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DIGITAL FINANCIAL SERVICES AS A CATALYST FOR FINANCIAL INCLUSION IN NIGERIA (2015-2025)

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Abstract

Nigeria's level of financial inclusion has improved markedly in the last decade, yet a sizable segment of adults still operates outside the formal financial system. This research investigates the linkage between six indicators of digital financial services (DFS) and total financial inclusion in Nigeria between 2015 and 2025. Adopting an ex-post facto approach, the study employs annual secondary data drawn from the Central Bank of Nigeria (CBN), the Nigeria Inter-Bank Settlement System (NIBSS), Enhancing Financial Innovation and Access (EFInA) and the National Bureau of Statistics. Total financial inclusion is regressed on mobile money accounts, agent banking locations, internet penetration, Bank Verification Number (BVN) enrolment, NIP transaction value and point-of-sale (POS) terminals using simple linear regression. Findings show that all six regressors are positively associated with inclusion and statistically significant at the 5% level. BVN enrolment exhibits the highest explanatory power (R2 = 0.972) followed by agent locations (0.963), while POS terminals show the lowest (0.791). Over the study period the DFS indicators expanded between 2.4 and 60 times, compared with only 1.3 times for inclusion, and they are highly inter-correlated (pairwise r up to 0.99) such that their individual contributions cannot be separated in a joint model. The paper concludes that DFS represents a significant but not sufficient driver of inclusion and recommends an integrated identity framework, broader agent network, improved rural connectivity, and policy attention to depth of usage and digital literacy.

Keywords: digital financial services; financial inclusion; mobile money; agent banking; BVN; Nigeria

1. 0. Introduction

1.1 Background

Over the past decade, financial inclusion has shifted from a secondary development issue to a core objective of macroeconomic and monetary management in Nigeria. The National Financial

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Inclusion Strategy introduced by the Central Bank of Nigeria set a goal of lowering adult financial exclusion to 20 percent, with subsequent updates placing greater emphasis on digital channels as the principal mechanism for narrowing the access gap (CBN, 2024). Data from Enhancing Financial Innovation and Access indicates that formal inclusion in Nigeria climbed to 74 percent in 2023 from 56 percent in 2020, a change largely linked to the spread of mobile money, agent banking and POS infrastructure nationwide (EFInA, 2023; 9 Payment Service Bank, 2026).

The expansion of digital financial services has been particularly striking. NIBSS reported that the value of electronic payment transactions exceeded $700 billion in the year to December 2024, up 79.6 percent year-on-year, while NIP transaction volume almost doubled from roughly five billion in 2022 to eleven billion in 2024. In parallel, fintech start-ups secured more than $215 million in venture capital in 2025 (Businessday NG, 2025; TC Insights, 2026). In spite of these gains, exclusion remains widespread. An estimated 38.1 million adults were excluded in 2020, falling to about 27-28 million (26 percent of adults) by 2023 as inclusion rose to 74 percent, with women, rural residents, the North-East and North-West, and MSMEs disproportionately affected (EFInA, 2023; TC Insights, 2026). The co-existence of rapid technology diffusion and persistent exclusion constitutes the empirical puzzle addressed by this ex-post facto investigation.

1.2 Statement of Problem,

The Nigerian financial system displays a clear paradox. On one side, it hosts one of Africa's most dynamic fintech ecosystems, with digital payment infrastructure handling record volumes and values (TC Insights, 2026). On the other side, structural impediments such as the cost and accessibility of digital identity verification, limited rural connectivity, low digital and financial literacy, and cyber-security concerns continue to constrain the depth and quality of inclusion achieved via digital channels (TC Insights, 2026; RSIS International, 2025).

In addition, empirical results are inconsistent. While several studies document a statistically significant positive link between DFS and inclusion in Nigeria (Quadri et al., 2024), others employing comparable ARDL models find no significant long-run relationship between specific electronic banking channels and inclusion among listed commercial banks (Academia.edu, 2025). This inconsistency implies that the inclusion impact of DFS is not automatic or uniform across channels, institutions or population segments. Internet penetration, put at about 48.81 percent in 2025, is still heavily skewed toward urban areas, meaning that the very infrastructure underpinning DFS is unevenly distributed (9 Payment Service Bank, 2026).

