.

III.1 Considerations for Regulators

Al is a rapidly growing technology that has the potential to revolutionise the financial industry. From chatbots that automate customer service to predictive analytics that help financial institutions manage risk, Al has the potential to bring significant benefits to businesses and consumers. However, the use of Al in the financial sector also raises a number of regulatory questions. For example, how can regulators ensure that Al algorithms are transparent and fair, and that they do not discriminate against certain groups of people? How can regulators ensure that Al-powered financial services are safe and secure, and that they protect consumer privacy?

Al has revolutionised financial services, providing financial institutions with new tools to improve their services and enhance the customer experience. Al has made financial services more efficient, secure, and accessible, and has had a positive impact on the industry. As Al technology continues to evolve, it is likely that the use of Al in Fintech will continue to grow, providing even greater benefits for both financial institutions and customers.

Artificial Intelligence will enable greater product **W** innovation and process efficiency **Key Notes Implication for Regulators Use Cases** Develop and continuously review effective, rights —protection Al regulations Artificial intelligence (AI) can generate up to \$1 trillion additional value for the global personalization banking industry annually (Mckinsey, 2022) Prohibit technologies that violate consumers fundamental rights e.g. biometric mass surveillance An "Al-first" mindset will vield greater Credit Offer Targeting operational efficiency via the extreme automation of manual tasks (a "zero-ops" ✓ Fraud Monitoring and or predictive policing etc. mindset) - augmenting human decisions by advanced diagnostics. Detection Promote data-secure use of Ai, such as: Privacy-aware Big Data Analytics i.e. Federated Learning Improved operational performance through ✓ Federated Learning cutting-edge AI, machine learning and facial recognition, to (near) real-time analysis of ✓ Advanced Encryption Al Chatbots and large and complex customer data sets. **Customer Support** ✓ Secure multi-party computing Partnerships with non-Banks will offer new AI/ML-enabled Robotic Process Automation ✓ Zero-knowledge proofs value propositions that are integrated across ✓ Privacy-aware Data Analysis journeys, technology platforms and data sets urce: Mckinsey & Co., 2022, Authors Perspective

Figure 4: Impact of Artificial Intelligence on Financial Services

Source: Mckinsey &Co (2022), Authours perspective.

IV. Impact of Decentralised Ledger Technology on Financial Services

The financial sector is undergoing rapid changes and is being reshaped by the latest technological advancements, including blockchain and decentralised ledger technology (DLT). The use of decentralised ledgers is becoming increasingly popular and is expected to change the way financial transactions are conducted in the future.

Decentralised ledger technology refers to a database that is spread across a network of computers, rather than being stored on a single central server. This decentralised database is managed and maintained by the network participants and is designed to be secure, transparent, and tamper resistant. Each transaction in the database is verified and recorded on multiple computers, making it difficult for any single participant to alter the database.

Some of the benefits of decentralised ledgers in financial services include:

Security: Decentralised ledgers offer a high level of security because they use cryptographic algorithms to secure transactions. Transactions are verified by the network participants and are recorded in multiple locations, making it difficult for any malicious actor to alter the database. This reduces the risk of fraud and hacking, which is a major concern for financial institutions.

Transparency: Decentralised ledgers are transparent and provide all participants with equal access to information. This makes it easier to detect and prevent fraudulent activities and helps to increase accountability and trust in financial transactions.

Cost Efficiency: Decentralised ledgers reduce the cost of financial transactions by eliminating intermediaries and reducing the need for third-party verification. This can result in lower fees for consumers and increased profits for financial institutions.

Speed and Scalability: Decentralised ledgers offer faster and more efficient transactions than traditional centralised systems. They also can scale to meet the demands of a growing number of users, which makes them ideal for use in the financial sector.

IV.1 Applications of Decentralised Ledgers in Financial Services

Payments and Transfers: Decentralised ledgers can be used to create a decentralised payment system that is faster, cheaper, and more secure than traditional payment methods. This could potentially eliminate the need for intermediaries such as banks and payment processors.

Digital Identity: Decentralised ledgers can be used to create a secure and transparent digital identity system. This would allow individuals to securely store

and manage their personal information and financial data and could also reduce the risk of identity theft and fraud.

Asset Management: Decentralised ledgers can be used to manage and track ownership of digital assets such as cryptocurrencies, securities, and real estate. This could simplify and streamline the asset management process and make it more accessible to a wider range of users.

