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Impact of Big Data in Financial Technology on Financial Inclusion in South-South, Nigeria

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Abstract

This study examines the impact of big data in financial technology on financial inclusion in South-South Nigeria, focusing on personalized financial services, credit scoring, and customer segmentation. A qualitative research methodology was employed, utilizing semi-structured interviews, focus group discussions, and secondary data to gather insights from Fintech professionals, policymakers, and underbanked populations. Thematic analysis, identified patterns and themes revealing that big data drives financial inclusion through tailored services, dynamic credit scoring, and effective customer segmentation. Personalized financial services enhance customer satisfaction by aligning financial products with individual goals, while predictive analytics and real-time data enable Fintech firms to anticipate and respond to shifting consumer behaviours. Advanced credit scoring technologies leverage AI, blockchain, and alternative data to expand access to financial services, mitigate risks, and improve operational efficiency. Additionally, customer segmentation using machine learning and behavioral insights enables targeted marketing, localized offerings, and optimized resource allocation. These advancements position Fintech firms as key drivers of inclusive and efficient financial ecosystems. The study recommends establishing robust regulatory frameworks to safeguard data privacy and encourage innovation while leveraging alternative data and advanced analytics to develop inclusive financial products.

Keywords: *Big Data, Financial Technology, Financial Inclusion, Financial ecosystem*

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Background to the Study

Financial inclusion, defined as the accessibility and availability of formal financial services to marginalized and unbanked groups, is essential for promoting economic growth and alleviating poverty. Nigeria, a nation marked by varied economic activities and demography, faces a significant challenge in financial inclusion due to restricted access to financial services, elevated poverty rates and inadequate financial literacy. A significant portion of the population persists in encountering obstacles to accessing the official banking system (Senyo & Osabutey, 2020). Also, the World Bank's 2021 report emphasizes the disparity in access to financial services and stresses the need for innovative solutions to address this issue (Demirguc-Kunt, Klapper, Singer & Ansar, 2022). The emergence of financial technology (Fintech) driven by big data analytics has provided creative ways to tackle these difficulties by delivering personalized, efficient and scalable financial services. Fintech has emerged as a cutting-edge approach to improve financial services accessibility, especially for underserved populations (Aleemi, Javaid & Hafeez., 2023; Senyo & Osabutey, 2020).

The provision of appropriate, affordable and timely financial products and services to all individuals and businesses—particularly those who have historically been marginalized or excluded from the official financial sector is known as financial inclusion (Ibor, Offiong & Mendie, 2017; Damayanthi, 2022). These services span a wide range, including savings accounts, credit, insurance, and payment systems. Effective financial inclusion empowers individuals to manage their finances, accumulate savings, and obtain loans and insurance to alleviate risks, therefore enhancing their economic stability and well-being (Kuznyetsova, Boiarko, Khutorna & Zhezherun, 2022). Financial inclusion underscores the accessibility and sustainable utilization of financial services by marginalized demographics, including low-income households, women, and rural communities (Chen, Kumara & Sivakumar, 2021). Financial services must be both accessible and effective in addressing user demands to enhance financial health and economic stability (Abdulquadri, Mogaji, Kieu, & Nguyen, 2021).

In recent years, the ascent of big data within the Fintech sector has been remarkable, with its importance expected to grow progressively (Allen, Gu, & Jagtiani, 2022; Johnson et al., 2021). Big data denotes vast and complex data collections produced by organizations, governments and private individuals (Pappas et al., 2018). The data sets come from a variety of sources, such as social media, sensor data, and financial transactions (George et al., 2014). Fintech companies' operations and customer relations may be revolutionized by their ability to handle and analyze data in real time (Mehrotra, 2019; Yang & Li, 2018). Big data analytics has an impact on many aspects of the Fintech industry, including risk management, product development, decision-making, and compliance. Through the real-time analysis of extensive data sets, Fintech organizations can discern patterns and trends, facilitating improved decision-making, such as forecasting loan default risks or identifying fraudulent activity (Cohen, 2018; Shirazi & Mohammadi, 2019). Big data makes it possible to create individualized financial services and products, such as insurance policies and investment portfolios. Studies indicate that financial institutions can realize revenue growth of 5%−15% through the use of personalization techniques (Chandra, Verma, Lim, Kumar & Donthu,

2022; Abdulquadri, Mogaji, Kieu, & Nguyen. 2021). Moreover, big data improves risk management and compliance by recognizing possible problems and proactively managing them. Furthermore, big data helps develop cutting-edge technologies like blockchain and artificial intelligence, which Fintech companies may use to enhance decision-making and streamline procedures.