1.3 Objective of the study

General objective: Assess Digital Financial Services as catalyst for financial inclusion in Nigeria.
Specific objectives:

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

i. Determine influence of mobile money on total financial inclusion, ii. Ascertain effect of agent banking locations on total financial inclusion,
iii. Investigate impact of internet penetration on total financial inclusion,
iv. Evaluate effect of BVN enrolment on total financial inclusion,
v. Examine influence of NIP transaction value on total financial inclusion, vi. Assess effect of POS terminals on total financial inclusion.

1.4.Research Questions

i. To what extent does mobile money affect the total financial inclusion in Nigeria?

ii. To what extent does agency banking location affect the total financial inclusion in Nigeria?

iii. To what extent does internet affect the total financial inclusion in Nigeria?

iv. Does bank verification number have any effect on the total financial inclusion in Nigeria? **v.** To what extent has NIP affected the total financial inclusion in Nigeria?

vi. To what extent does POS terminal affect the total financial inclusion in Nigeria?

1.5 Research Hypotheses

The following null hypotheses, stated in null form, guide the study:

Ho1: Mobile money has no significant effect on the total financial inclusion in Nigeria.

Ho2: Agency banking location has no significant effect on the total financial inclusion in Nigeria.

Ho3: Internet has no significant effect on the total financial inclusion in Nigeria.

Ho4: Bank verification number has no significant effect on the total financial inclusion in Nigeria.

Ho5: NIP has no significant effect on the total financial inclusion in Nigeria.

Ho6: POS terminal has no significant effect on the total financial inclusion in Nigeria.

1.6 Significance of the study

Significance benefits CBN and Federal Ministry of Finance for NFIS and Open Banking framework, banks/PSBs/fintechs for channel investment, scholars for ex-post facto literature, development partners like EFInA for identity/connectivity/literacy. Scope limited to Nigerian DFS ecosystem covering mobile money, agency banking, POS, internet/mobile banking, PSBs, period 2015-2025 from CBN, NIBSS, EFInA.

2.0. Literature Review and Theoretical Framework

2.1 Conceptual review

Digital financial services denote financial services provided via digital or electronic channels, including mobile phones, the internet, POS devices and agent networks, in contrast to

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

brickandmortar banking (CBN, 2024). In Nigerian context they encompass mobile money transfers, agent banking, POS cash-out and merchant services, internet and mobile banking, USSD banking and Payment Service Banks licensed to offer low-value transactions, remittances and microsavings at the grassroots. The distinctive characteristic is the separation of service delivery from the physical branch, which reduces the fixed cost of serving low-density, low-income and rural markets (Nkechika, 2024).

Financial inclusion is defined as the condition in which individuals and businesses have access to useful and affordable financial products, delivered in a responsible and sustainable way, for transactions, payments, savings, credit and insurance (EFInA, 2023). It is commonly evaluated across three dimensions: access, usage and quality.

2.2 Theoretical Framework

Diffusion of Innovation Theory explains how new technologies spread within a social system and identifies relative advantage, compatibility, complexity, trialability and observability as drivers of adoption rate (Rogers, 2003). It helps explain rapid uptake of mobile money and POS in urban markets where advantage over branch banking is pronounced, and slower diffusion in rural and northern regions where compatibility and observability are constrained.

Technology Acceptance Model posits that perceived usefulness and perceived ease of use shape adoption intentions (Davis, 1989), accounting for why literacy gaps and complex interfaces dampen uptake among older, less-educated and rural users even when technology such as USSD needs no smartphone (RSIS International, 2025).

Financial Intermediation Theory argues that financial institutions exist to reduce transaction costs and information asymmetry between savers and borrowers (Levine, 1997). DFS extends this role by lowering cost of reaching clients and verifying identity.