Lending and Borrowing: Decentralised ledgers can be used to create peer-to-peer (P2P) lending platforms that allow borrowers to access funding directly from investors. This could provide borrowers with access to lower-cost funding and increase the efficiency of the lending process.

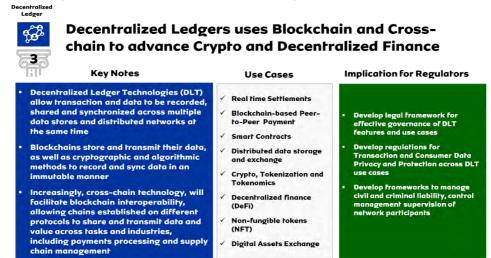
Decentralised ledger technology has the potential to transform the financial sector and shape the future of Fintech. Its benefits, including security, transparency, cost efficiency, and speed, make it ideal for use in a variety of financial applications, from payments and transfers to digital identity and asset management.

IV.2 Considerations for Regulators

Decentralised ledgers, such as blockchain, are a relatively new technology that is being used in the Fintech sector to enable peer-to-peer transactions and secure data storage. Decentralised ledgers have the potential to bring many benefits to the financial industry, such as reduced costs, improved efficiency, and increased transparency.

However, they also present some regulatory challenges. For example, how can regulators ensure that decentralised ledgers are used in a manner that protects consumers and promotes stability in the financial system? How can regulators ensure that decentralised ledgers are used in a way that prevents money laundering, terrorism financing, and other financial crimes?

Figure 5: Impact of Decentralised Ledgers on Financial Services



Source: Mckinsey &Co (2022), Authours perspective.

ource: Mckinsey & Co. 2022, Authors Perspective

V. Impact of Open Sourcing on Financial Services

The rise of Fintech has been driven in large part by the availability of open source technology. Open source refers to software that is freely available to use, modify, and distribute.

Some of the benefits of open source technology to financial services include:

Cost Efficiency: Open source technology is available at no cost, making it a cost-effective option for Fintech start-ups and small businesses. This reduces the barrier to entry for new entrants and allows for rapid innovation in the Fintech sector.

Collaboration: Open source technology allows for collaboration and contributions from a global community of developers. This leads to faster innovation and the development of more advanced and sophisticated technologies.

Security: Open source technology is transparent, which allows for regular security audits and updates to be made. This helps to ensure the security and reliability of the technology, which is essential in the financial sector.

Customisation: Open source technology can be easily customised to meet the specific needs of different businesses and industries. This allows for the development of innovative solutions that are tailored to the specific needs of the Fintech sector.

V.1 Applications of Open Source Technology in Financial Services

Blockchain: Open source technology has been instrumental in the development of blockchain, a decentralised ledger technology that is transforming the financial sector. Blockchain allows for secure, transparent, and tamper-resistant transactions, which has the potential to disrupt traditional financial intermediaries.

Payments and Transfers: Open source technology has been used to develop low-cost payment and transfer solutions that are faster and more secure than traditional methods. This is increasing access to financial services for people who were previously excluded from the formal financial system.

Digital Identity: Open source technology has been used to develop secure and transparent digital identity systems, which are becoming increasingly important in the digital age. These systems allow individuals to securely store and manage their personal and financial data and help to reduce the risk of identity theft and fraud.

Lending and Borrowing: Open source technology has been used to develop peer-to-peer (P2P) lending platforms that allow borrowers to access funding directly from investors. This has the potential to increase access to low-cost funding and reduce the cost of borrowing, which could benefit borrowers and investors alike.

Open source technology is playing an increasingly important role in shaping the future of Fintech. Its benefits, including cost efficiency, collaboration, security, and customisation, make it ideal for use in a variety of financial applications. As the use of open source technology continues to evolve, it is likely that it may lead to more disruptive innovation in the Fintech sector, which could have far-reaching implications for the financial industry and society.

V.2 Considerations for Regulators

Open source platforms are increasingly being used in the Fintech sector to develop new financial products and services, and have the potential to bring many benefits to the financial industry, such as increased collaboration, faster innovation, and reduced costs.

However, it also presents some regulatory challenges. For example, how can regulators ensure that open source software used in the financial sector meets standards for security, privacy, and reliability? How can regulators ensure that open source software is used in a manner that protects consumers and promotes competition?