In this context, big data analytics allows Fintech organisations to analyze extensive volumes of structured and unstructured data to extract actionable insights. Utilizing these insights, Fintech organisations can provide customized financial solutions, evaluate creditworthiness with enhanced precision and efficiently segment clients to address their specific requirements. These capabilities possess considerable potential to enhance financial inclusion in South-South, Nigeria, where conventional banking systems frequently neglect the unbanked and underbanked populace. Hence, this study investigates the influence of big data in financial technology on financial inclusion in South-South, Nigeria. The study examines the significance of personalized financial services in boosting accessibility, the impact of credit scoring on broadening financial prospects and the role of customer segmentation in optimizing service delivery. This study seeks to elucidate how Fintech might mitigate the financial inclusion gap, hence enhancing economic involvement and growth in the region.

Statement of the Problem

Despite significant advancements in financial technology (Fintech), financial exclusion remains a pressing challenge in South-South, Nigeria. Formal financial services including savings accounts, credit facilities, insurance etc. are still inaccessible to a substantial section of the population, especially those living in rural areas and low-income groups. Traditional financial institutions often fail to address the unique needs of these underserved populations due to limited infrastructure, high operational costs, and stringent requirements for financial inclusion. This persistent gap hinders economic participation, exacerbates poverty, and limits opportunities for socio-economic development. While Fintech solutions, powered by big data analytics have the potential to address these challenges, their application in driving financial inclusion in this region remains underexplored and inadequately leveraged.

The untapped potential of big data in Fintech to revolutionize financial inclusion lies in its ability to provide personalized financial services, assess creditworthiness through accurate credit scoring, and segment customers effectively to meet their specific needs. However, the extent to which these capabilities have been utilized to bridge the financial inclusion gap in South-South Nigeria is unclear. Challenges such as inadequate digital infrastructure, data privacy concerns, and low financial literacy further compound the problem. This study seeks to address these gaps by exploring how big data-driven solutions in Fintech can enhance financial inclusion, providing insights into their impact on personalized financial services, credit scoring, and customer segmentation.

Objectives of the Study

The general objective of the study is to examine the impact of big data in financial technology toward financial inclusion in South-South Nigeria. The specific objectives are to

I. Ascertain the relevance of personalized financial services on financial inclusion in South-South Nigeria.
ii. Determine the influence of credit scoring on financial inclusion in South-South Nigeria.
iii. Explore the relevance of customer segmentation on financial inclusion in South-South Nigeria.

Review of Related Literature

The concept of Big Data

Big data is defined as "the gathering, storing, and processing of very large and complicated datasets" (Aho & Duffield, 2020). Structured, semi-structured, and unstructured data may originate from a variety of sources, such as social media, sensors, and transactional systems. Conventional data processing methods are inadequate for analyzing big data due to its size, velocity, and variety. Extensive data is characterized by its size. Companies are facing challenges in managing the vast amounts of data due to the rapidly expanding volume of data (Vlassenroot et al., 2021; Rehman et al., 2022). Big data is defined by both its enormous volume and its tremendous velocity, indicating that information is created and requires processing in real-time. Businesses like healthcare and banking rely heavily on prompt choices, therefore this is of the utmost importance. Big data's diversity is another important feature. The many forms that big data can take include text, pictures, videos, and audio. Because of this, processing using conventional data processing methods becomes more difficult, as these methods are often tailored to deal with particular kinds of data. To efficiently handle the volume, velocity and diversity of big data, organisations are utilising cutting-edge tools and approaches like Hadoop Spark, and NoSQL databases (Oussous et al., 2018; Venkatesh et al., 2019).

Advanced analytics, such as machine learning and natural language processing, are made possible by these technologies, which are built to manage massive, complicated data sets. Big data has many uses, but there are still some problems that need fixing. Protecting sensitive information is a big obstacle. Protecting this data from unauthorized access or breaches is crucial because of the large amount of personal information that has been accumulated. Businesses also have a responsibility to follow applicable laws, such as Europe's General Data Protection Regulation (GDPR) (Goddard, 2017; Voigt & Vondem Bussche, 2017). Furthermore, there is a lack of qualified workers, which adds another obstacle. There is a severe lack of qualified workers versed in big data technologies and methodologies due to the industry's meteoric rise. For companies lacking in-house knowledge, this is a major obstacle to leveraging big data.