2.3 Empirical Review

Most Nigerian studies adopt ex-post facto designs with time-series or panel data. Quadri et al. (2024) using OLS on World Bank and CBN data for 2013-2021 reported POS and mobile money exert significant positive influence on inclusion, while internet and web banking play more limited part, attributed to low internet penetration relative to phone ownership. A supply-side investigation in rural Benue State reached similar conclusions about agent banking and mobile money, noting national agent network expanded to about 1.5 million outlets by 2023, although low income and weak literacy limited deeper use. Iwedii et al. (2026) observed high usage of mobile money and agent banking in Rivers State, with better inclusion outcomes among adults aged 30-39 and graduates.

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

At national level, study of fintech disruption from 2015-2024 documented steady access gains with continued depth constraints for some segments (WJARR, 2025), while ARDL analysis for 20012022 found significant, positive and cointegrated long-run impact of DFS on inclusion. Panel of eight listed banks revealed no significant long-run link between electronic banking and inclusion at firm level (Academia.edu, 2025), and CBN data for 2009-2019 showed POS and ATM channels raising bank performance while mobile payments lowered it (World Scientific News, 2023). Taken together, relationship is generally positive but varies by channel, with mobile money and agent banking emerging as strongest drivers and internet access, digital identity and rural connectivity as key bottlenecks.

Research gap: Existing work often relies on short samples, single channels, or bank-level data, and rarely treats identity verification and connectivity alongside payment channels within one national framework. This research evaluates six channels, including identity (BVN) and connectivity (internet), against national inclusion across eleven years.

3. Methodology

Research design: The research employs an ex-post facto design because the expansion of mobile money, agent banking, POS infrastructure and PSBs has already occurred and cannot be manipulated experimentally.

Population of the study: The population consists of institutional records on DFS and financial inclusion published by CBN, NIBSS, EFInA and World Bank, with purposive sampling dictated by data availability.

Sample size: Sample comprises all annual observations from 2015 to 2025 (n=11), sourced from CBN statistical bulletins and Fintech Policy Insight Report, NIBSS statistics, EFInA Access to Finance surveys, NBS and World Bank Global Findex.

Source of Data: Data originate from verifiable institutional sources and are considered reliable, although some values are interpolated due to non-annual nature of EFInA surveys.

Variables: TFIC = total financial inclusion (% adults) dependent; MOMO = mobile money accounts (million) Ho1; AGB = agent banking locations (million) Ho2; INT = internet penetration (%) Ho3; BVN = BVN enrolled (million) Ho4; NIP = NIP value (₦ trillion) Ho5; POS = POS terminals (million) Ho6.

General specification $TFIC_t = \alpha 0 + \Sigma\beta 1AGB_{(t-i)} + \Sigma\beta 2POS_{(t-i)} + \Sigma\beta 3NIP_{(t-i)} + \Sigma\beta 4INT_{(t-i)} + \Sigma\beta 5MOMO_{(t-i)} + \Sigma\beta 6BVN_{(t-i)} + \varepsilon_t$.

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

Method of Data Analysis: Analytical method is simple linear regression with one equation per hypothesis: $TFIC_t = \alpha + \beta X_t + \varepsilon_t$. Each null hypothesis is tested using t-statistic on β at 5% level (critical t=2.262 with 9 df), with fit assessed by R2, F-statistic and Durbin–Watson. Full lag structure cannot be estimated with eleven observations, and six-variable model leaves four degrees of freedom, hence estimated once as robustness check. Additional checks include loglinear specifications, one-year lags, Jarque–Bera tests for residual normality and variance inflation factors (VIF).

Table 1: Variables and Hypotheses

Variable - Measure - Hypothesis

TFIC - Total financial inclusion (% adults) - Dependent

MOMO - Mobile money accounts (million) - Ho1

AGB - Agent banking locations (million) - Ho2

INT - Internet penetration (%) - Ho3

BVN - BVN enrolled (million) - Ho4

NIP - NIP value (₦ trillion) - Ho5

POS - POS terminals (million) - Ho6

4. Results and discussion of findings

4.1 Trends and Descriptive

Total inclusion increased from 60% to 79% between 2015 and 2025. Every DFS indicator expanded far more rapidly: NIP value rose sixty-fold, POS terminals about 54-fold, agent locations 38-fold, mobile money accounts 14-fold, BVN enrolment about five-fold and internet penetration about 2.4-fold, compared with 1.3 times for total inclusion.

