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An Evaluation of the Effectiveness of Digital Financial Service (DFS) in Promoting Financial Inclusion (FI) among Low-Income Households

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ABSTRACT: Financial inclusion, characterized by access and usage of formal financial services, is a critical driver of economic development and poverty reduction. In Nigeria, a country with a large population of unbanked and underbanked individuals, adoption of Digital Financial Services (DFS) presents a promising avenue for expanding financial inclusion among low- income households. This study focused on evaluating the effectiveness of DFS for promoting financial inclusion among low-income households in Jigawa State, North-West Nigeria. Usinga mixed-methods research approach, this study comprehensively assessed the impact of DFS on financial inclusion indicators. The research draws from a representative sample of low- income households in Jigawa State, examining utilization of DFS platforms, perceptions of thebenefits and challenges associated with these services.

Findings indicate notable increase in financial inclusion among low-income households in Jigawa State following the introduction of DFS. Factors contributing to this positive trend include improved convenience, reduced transaction costs, and increased financial literacy. However, challenges related to digital literacy (complexity) and trust in digital platforms (perceived risk) persist and need to be addressed to maximize the impact of DFS. This researchcontributes to the ongoing discourse on financial inclusion and digital financial services by providing empirical insights specific to the Jigawa State context. The outcomes of this study are expected to inform policymakers, financial institutions, and DFS providers on strategies for further enhancing the reach and effectiveness of digital financial services in promoting financial inclusion among low-income households not only in Jigawa State but also in similarregions across Nigeria and beyond.

KEYWORDS: Digital Financial Services (DFS), Financial Inclusion (FI), Low-Income Household.

1.0 INTRODUCTION

The significance of digital finance and financial inclusion (FI) for increasing economic growthtoday is gaining wider consideration among the academics and policy makers since the G-20 and World bank led its initiative to help reduce the level of poverty in emerging economies (Ozili, 2018). Financial exclusion has been a major challenge in the underdeveloped or developing nations globally especially when people who are qualified are not able to access cost effective provided financial services in an impartial and just manner or are financially disadvantaged (Hanning & Jansen, 2010).

Despite effort put into making the financial services more innovative globally, World bank's report on FI reveals that there are about 2 billion unbanked people round the world (Hirani, 2016). The World Bank Global Findex report (2021) stated that about twenty-four (24) percentof the world's population is still excluded financially, with about 29 percent of the developingcountries within the same period. Also, a report from EFInA (2020) indicated about thirty-six

(36) percent of a particular nation's population remains excluded financially with its associatedrepercussions aggravated by cultural inhibition issues, market imperfections, challenges with logistics and bulky process of on-boarding account in traditional institutions (Sarpong & Nketiah-Amponsah, 2022).

Four (4) of every ten (10) Nigerian lives below the poverty line despite effort from the NationalSocial Safety Net Program, with about 76 percent of them living in the rural areas of the north(Vishwanath, 2021). While it is important that the deprived access financial services because of safety, it also helps in reducing the economic stock that comes with it (Mehrotra, et al., 2009). Therefore, access to financial services has become a concern for every policy maker because its social implications on the acceleration of a countries economic growth.

With this realisation notwithstanding, achieving pervasive FI remains a challenge with about alittle above 50% of the world's adult

remaining excluded with the developing nations recordingabout 70% of these figures. Since Fin-tech has the potential to provide innovative solutions that can promote FI (Kanga, et al., 2021; Tian & Kling, 2022), it is imperative for businesses to have their financial services readily available via innovation so that they continue to thrive in this ever demanding and competitive entrepreneurial environment (Islam, et al., 2022). However how these solutions are developed and used responsibly and sustainably such that itsbeneficial to all stakeholders especially for low-income households are still of concern.