Barriers impeding Financial Inclusion in Nigeria

In developing economies, financial inclusion has several obstacles that prevent it from reaching its full potential, despite the benefits it may provide. One way to classify these obstacles is according to the regulations that are in place, as well as the societal and technological constraints. Access to banking services is severely limited due to geographical obstacles, especially in outlying and rural regions (Renner et al., 2021). Financial institutions

are hesitant to open branches or service centres in rural areas due to the lack of suitable physical infrastructure, including roads, electricity, and communication networks. In areas where transportation is lacking, the long distances that people have to travel to go to the closest bank or ATM can be too much to bear. Financial exclusion occurs when banks and other financial institutions are unable to open branches in rural areas because to the low population density (Ji et al., 2023). In terms of socioeconomic hurdles, we can think about things like low levels of education, societal norms, and poverty as roadblocks to financial inclusion. People on low incomes have a far harder time meeting bank account minimum balance requirements and paying for the fees associated with financial services. People are unable to comprehend and make good use of financial products due to a lack of financial knowledge and literacy. Not enough people know about the financial services that are out there because of poor education. Financial services may be inaccessible to certain populations due to cultural and gender conventions, especially women. There may be cultural obstacles that prevent women in some areas from opening bank accounts or getting loans. Loans and other financial services often demand documentation of stable income, which can be difficult to obtain for persons with informal employment or who do not have their income officially verified. The availability and use of digital technology, which is essential for contemporary financial services, are constrained by technological constraints. Agur et al. (2020) found that digital financial services like mobile banking and online payments are hindered by limited internet connectivity, especially in rural areas. People can't make good use of online banking and other digital financial services since they don't have enough digital literacy. For inclusion, knowing how to use these gadgets is crucial. The implementation and utilization of digital financial services are impeded by an inadequate technological infrastructure, which includes unreliable electricity and mobile networks. Also, when people don't believe the security protections in place, they can be scared off from utilizing digital financial services altogether.

Laws and regulations that have the power to encourage or discourage financial inclusion are known as regulatory obstacles. According to Oster & Riedel (2021), those who do not possess proper identity may find it difficult to open bank accounts due to strict Know Your Customer (KYC) regulations. Financial firms may be unable to help disadvantaged people due to inconsistent or overly strict laws, which could hinder innovation. Financial institutions may be hesitant to offer services to low-income or rural communities due to the high expenses of licensing and regulatory compliance. While it is critical to safeguard customer data, financial service companies may face difficulties due to too complicated data protection requirements.

Recognizing the many components that go into financial inclusion is essential for understanding it. These components include the availability, use and quality of financial services. Geographical, social, technical, and regulatory hurdles all play a role in slowing financial inclusion in emerging nations (Isukul & Tantua, 2021). In order to overcome these obstacles, a holistic strategy is needed, one that incorporates new technologies, changes to regulatory frameworks, improvements to financial and digital literacy, and upgrades to infrastructure. By addressing these obstacles, financial inclusion can be greatly improved, which in turn can contribute to more economic stability, empowerment, and progress in developing nations.

Personalized Financial Services

According to Melnychenko et al. (2020) and Awotunde et al. (2021), Fintech companies may use big data to provide customers with more personalised financial products and services. According to Cohen (2018) and Riikkinen et al. (2018), big data can be used to analyze a customer's income, spending habits, and financial history in order to create individualized insurance policies or investment portfolios. By using big data to provide personalized products and services, Fintech companies have a better chance of increasing revenue and enhancing client acquisition and retention. Fintech companies' operations have been drastically changed by big data, which is having an ever-increasing impact on the financial sector. By analyzing large amounts of customer data, Fintech companies may better understand their customers' habits, likes, and dislikes, and meet their specific financial product and service requirements. There are a lot of ways in which Fintech companies may use big data to help customers get tailored financial products and services. Using big data analytics, Fintech companies can divide their customers into several groups according to their demographics, spending habits, and other personal preferences (Rizvi et al., 2018; Kovács et al., 2021). This allows financial technology companies to cater to specific client needs by tailoring their solutions to different categories. Using big data analytics, Fintech companies can identify customers who are more inclined to request certain financial products, such loans or investment opportunities (Lee & Shin, 2018; Huttunen et al., 2019). Based on customers' tastes and needs, businesses can then create customized advertising campaigns and offer individualized product recommendations. One major concern is that Fintech companies can use big data to better assess the risks associated with offering individualized financial products and services to their customers.