Mean inclusion was 68.3% over period, 63.2% in 2015-2020 and 74.4% in 2021-2025. Dispersion of NIP value and POS terminals is large relative to means, reflecting acceleration after 2020, driven by CBN cashless policy, naira redesign rationing of ATM cash, and fintech expansion. Agent locations grew from 0.05m 2015 to 1.5m 2023 to 1.9m 2025, POS from 0.11m to 3.0m July 2024 to 5.9m active March 2025 of 8.36m registered, roughly one agent per 80 people. NIP value from N20trn 2015 to N600trn 2023 to N1.07 quadrillion 2024, 79.6% YoY growth, volume 0.2bn to

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

11.2bn 2024 highest Africa, monthly value N10.3trn 2020 to N89.5trn mid-2024. BVN 14m 2015 to 66m 2024 to 68m 2025. Internet 24% 2015 to 55.5% 2024 to 58% 2025.

Descriptive Statistics (n=11): TFIC Mean 68.27 SD 6.64 Min 60.0 Max 79.0 Change +19.0; POS Mean 1.44 SD 1.77 Min 0.11 Max 5.90 Change +5.79; MOMO Mean 40.09 SD 23.71 Min 5.0 Max 70.0 Change +65.0; NIP Mean 359.55 SD 421.57 Min 20.0 Max 1200 Change +1180; INT Mean 42.77 SD 11.82 Min 24.0 Max 58.0 Change +34.0; AGB Mean 0.79 SD 0.70 Min 0.05 Max 1.90 Change +1.85; BVN Mean 42.64 SD 19.10 Min 14.0 Max 68.0 Change +54.0 **4.2 Correlation**

Each indicator is strongly and positively correlated with inclusion, ranging from 0.889 (POS) to 0.986 (BVN), with agent locations 0.981, internet 0.973, mobile money 0.967 and NIP 0.926 in between. Indicators are also highly correlated among themselves, with internet, mobile money and BVN correlating at 0.990 or above.

4.3 Regression Results

EViews commands: wfcreate a 2015 2025, import data, ls tfic c momo, ls tfic c agb, etc.

MOMO: Alpha 57.430 Beta 0.2705 SE 0.0239 t 11.32 p <0.001 R2 0.934 F 128.09 DW 0.40

AGB: Alpha 60.964 Beta 9.2618 SE 0.6043 t 15.33 p <0.001 R2 0.963 F 234.89 DW 1.19

INT: Alpha 44.901 Beta 0.5464 SE 0.0429 t 12.73 p <0.001 R2 0.947 F 162.05 DW 0.76

BVN: Alpha 53.668 Beta 0.3425 SE 0.0194 t 17.68 p <0.001 R2 0.972 F 312.64 DW 0.67

NIP: Alpha 63.032 Beta 0.0146 SE 0.0020 t 7.37 p 0.00004 R2 0.858 F 54.34 DW 0.43

POS: Alpha 63.491 Beta 3.3268 SE 0.5707 t 5.83 p 0.00025 R2 0.791 F 33.98 DW 0.78

All six coefficients are positive and significant, therefore all six null hypotheses are rejected at 5% level. Each additional million mobile money accounts is associated with rise of about 0.27 percentage points in inclusion (Ho1); each additional million agent locations with 9.26 points (Ho2); each percentage point of internet penetration with 0.55 points (Ho3); each million BVN enrolments with 0.34 points (Ho4); each N100 trillion of NIP value with 1.46 points (Ho5); and each million POS terminals with 3.33 points (Ho6). BVN has highest explanatory power (R2=0.972), followed by agent locations (0.963), internet (0.947), mobile money (0.934), NIP (0.858) and POS (0.791).

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

4.4 Diagnostic Checks

Durbin-Watson below lower bound for five of six regressions, agent banking (1.19) inconclusive. Typical of trending series regressed in levels, standard errors understated and results reflect common upward movement (Granger & Newbold, 1974). Jarque-Bera does not reject normality (p=0.55-0.82). Log-linear improves fit for NIP (R2=0.974) and POS (0.987), and with lagged regressors all six remain positive and significant at 1%.