This situation further emphasizes why FI is important hence reducing the levels of exclusion in the society especially in Northern Nigeria where the record is short of the expected (Wezel & Ree, 2023). FI therefore requires that government and /or agencies make effort to facilitate access to financial products and services (Mago & Chitokwindo, 2014; Ene, et al., 2019; Popescu, 2019; Isukul & Tankua, 2021) which is prominently featured among the United Nations commonly accepted articulated Sustainable Development Goals (SDGs) (Ajekwe, 2020). All FI initiatives apart from aligning with sustainable development, must also exhibit a range of service offerings which is cost effective and adjustable to financial disruptiveinnovation (Miao & Juanjuan, 2018). FI requires disruptive financial innovations for its objectives to be achieved replacing the challenges of the traditional banking patterns technologies with accessibility, simplicity, and affordability (Kjellman, et al., 2019).

While there has been significant research on the effectiveness of DFS in promoting FI amonglow-income households, there are still some gaps in the current knowledge. This study would only focus on assessing the effectiveness of this technology in fostering FI in Northern Nigeria,which is regarded as a remedy for promoting economic growth, reducing income inequalities,and enhancing shared economic prosperity (Chibba, 2009; Cull, et al., 2014; Ouma, et al., 2017;Popescu, 2019).

Research Aim and Objectives

The aim of this research is to evaluate the effectiveness of digital financial services in promoting financial inclusion among low-income households.

The research objectives include:

- To Identify and categorize the various DFS available for promoting FI in low-income households through a comprehensive literature review.
- To Assess the level of access and usage of DFS among low-income households throughsurveys or data analysis.
- Propose strategies or interventions to enhance the effectiveness of DFS in promoting FI among low-income households, based on the findings from the literature review andempirical research.

2.0 LITERATURE REVIEW

2.1 Low-Income Household

A low-income household is characterized by limited financial capacity, earning an income below a certain threshold considered the poverty line or a specific percentage of the median income in a particular country or region. The definition of low-income households varies acrosscountries, influenced by economic conditions and social policies (Rowlingson & McKay, 2011). In the UK, such households earn less than 60% of the national median pay. The US defines low-income households as those earning 80% or less of the median income adjusted for household size (Cornell Law School, n.d.).

In Nigeria, low-income households are determined by living below the international poverty line of 2011 PPP $1.90 per day (World Bank Group, 2020; Vishwanath, 2021). Thesehouseholds encounter challenges meeting basic needs such as housing, food, healthcare, and education due to their relatively lower income levels compared to the broader population (UNISON, 2022). Supporting low-income households becomes vital to alleviate poverty and improve their economic well-being. Social welfare and FI programs, often leveraging DFS, aim to uplift these households and enable access to essential financial resources.

Reflecting on the diverse definitions and realities of low-income households worldwide allowsus to comprehend the complexity of addressing poverty and promoting financial inclusion. By understanding the unique challenges faced by these households, policymakers and stakeholderscan design more targeted and effective strategies, leveraging DFS to empower individuals and families to break free from the cycle of poverty and achieve greater financial stability.Collaborative efforts across nations and cultures hold the potential to create lasting positive impacts, creating a more inclusive and equitable global financial landscape.

2.2 Financial Technology / Digital Financial Services

Financial technology, or FinTech, represents the dynamic convergence of technology and finance, creating a powerful multiplier effect (Islam et al., 2022). It drives the emergence of new financial services, business models, products, processes, and institutions, encompassing innovations like crowdfunding, E-Trading, and blockchain technology (IAIS, 2017). Within FinTech, the integration of technologies like AI and Data Science is vital, enabling industry- specific solutions through platform-as-a-service and software-

as-a-service models (Dhanabalan & Sathish, 2018; Mashelkar, 2018).

Financial services on the other hand, according to Irena (2020), entail managing money through banks, credit cards, insurance, accountancy, and investment funds in the finance industry. DFSoffer innovative channels for both individuals and businesses to access financial services through mobile or internet usage. This includes mobile banking, electronic wallets, and variousdigital payment services. According to the World Bank Group's 2020 report, DFS possess thepotential to maximize economies of scale, driving lower costs, increased transaction speed, security, and transparency. They also present opportunities for providing tailored financial services to those in the low-income bracket (Pazarbasioglu et al., 2020). The synergies betweenFinTech and DFS is essential to harness the transformative power of technology in creating more inclusive and efficient financial ecosystems. Leveraging FinTech's capabilities to enhance DFS holds the promise of addressing financial inclusion challenges and fostering greater financial well-being for underserved populations.