By analyzing extensive data pertaining to consumer behaviour, credit ratings, and financial records, Fintech firms can determine the likelihood of a client's default on a loan or other form of financial product. Loan conditions and interest rates can be customized according to each customer's risk tolerance using this data. Another use of big data analytics is to forecast customer actions and monetary needs. By analyzing past actions and current market trends, Fintech firms may predict future monetary needs and make tailored recommendations for monetary products and services. One use case for predictive analytics in Fintech is helping companies find customers who are likely to apply for a loan soon by analysing their spending habits and credit history. This allows them to adapt the loan conditions and interest rates to each individual customer's risk tolerance and financial needs. In order to provide personalised financial services and solutions, businesses can use big data to gain real-time insights into customer activities. By monitoring customer interactions in real-time, Fintech companies can identify opportunities to offer personalized financial products and services, such investment or loan alternatives (Yang & Li, 2018; Awotunde et al., 2021). By utilising real-time data analytics, Fintech companies may identify clients whose spending is skyrocketing. Consequently, they are able to present these customers individualised investment opportunities or financing choices that meet their specific financial needs and tastes. When it comes to providing tailored financial goods and services, Fintech companies have found big data to be an indispensable tool. By analyzing extensive data on consumer preferences and goals, Fintech companies may personalize their services for each customer, evaluate risk

factors, predict future financial needs, and provide real-time insights into consumer behaviour. This can help financial technology businesses boost customer satisfaction, income, and sector competitiveness.

The Concept of Credit Scoring

Big data analytics presents Fintech companies with significant opportunities for developing new technologies and improving credit scoring (Onay & Öztürk, 2018; Hung et al., 2020). Here we'll go over the ways in which big data is influencing credit scoring and how it's empowering Fintech to think beyond the box. To determine the likelihood of a borrower failing on a loan or other financial commitment, a credit rating is used (Roy & Shaw, 2021). Among other things, the traditional method of credit scoring involves looking at a person's income, work history, and credit record. However, Fintech companies can enhance their credit scoring algorithms with the help of big data, which can provide a more comprehensive assessment of a person's creditworthiness. Emerging technologies, such as blockchain and AI, rely on big data to advance. Using big data analysis to look at blockchain transactions might help find trends and patterns, which might make blockchain networks more secure and easier to scale. Machine learning techniques, which are a kind of artificial intelligence (AI), are trained using big data. With these models in hand, Fintech companies can streamline their operations and make better decisions. The use of alternative data sources, like social media feeds, mobile device usage, and other behavioural data, by Fintech companies to exploit big data is a major concern. By combing through a variety of data points, Fintech firms can get more accurate insights into a person's creditworthiness. In contrast to more traditional approaches, machine learning algorithms are able to sift through massive datasets in search of correlations and patterns. Using these algorithms, Fintech organisations can improve the precision of their credit evaluations and streamline their loan decision-making processes. Technology companies in the financial sector can monitor a borrower's financial situation in real-time and adjust their credit score appropriately. By allowing Fintech companies to identify and manage risks in real-time, this can reduce the likelihood of default.

Financial technology companies may improve their service offerings and streamline procedures by utilising big data to generate innovative solutions. There is a plethora of ways in which big data could boost technological progress. Using big data, we may examine massive amounts of data to find patterns and insights that direct the development of cutting-edge tech. With this, Fintech businesses will be better able to spot opportunities for innovation and meet customer demand with new products and services. Basically, Fintech companies may greatly benefit from big data when it comes to technological innovation and credit assessment. Using big data, Fintech companies may get a leg up in the market by making credit scoring more accurate, coming up with new and useful products and services, and streamlining their processes.

Customer Segmentation

According to Casas-Rosal et al. (2023) and Li et al. (2021), customer segmentation comprises grouping customers into subsets with shared characteristics, including demographics, preferences, or behaviours. Financial technology companies can improve their ability to meet

customer needs by breaking down their customer base into several segments. Since big data gives more complete and precise information about clients, it can considerably improve customer segmentation (Grover et al., 2018). In a number of ways, financial institutions can benefit from better customer segmentation thanks to big data. With the use of big data, it is possible to examine large amounts of data from many sources, including social media, transaction records, and other behavioural information, in order to find patterns and connections that could be useful for customer segmentation. Machine learning and predictive analytics are two examples of the advanced analytical tools that Fintech companies might use to classify customers according to their interests and behaviours. Companies in the financial technology sector can adapt their market segmentation tactics in response to changes in customer behaviour by utilizing real-time data. When Fintech companies see changes in customer behavior or preferences, they can adjust their segmentation approach to reach them more effectively. Utilizing big data to analyse customer behavior and preferences allows for the customization of the client experience. This is a great opportunity for Fintech companies to enhance customer happiness and loyalty by tailoring their offers to individual clients. Fintech organisations can improve their marketing efforts by targeting specific demographics by dividing their user base into several segments. Fintech companies can use this to their advantage to boost ROI and make their marketing campaigns more efficient.