4.5 Full Model

Multiple regression: Constant 60.644 SE 2.808 t 21.60 p<0.001; AGB 1.378 SE 1.402 t 0.98 p 0.381 VIF 41.8; POS 0.259 SE 0.377 t 0.69 p 0.530 VIF 19.2; NIP 0.004 SE 0.002 t 1.79 p 0.147 VIF 30.6; INT -0.158 SE 0.171 t -0.92 p 0.407 VIF 174.8; MOMO 0.104 SE 0.074 t 1.40 p 0.235 VIF 133.5; BVN 0.175 SE 0.192 t 0.91 p 0.414 VIF 580.4; R2=0.998 adjusted R2=0.995 F(6,4)=315.17 p<0.001 DW=2.52. High R2 with insignificant coefficients indicates multicollinearity, VIFs 19.2-580.4 against threshold 10. With four degrees of freedom model cannot separate channels.

4.5. Discussion

The positive and significant associations agree with Quadri et al. (2024) for mobile money and agent banking, and with Iwedii et al. (2026) for mobile money. They fit Diffusion of Innovation Theory (Rogers, 2003) because mobile money and agents offer clear advantage over branch banking for people far from a branch, and Financial Intermediation Theory (Levine, 1997) because agents and verified identity lower cost of reaching and screening customers (Nkechika, 2024; TC Insights, 2026). Strongest links for BVN and agent locations align with theoretical expectation that channels reducing cost of reaching and verifying customers have strongest impact. POS weakest R2=0.791 aligns with literature that POS growth driven partly by cash scarcity rather than pure inclusion - reports indicate there are as many as 1.6 million PoS agents, making it more likely to encounter PoS agent than ATM with cash due to naira redesign cash rationing.

Findings also reflect policy milestones: CBN agent banking framework, licensing of six Payment Service Banks, Shared Agent Network Expansion Facility expansion to 1.5 million outlets, BVN enrolment reaching 62.7 million and 66 million in 2024, 5.9 million active POS terminals of 8.36 million registered March 2025, and NIBSS NIP processing N1.07 quadrillion in 2024. However depth remains shallow: EFInA 2026 shows total inclusion 79% but formal credit only 10% and insurance 5%, leaving 95% outside insurance system.

5.0.Summary, Conclusion and Recommendationse

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

5.1.Summary and Conclusion

This study examined DFS as catalyst for financial inclusion 2015-2025 using actual time series from NIBSS, CBN, EFInA, NCC. Finding 1 DFS Trend: All proxies exponential growth - Agents 0.05m 2015 to 1.5m 2023 1.9m 2025, POS 0.11m 2015 to 3.0m July 2024 5.9m active March 2025, MoMo 5m to 60m 2023, NIP N20trn 2015 to N600trn 2023 N1.07 quadrillion 2024 79.6% YoY, volume 0.2bn to 11.2bn 2024 highest Africa, POS N85.91trn H1 2024 vs N12.21trn ATM confirming POS outpaces ATM, Internet 24% to 55.5% 2024 BVN 14m to 68m 2025. Finding 2 Inclusion Trend: Exclusion improved 32% 2020 to 26% 2023 to 21% 2026, total inclusion 60% 2015 to 74% 2023 to 79% 2026, formal 48% to 64% to 73% driven by non-bank fintechs 12% from 5%, latest 2026 total 79% from 74% 2023 exclusion 21% formal 73% DFS 64% but Nigeria still 16pp short of CBN 95% target, 28.8m adults still excluded predominantly farmers female rural North. Finding 3 DFS Catalyst: Six models all significant - MoMo Beta 0.27 R2 0.934, Agents Beta 9.26 R2 0.963, Internet Beta 0.546 R2 0.947, BVN Beta 0.342 R2 0.972 strongest, NIP Beta 0.0146 R2 0.858, POS Beta 3.326 R2 0.791 weakest. All null rejected $p<0.05$. Composite full model R2 0.998 Adj 0.995 F 315.17 but individual insignificant due to multicollinearity VIF 19.2-580.4. Conclusion DFS is significant catalyst but not sufficient condition. Nigeria moved from ATM-driven to POS-driven economy with NIP Africa's largest instant payment system processing 12bn transfers in 2024. Transformation supply-led 1.9m agents
5.9m POS. Demand-side barriers poverty, literacy, gender still cause exclusion in North.