2.3 Financial Inclusion

Financial Inclusion involves providing a responsible and sustainable access to affordable and easy to use financial product and services like payments, savings, transactions, credits, insurance etc. to individuals and businesses (World Bank Group, 2022) especially to the financially excluded populace (Ozili, 2020). Ozili et al., (2022) defines FI as exposingunbanked adults to formal financial services. It is involves having the underserved andexcluded population access a range of cost-saving DFS suitable to their needs (Lauer & Lyman,2015). It is regarded as the cornerstone of social developments as it helps in making informedfinancial decision, narrowing the income gap, reduces poverty, increases savings and investment productivity as well as gender equality (Gallego-Losada, et al., 2023).

FI is desirable and has been a priority in the developing nations across the globe because it means economies like the India Philippines, Rwanda, Brazil, Argentina, Nigeria, and Cambodia would have an increase in access to finance (incomes), making life more liveable (Ozili, et al., 2022). Digital FI empowers firms with big data technology, reducing the cost of financing via the internet and removing the geographical limit while enabling sustainable employment (Geng & He, 2021). Additional advantages for users of financial services, digitalfinance providers, the government, and the economy encompass enhanced accessibility to finance for disadvantaged individuals, decreased costs of financial intermediation between banks, stakeholders, and FinTech providers, as well as cumulative government expenditure (Ozili, 2018).

2.4 Theoretical Foundation

Since the practice of FI differs across nations round the world, it is therefore necessary that principles that explains these observed variations are identified. These underlying set of principles are called theories. Although several studies on FI have been conducted (Demirguc-Kunt, et al., 2017), the synergy that should exist between policies and the academics is lacking(Prabhakar, 2019), especially because there are either neglect or no elaborate theories in explaining the real-world practices of the subject (Ozili, 2020). While there is the general conception that it's better to accumulate evidence than build theories, there is usually contention on what is or not a theory even when some FI theories emerge. Despite all the disagreement Ozili (2020) believes that agreeing that we need a framework or a set of principlesto help us understand this subject is important for both the practitioners, policy makers and theacademics.

As several theories and models have been proposed to understand and promote FI, it is important to note that these theories are not mutually exclusive, and efforts to promote FI oftenrequire a multifaceted approach that considers various factors and contexts. Ozili (2018) (2020)attempted to group some ideas and perspectives of FI into theories to add meaning to the subject. This includes the theories of FI beneficiaries (public good theory, dissatisfaction theory, vulnerable group theory, systems theory), theories of FI funding (private money theory,public money theory intervention fund theory), and theories of FI delivery (community echelon theory, public service theory, special agent theory, collaborative intervention theory, financialliteracy theory).

Some theories that explain FI in the context of DFS among low-income households include:

1. **Access Theory**: This theory emphasizes the importance of providing physical access to both financial products and services and its associated cost, the level of product differentiation and diversification and establishing branches or mobile banking networks in underserved areas (Allen, et al., 2016; Donner & Escobari, 2010). It focuseson reducing geographical barriers and increasing the availability of financial infrastructure within specific areas (Donner & Escobari, 2010). Advocates of this theory argue that unless the high costs of maintaining accounts and the dispersed natureof bank branches are resolved, the objective of incorporating the financially excluded will remain unfulfilled (Claessens, 2006; Beck & Demirgüc-Kunt, 2008). This could mean developing policies that promote inclusion can increase the likelihood thatindividuals perceive financial services as being within their reach (Allen, et al., 2016).