Creditworthiness and other risk variables can help Fintech organisations classify customers, which improves risk management and reduces the likelihood of default and other financial losses. Using big data, you can group customers into different groups based on where they're located. Financial institutions can use this information to better target certain areas with their products and services. Fintech companies may provide products and services personalised for clients in specific locales or perform localised marketing efforts. By categorising customers according to their past actions, Fintech companies can identify opportunities for upselling and cross-selling. Financial technology firms have the opportunity to entice customers who have already purchased a certain commodity or service by providing them with complementary goods and services. By analysing customer data, Fintech organisations may determine the lifetime worth of each client. This helps them prioritize different customer segments and allocate resources effectively. In order to increase sales and profitability, Fintech companies may choose to focus on high-value clientele. Finally, Fintech companies may greatly benefit from big data when it comes to customer segmentation. By leveraging big data to get insights into consumer behaviour and tailor their products and services to individual requests, Fintech companies may increase customer happiness and loyalty while staying competitive in the market.

The Inclusion-through-Technology Theory

The idea behind "Inclusion-through-Technology" is that new technologies, particularly those related to digital financial services, can be used to increase access to these services. There will be more options for underbanked people if digital financial services lower the costs of delivering them and remove obstacles to access, according to the theory. By making it easier to acquire different types of financial aid, technology greatly enhances financial inclusion (Arner et al., 2020; Mhlanga, 2022a). Especially in less developed or rural areas, people can

easily access financial services through digital wallets and mobile banking. People without regular banking services, such as low-income individuals and migrant workers, can be efficiently reached through digital financial services. Digital financial services have the potential to reach more people than conventional banking does, making this a realistic goal. One more way that technology can help expand access to financial services is by making them more affordable. For underserved populations, internet financial services may be more accessible due to cheaper operational expenses compared to brick-and-mortar branches. Users can save time and money by switching to digital banking services, which also reduce transaction costs. There is more safety and openness with digital and conventional financial services than with their analogue counterparts.

By recording and monitoring all digital transactions, digital ledger technology helps reduce fraud and increase transparency. According to the Inclusion-Through-Technology hypothesis, technology has the potential to be a powerful tool in the fight for financial inclusion. To achieve this goal, underbanked populations can have better access to affordable financial services. A thorough understanding of the population's desires and habits, as well as a robust infrastructure, are required for the effective launch of digital financial services.

Table 1: Reviewed Empirical Studies

Author(s) & Year	Focus Area	Key Findings	Challenges Highlighted	Policy/Practical Recommendations
Bello (2024)	Role of data analytics in enhancing financial inclusion in emerging economies	Data analytics improves identification of unbanked populations, enhances credit scoring through alternative data, personalizes financial products, and facilitates digital transactions. Case studies highlight significant progress in Kenya, India, and Africa.	Data privacy and security risks, inadequate digital infrastructure, regulatory barriers, and biases in data usage.	Build robust public-private partnerships, establish open data frameworks, improve regulations, and invest in digital infrastructure and education.
Basid, Selvam, and Parayitam (2024)	Potential of FinTech in promoting financial inclusion through digital financial literacy and regulatory support	Trust, service quality, and security significantly influence FinTech adoption. Digital financial literacy mediates access to financial services, while regulatory support moderates FinTech's impact on financial inclusion.	Limited financial literacy and inconsistent regulatory support slow FinTech adoption.	Strengthen digital literacy initiatives, improve trust and security in FinTech services, and establish supportive regulatory policies.
Nejjari & Aamoum (2021)	Influence of big data analytics on financial performance and market value using intellectual capital as a proxy	Capital employed efficiency and human capital efficiency significantly boost financial performance and market value. Structural capital efficiency showed moderate impact.	Lack of effective integration of intellectual capital into big data strategies.	Promote intellectual capital development and implement holistic data strategies across industries.
Zhu and Yang (2021)	Big data analytics strategies for improving financial performance and sustainability in banks	Big data enhances operational efficiency, sustainability goals, and financial stability. Green innovation strategies and green supply chain management lead to better environmental and economic performance in ASEAN banks.	Gaps in Green HR training and uneven implementation of green strategies limit effectiveness.	Train employees on Green HR practices and integrate green strategies in banking operations.
Soltani, Hajiheydari, and Fahimi (2021)	Strategic applications, drivers, and challenges of implementing big data analytics in banks	Fraud detection and credit risk analysis are key applications. Drivers include decision-making enhancement and product/service development. Challenges include unintegrated data and information silos, limiting analytics efficiency.	Information silos and lack of data integration impede analytics-driven outcomes.	Invest in centralized data integration systems and address organizational silos to maximize the benefits of big data.