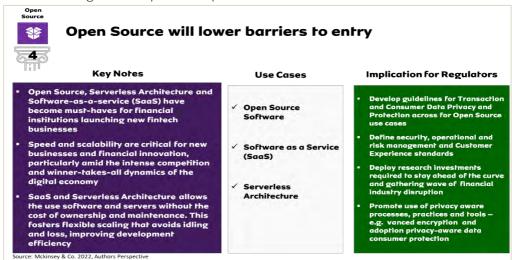


Figure 6: Impact of Open Source on Financial Services

Source: Mckinsey &Co (2022), Authours perspective.

VI. Impact of Hyper Automation on Financial Services

Hyper automation is a term used to describe the integration of advanced technologies such as artificial intelligence (Al), machine learning (ML), and robotic process automation (RPA) to automate business processes. The rise of hyper automation is having a profound impact on the financial services industry and is set to shape its future in significant ways.

Some of the benefits of hyper automation in financial services include:

Increased Efficiency: Hyper automation can automate many routine and repetitive tasks, freeing up employees to focus on higher-value activities. This

can result in increased efficiency and reduced costs for businesses, making them more competitive in the market.

Improved Customer Experience: Hyper automation can be used to improve the customer experience by automating customer service and support processes. This can lead to faster response times, more accurate responses, and a higher level of customer satisfaction.

Data Management and Analytics: Hyper automation can be used to manage and analyse vast amounts of financial data, which can help businesses to make better decisions, identify new business opportunities, and reduce the risk of fraud and other financial crimes.

Compliance and Risk Management: Hyper automation can be used to automate compliance and risk management processes, helping businesses to ensure that they comply with relevant regulations and minimise risks.

VI.1 Applications of Hyper Automation in Financial Services

Digital Banking: Hyper automation can be used to automate many of the routine and repetitive tasks associated with digital banking, such as account opening, loan applications, and customer service. This can reduce the time and cost associated with these processes and improve the customer experience.

Payments and Transfers: Hyper automation can be used to automate payments and transfers, reducing the time and cost associated with these transactions and improving the speed and accuracy of the process.

Investment Management: Hyper automation can be used to automate investment management processes, such as portfolio management, risk management, and compliance. This can result in improved investment performance and reduced costs for investors.

Insurance: Hyper automation can be used to automate many insurance processes, such as underwriting, claims processing, and customer service. This can result in faster and more accurate processing of claims, reduced costs for insurance companies, and improved customer experience.

Hyper automation is set to have a major impact on the future of Fintech, bringing significant benefits to businesses and consumers alike. Its ability to automate routine and repetitive tasks, manage and analyse vast amounts of

financial data, and improve the customer experience are just a few of the many ways that hyper automation is shaping the future of Fintech.

As the use of hyper automation continues to grow, it is likely that we will see more disruptive innovation in the Fintech sector, which could have far-reaching implications for the financial industry and the society.

VI.2 Considerations for Regulators

Hyper automation is a technology that uses a combination of advanced technologies, such as artificial intelligence (AI) and robotic process automation (RPA), to automate complex business processes. This technology has the potential to transform the Fintech industry by enabling faster, more efficient, and more accurate financial services.

Yet, hyper automation also raises important regulatory questions. For example, how can regulators ensure that hyper automation algorithms are transparent, fair, and do not discriminate against certain groups of people? How can regulators ensure that hyper automation-powered financial services are safe, secure, and trustworthy, and that they protect consumer privacy?

Figure 7: Impact of Hyper Automation on Financial Services



Hyper Automation will enable greater speed, accuracy and standardization

Use Cases

✓ Real time Settlements

Robotic Process Automation (RPA) improves decision-making efficiency and work automation capabilities by allocating the handling of workflow information and business interactions to robots, thereby automating and standardizing business execution High repeatability, clear logic and solid stability are the key criteria to validate RPA tech feasibility In the future, RPA will become more deeply integrated with AI to deal with more

complex business scenarios, and further

streamline financial service provision

- Automating Accounting reconciliation

 Process automation for accounts receivable and payable

 Fund appropriation at shared finance

 Accounting service centers

 Work hour adjustment and review

 Automation of financial recording, reporting and treasury processes
- Develop/Update Regulatory Sandbox to advance the adoption use of RPA in the Financial Services Industry

 Provide guidelines for adoption of RPA use cases for better, faster and standardized processes

 Define Operational and Risk Management Standards for Automation to improve Quality of Service

 Develop RPA Sandbox for Banking Processes that deliver improved User/Customer Experiences

Implication for Regulators

Source: Mckinsey & Co. 2022, Authors Perspective

Source: Mckinsey &Co (2022), Authours perspective.