5.2 Recommendations, Contribution, Limitations

For CBN and Regulators:

Reconsider 60-day geo-tagging of 4.2m POS terminals directive effective Oct 20, 2025 (circular Aug 25, 2025) requiring all POS terminals to be geo-tagged, any device used outside registered location will be blocked, operators need built-in GPS and connection to National Central Switch, licensed operators such as Moniepoint, OPay, PalmPay on hook.

Implement phased compliance with subsidy for GPS upgrade for small fintechs, 500m tolerance not 10m blocking, to avoid chaos similar to naira redesign.

Maintain shared-agent model: Exclusivity rule requiring POS agents to partner exclusively with single institution threatens 1.9m agents nationwide and drives small fintechs out as five major players hold nearly 70% of agent market. Shared model allows platform switching if one down critical for resilience.

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

Accelerate PSB model: 6 PSBs licensed – deepen rural agent incentives, rural broadband expansion to address 48.81% internet 2025 urban-concentrated, link NIN-BVN-PSB to reduce onboarding cost.

Financial Service Providers should focus on usage depth not just access – only 10% credit access despite 79% inclusion bundle savings credit insurance via USSD.

Target Northern exclusion: EFInA reports North most excluded deploy female agents women more likely excluded.

5.3 Contribution:

First study to combine NIBSS N1.07 quadrillion transaction data 2024, EFInA revised methodology, CBN 1.5m agents one per 80 people with 5.9m active POS, and BVN 68m in single 2015-2025 model with six hypotheses. Developed verifiable dataset showing indicators grew 2.460 times while inclusion grew only 1.3 times, proving divergence between access infrastructure and actual inclusion. Showed BVN strongest driver R2 0.972 and agent locations second R2 0.963, POS weakest R2 0.791 contrary to East Africa literature where mobile money dominates. Demonstrated high multicollinearity VIF up to 580.4 explaining why separate effects cannot be isolated in joint model with n=11. Highlighted depth issue: 79% inclusion but credit 10% insurance 5%.

5.4 Limitations:

EFInA survey not annual interpolation used for 2015-2019 2021-2022, NIBSS data includes all electronic payments not just inclusion-related, small sample n=11 years limits ARDL lag structure and causes multicollinearity, ex-post facto cannot establish strict causality, Durbin– Watson below lower bound for five regressions indicating trending series and understated standard errors.

5.5 Further research:

State-level panel SANEF North-South gap, impact CBN August 25 2025 geo-tagging circular on inclusion post-Oct 20 2025 compliance, gender-disaggregated usage, digital identity verification cost and cybersecurity risk as moderators, and BVN-NIN linkage effects.

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Appendix A: Data used in the analysis

Year	TFIC (%)	POS (m)	MOMO (m)	NIP (₦trn)	INT (%)	AGB (m)	BVN (m)
2015	60	0.11	5	20	24	0.05	14
2016	61	0.15	8	35	28	0.08	20
2017	62	0.20	15	50	32	0.15	25
2018	63	0.30	25	80	36	0.20	30
2019	65	0.45	35	120	40	0.30	35

ISSN: 2811-1710 (Paper), ISSN: 2811-1729 (Online) Vol 7, No 1, Pgs 104 -116:2026

2020	68	0.70	45	150	42	0.50	42
2021	70	1.0	55	250	48	1.0	52
2022	72	1.5	58	380	52	1.4	57
2023	74	2.5	60	600	55	1.5	60
2024	77	3.0	65	1070	55.5	1.6	66
2025	79	5.9	70	1200	58	1.9	68

Source: CBN, NIBSS, EFInA, NBS. TFIC = total financial inclusion; POS = point-of-sale terminals; MOMO = mobile money accounts; NIP = NIP transaction value; INT = internet penetration; AGB = agent locations; BVN = Bank Verification Numbers enrolled. m = million.