The reviewed studies relate to the recent topic by highlighting the transformative role of big data and financial technology in improving financial access and inclusion. For instance, Bello (2024) underscores the potential of data analytics to identify underserved populations, personalize financial products, and enhance credit scoring—key aspects that directly align with the study's objectives. Similarly, Basid et al. (2024) demonstrate the role of Fintech and digital literacy in fostering access to financial services, while Soltani et al. (2021) and Zhu & Yang (2021) emphasize the applications of big data analytics in improving decision-making, credit risk analysis, and operational sustainability. However, the recent topic uniquely focuses on South South, Nigeria, specifically examining how personalized financial services, credit scoring, and customer segmentation impact financial inclusion in this region, offering localized insights that complement the global perspectives presented in the reviewed studies.

Methodology

This study adopts a qualitative research methodology to explore the impact of big data in financial technology on financial inclusion in South-South Nigeria. The qualitative approach was chosen to provide an in-depth understanding of the complex and dynamic relationship between Fintech innovations and financial inclusion in the region. Using an interpretive paradigm, the study seeks to uncover insights into how personalized financial services, credit scoring, and customer segmentation influence financial inclusion from the perspectives of stakeholders such as Fintech professionals, policymakers, and end-users. Data collection primarily involved semi-structured interviews with purposefully selected participants who have relevant experience or knowledge in Fintech and financial inclusion. These participants include representatives from Fintech companies, financial regulators, microfinance institutions, and individuals within the unbanked or underbanked population in South-South Nigeria. Additionally, focus group discussions were conducted to facilitate interaction and gather diverse viewpoints on the role of big data in enhancing financial inclusion. Secondary data from reports, policy documents, and existing literature also complement the primary data to enrich the findings.

Thematic analysis was employed to analyze the qualitative data. This involves coding the data to identify patterns and themes that align with the study's objectives, such as the relevance of personalized financial services, the influence of credit scoring, and the impact of customer segmentation. NVivo software was utilized to organize and analyze the data systematically. The study ensured credibility by adhering to stringent qualitative research criteria through the use of triangulation, member verification, and a comprehensive audit trail. Ethical principles, such as informed consent, confidentiality, and voluntary involvement, were rigorously upheld throughout the research procedure.

Results and Discussions

This section presents and discusses the findings of the study, emphasizing the transformative impact of big data on financial technology and its role in driving financial inclusion. The thematic analysis focuses on three key aspects: personalized financial services, credit scoring, and customer segmentation. Each theme highlights the ways Fintech companies leverage big data to innovate and enhance their operations, enabling tailored services, improved risk management, and dynamic customer engagement strategies. By exploring these themes, the discussion provides insights into how big data-powered solutions address financial inclusion challenges, foster customer satisfaction, and strengthen the competitive positioning of Fintech firms in the evolving financial landscape.

Table 2: Thematic analysis of personalized financial services through Big Data in Financial Technology toward Financial Inclusion

Node	Theme	Source	Key Points
Customized Product Offerings	Tailoring Financial Products	Lee and Shin (2018); Huttunen et al. (2019)	- Personalized offerings such as loans and investment opportunities based on customer needs and behaviors.
			- Products are tailored to match individual financial goals, enhancing satisfaction.
Risk Assessment	Personalized Risk Management	Lee and Shin (2018); Huttunen et al. (2019)	- Big data allows for more precise risk assessment of individual clients.
			- Loan conditions and interest rates are adjusted based on individual risk factors and financial behavior.
Predictive Analytics	Forecasting Future Financial Needs	Yang and Li (2018); Awotunde et al. (2021)	- Predicts customer financial needs (e.g., likely loan seekers).
			- Personalized recommendations are made in advance, based on historical data and trends.
Real-Time Insights	Real-Time Data for Personalization	Yang and Li (2018); Awotunde et al. (2021)	- Real-time data analysis identifies shifting customer needs, such as increased spending.
			- Enables the delivery of customized services, like investment options or loans, based on immediate customer behavior.
Customer Satisfaction and Retention	Enhancing Client Retention	Melnychenko et al. (2020); Awotunde et al. (2021)	- Personalization increases customer satisfaction, loyalty, and retention.
			- Leads to better financial inclusion by expanding access to tailored services.
Market Competitiveness	Competitive Advantage	Awotunde et al. (2021); Melnychenko et al. (2020)	- Personalized financial services create a competitive edge for fintech companies.
			- Fintech companies drive growth in the financial services sector, contributing to improved financial inclusion.