VII. Impact of Cloud Technology on Financial Services

Cloud computing is a rapidly growing technology that is changing the way financial services are delivered and consumed. By leveraging the power of the cloud, Fintech companies can offer a wide range of financial services, from digital payments to insurance and wealth management, in a fast and cost-effective manner.

Additionally, the use of cloud computing can enable Fintech companies to more easily scale their operations and expand into new markets, allowing them to reach a wider customer base and increase their market share. However, the use of cloud computing in the Fintech sector also raises important regulatory questions, such as data privacy and security.

VII.1 Considerations for Regulators

Cloud computing is a rapidly growing technology that is transforming the way financial services are delivered and consumed. By leveraging the power of the cloud, Fintech companies can offer a wide range of financial services, from digital payments to insurance and wealth management, in a fast and cost-effective manner.

However, the use of cloud computing in the Fintech sector also raises several regulatory questions. For example, how can regulators ensure that cloud providers meet standards for data privacy and security, and that customer data is protected against cyberattacks? How can regulators ensure that Fintech companies that use cloud services are transparent and accountable, and that they are operating in a manner that promotes stability in the financial system?

Figure 8: Impact of Cloud Computing on Financial Services

Cloud computing will enable greater operational efficiency and business performance **Key Notes Use Cases Implication for Regulators** By 2030, Cloud technology will account for EBITDA in excess of \$1 trillion across the √ Cloud-enabled Open Periodic reviews and engagement on the CBN's IT Standard Blueprint world's top 500 companies (Mckinsey, 2022) banking and with a goal of establishing
 minimum standards for adoption of Research shows effective use of the cloud Banking-as-aservice emerging technologies such as Cloud computing Increase the efficiency of migrated √ Big Data Analytics will boost demand for application development and maintenance Periodically review Regulatory by 38 percent cloud-based elastic Sandbox to foster innovation and adoption of Cloud Technology for computing Raise infrastructure cost efficiency by 29 the Financial Services Industry √ Cloud-based microservice Reduce migrated applications' downtime Architecture by ~57 percent Lower costs associated with technical

Source: Mckinsey &Co (2022), Authours perspective.

violations by 26 percent

Source: Mckinsey & Co. 2022, Authors Perspective

VIII. Impact of No-Code Development Platforms on Financial Services

No-code development platforms (NCDPs) are tools that allow businesses and entrepreneurs to build and launch new financial products and services without writing any code. These platforms have the potential to democratise access to financial services, making it easier for businesses and entrepreneurs to build and launch innovative Fintech products and services.

Additionally, no-code development platforms can help to lower the barriers to entry for Fintech start-ups, increasing competition in the sector and driving innovation. However, no-code development platforms also raise important regulatory questions, such as the risk of financial fraud and the need for consumer protection that must be addressed by regulators.

VIII.1 Considerations for Regulators

It is important regulators ensure that no-code development platforms are used in a manner that promotes competition and protects consumers, and that they are not being used to build and launch fraudulent or illegal financial products and services. They should also ensure that the financial services built

on no-code development platforms meet standards for security, privacy, and reliability.

Figure 9: Impact of NCDPs on Financial Services



No-Code

No-Code Dev. Platforms (NCDPs) will redefine application development

Key Notes

- No-Code Development Platforms (NCDPs) and their close relation low-code platforms, allow users to develop applications through graphical user interfaces and configurations instead of traditional computer programming
- While still relatively immature, the platforms can reduce the need to hire scarce and expensive software talent
- NCDP is the combination and application of component reuse and assembly in software engineering, DSL (domain specific language), visual fast development tools, customizable workflow process orchestration and Design thinking

Use Cases

- ✓ Banking as a Service (BaaS)
- √ Embedded Fintech

Implication for Regulators

- Define Operational, Security, Privacy and Risk Management Standards to guide the adoption of NCDPs
- Periodic reviews and engagement on the CBN's IT Standard Blueprint

 with a goal of establishing minimum standards for adoption of emerging technologies such as Cloud computing
- Develop and periodically review Regulatory Sandbox to foster Innovation and adoption of No/Low Code Development Platforms for the Financial Services Industry

Source: Mckinsey & Co. 2022, Authors Perspective

Source: Mckinsey &Co (2022), Authours perspective.

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