The thematic analysis in Table 2 underscores the transformative impact of big data on personalized financial services in the Fintech sector, driving financial inclusion. Customized product offerings, tailored to individual needs and behaviors, enhance customer satisfaction by aligning financial products with personal goals. Big data facilitates precise risk assessments, enabling dynamic adjustments to loan conditions and interest rates, while predictive analytics anticipate future financial needs, allowing proactive recommendations. Real-time data analysis further empowers Fintech firms to respond swiftly to shifting customer behaviors, delivering timely and relevant services. These innovations boost customer satisfaction, loyalty, and retention while providing Fintech companies with a competitive advantage. Collectively, these advancements contribute to financial inclusion by broadening access to tailored financial services and fostering sectoral growth.

Table 3: Thematic analysis of credit scoring through Big Data in Financial Technology toward Financial Inclusion

Node	Theme	Source	Key Points
Emerging Technologies	Blockchain and AI in Credit Scoring	Onay and Öztürk (2018); Hung et al. (2020)	- Big data aids in the development of AI and blockchain technologies, which improve credit scoring and data analysis.
			- AI models, including machine learning, refine credit scoring algorithms by analyzing vast amounts of data.
Alternative Data Sources	Alternative Data in Credit Scoring	Roy and Shaw (2021); Onay and Öztürk (2018)	- Information from social media, mobile use, and behavioural trends aids fintech firms in enhancing credit evaluations.
			- Machine learning identifies patterns in alternative data that traditional methods would overlook.
Real-Time Credit Scoring	Real-Time Credit Monitoring	Roy and Shaw (2021); Onay and Öztürk (2018)	- Real-time monitoring allows fintech firms to adjust credit scores dynamically based on changes in financial status.
			- Reduces the risk of default by providing timely identification of potential financial difficulties.
Decision-Making Enhancement	Enhancing Decision-Making Processes	Hung et al. (2020); Onay and Öztürk (2018)	- Machine learning enhances decision-making by analyzing complex data to predict loan outcomes.
			- More accurate credit assessments improve lending decisions and reduce the risk of defaults.
Innovative Financial Products	Development of Tailored Financial Products	Onay and Öztürk (2018); Roy and Shaw (2021)	- Big data facilitates the creation of innovative financial products, like customised loans and credit alternatives.
			- Personalized financial products attract more customers, enhancing customer acquisition and retention.
Operational Efficiency	Streamlining Operations	Hung et al. (2020); Roy and Shaw (2021)	- Big data facilitates operational efficiency by automating and refining the credit scoring process.
			- Streamlined operations lead to quicker processing and decision-making, benefiting both fintech firms and customers.
Competitive Advantage	Gaining a Competitive Edge	Onay and Öztürk (2018); Hung et al. (2020)	- Fintech companies using big data gain a competitive advantage by offering more accurate and personalized services.
			- Innovation in credit scoring technology allows fintech firms to stand out in the market, attracting more customers.

The thematic analysis in Table 3 highlights the pivotal role of big data in revolutionizing credit scoring through Fintech, fostering greater financial inclusion. Emerging technologies like AI and blockchain enhance the precision and efficiency of credit scoring algorithms, while alternative data sources, including social media and behavioral patterns, enable more comprehensive credit assessments. Real-time credit scoring dynamically adjusts credit evaluations based on financial changes, reducing default risks. Machine learning enhances decision-making by accurately predicting loan outcomes and refining lending processes. Additionally, big data facilitates the creation of innovative, tailored financial products, improving customer acquisition and retention. Operational efficiency is boosted through automation, streamlining credit scoring processes and expediting decisions. Collectively,

these advancements provide Fintech firms with a competitive edge, enabling them to offer personalized, accurate, and inclusive financial services.

Table 4: Thematic analysis of customer segmentation through Big Data in Financial Technology toward Financial Inclusion

Node	Theme	Source	Key Points
Advanced Analytics	Machine Learning and Predictive Analytics	Li et al. (2021); Grover et al. (2018)	- Fintech firms can employ machine learning and predictive analytics to categorise customers and anticipate their needs.
			- These sophisticated instruments facilitate the categorisation of consumers according to their behaviours and preferences.
Real-Time Data	Dynamic Segmentation	Li et al. (2021); Grover et al. (2018)	- Real-time data analysis helps fintech companies monitor consumer behavior and adapt segmentation strategies.
			- Changes in consumer preferences or behaviors can be tracked and addressed in real time.
Customer Experience	Customizing Client Experience	Grover et al. (2018); Casas-Rosal et al. (2023)	- Segmentation enables Fintech companies to customise products and services for customers as individuals, thereby improving satisfaction.
			- Personalization of services based on segmentation increases customer loyalty.
Marketing Strategies	Targeted Marketing and ROI	Li et al. (2021); Grover et al. (2018)	- Segmented customer bases enable targeted marketing strategies that increase marketing effectiveness.
			- Customized marketing tactics improve return on investment (ROI) for Fintech companies.
Risk Management	Managing Risk through Segmentation	Grover et al. (2018)	- Categorizing customers based on risk factors (e.g., creditworthiness) helps mitigate potential losses.
			- Risk management becomes more precise with segmented data, improving decision-making.
Geographical Segmentation	Targeting Regions and Localisation	Li et al. (2021)	- Big data allows segmentation based on geographic location, enabling region-specific product offerings.
			- Localized promotions or products can be developed to cater to regional needs.
Cross-Selling and Up-Selling	Identifying Cross-Selling Opportunities	Grover et al. (2018)	- Segmentation facilitates the recognition of potential for cross-selling and up-selling predicated on consumer behaviour.
			- Fintech firms can offer additional products based on prior consumer purchases or behaviors.
Customer Lifetime Value (CLV)	Prioritizing High-Value Customers	Li et al. (2021); Grover et al. (2018)	- By evaluating customer data, Fintech companies can estimate lifetime value and prioritize high-value clients.
			- Prioritization helps optimize resource allocation, improving sales and profitability.

The thematic analysis in Table 4 reveals how big data empowers Fintech companies to optimize customer segmentation, advancing financial inclusion. Advanced analytics tools like machine learning and predictive analytics classify customers based on behaviors and preferences, enabling targeted and dynamic segmentation strategies that adapt in real time to changing consumer needs. Tailored products and services enhance customer satisfaction and

loyalty, while segmented marketing improves the return on investment through more effective campaigns. Segmentation also strengthens risk management by categorizing customers according to risk factors, enabling precise decision-making. Geographical segmentation allows for localized product offerings, while cross-selling and up-selling strategies are refined through behavioral insights. Furthermore, evaluating customer lifetime value (CLV) helps Fintech firms prioritize high-value clients, ensuring optimal resource allocation and boosting profitability. Collectively, these strategies position Fintech firms as key drivers of inclusive, personalized financial services.

Conclusion

The study examined the impact of big data in financial technology toward financial inclusion in South-South Nigeria. It underscores the transformative role of big data in revolutionizing financial technology, advancing personalized financial services, credit scoring and customer segmentation and targeting to drive financial inclusion. The findings suggest that big data analytics in Fintech significantly enhances financial inclusion by improving access to financial services, reducing costs and enabling tailored financial products that engendered a robust economy. More so, the research highlights the potential of big data-driven Fintech solutions to bridge the financial inclusion gap in Nigeria's South-South region.

Conclusively, big data innovations in credit scoring, such as AI-driven algorithms and alternative data sources, enable comprehensive and dynamic risk assessments, reducing default risks and improving access to financial services. Similarly, advanced customer segmentation techniques, including machine learning and behavioral insights facilitate tailored marketing, localized product offerings, and improved risk management. Collectively, these advancements position Fintech firms as catalysts for inclusive, efficient, and sustainable financial systems, fostering growth and broadening access to financial services for underserved populations.

However, the study has a number of observed limitations that should be addressed in further researches. These are:

1. Geographic scope: The study focused on South-South, Nigeria, which may limit generalizability to other regions.
2. Data availability: Limited access to comprehensive data on Fintech adoption and financial inclusion in the region may have impacted the findings.
3. Methodological constraints: The study's reliance on qualitative data may not fully capture the complexities of big data's impact on financial inclusion.

Hence, future research directions should therefore investigate the role of big data in Nigeria's Microfinance Sector. Also, future research should examine the impact of Fintech on financial stability in Nigeria.

Policy Recommendations

To harness the full potential of big data in Fintech and amplify its contribution to financial inclusion, the following are recommended in line with the findings from the study:

1. Policy makers must establish robust regulatory frameworks that prioritize data security and privacy while encouraging innovation.
2. Financial institutions should leverage alternative data sources and advanced analytics to create inclusive products that cater to underserved groups.
3. Governments and Fintech companies should collaborate to expand digital infrastructure and ensure equitable access across regions, fostering an enabling environment for technology-driven financial services.
4. The government should foster collaboration between Fintech companies and financial institutions.
5. Today's firms should develop targeted financial products using big data insights.
6. Additionally, initiatives to promote financial literacy are crucial to empowering consumers to navigate personalized financial products effectively.
7. Public-private partnerships should also focus on accelerating the adoption of emerging technologies, such as AI and blockchain, to enhance operational efficiency, transparency, and accessibility within the financial sector. These strategies will ensure that fintech continues to drive meaningful progress toward an inclusive global financial ecosystem.

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