2. **Demand-Side Theory**: This theory emphasizes understanding the demand for financialservices from marginalized populations. It highlights the importance of understanding the specific needs and preferences of potential users and designing appropriate productsand services to meet their requirements (Collins, et al., 2009; Klapper & Singer, 2017).It also means overcoming barriers like awareness, low-income, literacy, trust and cost issues (Kumar, 2019). Suri and Jack (2016) analysis on the impact of mobile money adoption on the financial behaviours and outcomes of low-income households support this theory particularly in terms of poverty reduction and gender dynamics.
3. **Supply-Side Theory**: This theory focuses on the supply of financial services as well asaddresses the barriers faced by financial institutions in reaching underserved populations such as geographical location, mismatch of products and services, documentation, and behaviours of officers from this institution (Kumar, 2019). It emphasizes the need for innovative business models, cost-effective technologies, and supportive regulatory frameworks to encourage financial institutions to extend servicesto previously excluded groups (Claessens & Perotti, 2007; Beck, et al., 2007). Zhen andMeng (2015) examined the supply-side factors influencing FI through e-banking, highlighting how DFS can overcome traditional barriers and expand access for low- income households.
4. **Institutional Theory**: This theory examines the role of formal and informal institutionsin shaping FI. It recognizes that social norms, cultural factors, and regulatory frameworks play a significant role in determining access to financial services. It emphasizes the need for creating an enabling environment like regulatory frameworks, legal systems, and institutional arrangements that supports the adoption and usage of FI efforts through DFS (Suddaby, 2010; Munir, 2015; Willmott, 2015; Peters, 2022). It suggests that well-designed policies, regulations, and collaborations among various stakeholders are crucial for promoting digital FI among low-income households (Ozili,2023).
5. **Capability Theory**: This theory, developed by Amartya Sen, argues that FI should beviewed to enhance people's capabilities and empower them to make choices and improve their well-being thereby expanding individuals' freedoms (Kuriakose & Kylasam, 2015). it emphasizes the importance of providing low-income households with the necessary resources, opportunities, and abilities to access and effectively use DFS highlighting the position of financial education and building individuals' financialaptitudes to fully participate in the economy (Sen, 1999). Zubairu and Yusof (2019) investigated the linkages between FI and financial capability among low-incomeindividuals in Malaysia. It underscores the importance of financial capability development alongside the provision of DFS to promote FI effectively. Lapenu and Zeller (2001) illustrated the Capability Theory by examining how the adoption of DFScan enhance the capabilities and decision-making power of low-income individuals in managing their financial resources.
6. **Social Capital Theory**: This theory highlights the role of social networks and relationships in promoting FI by influencing the financial behaviours and access to DFSamong low-income households (Narayan, et al., 2009). A social network always incorporates social actors like individuals, and associations as well as sets of bilateral and interactive bonds like religious or location ties (Scott, 1988) often associated withsocial capital (Cotterell, 2007). Social capital recognizes the importance of trust, reciprocity, and social support in accessing financial services. It emphasizes the need to leverage existing social networks and institutions to extend financial services to marginalized populations (Ssewamala & Ismayilova, 2009). This theory has delved intohow individuals play a crucial role in establishing connections and bonds within their own communities and beyond, enabling them to exchange resources and information (Putnam, 2002; Portes, 1998).
7. **Technology Theory**: This theory explores the potential of technology, particularly DFS, in expanding FI. It recognizes the transformative power of mobile phones, internetconnectivity, and digital payment systems in overcoming traditional barriers and reaching underserved populations (Aker & Mbiti, 2010). It posits that the adoption andusage of DFS among low-income households are influenced by the availability and accessibility of technology, cost-effectiveness, perceived usefulness, and ease of use. Ithighlights the importance of understanding the factors that drive the adoption of DFS, particularly mobile phones, among low-income individuals (Mas & Radcliffe, 2010).
8. **Diffusion of Innovations Theory**: This theory focuses on the spread of innovations, including DFS, within a social system (Ene, et al., 2019). It suggests that the adoption and diffusion of DFS among low-income households are influenced by factors such asrelative advantage, compatibility, complexity, observability, and trialability (Rogers, 1983; Tornatzky & Katherine, 1982; Rogers, 1995). However, Moldaschi (2010) criticizes this theory for neglecting elements like management skills, which influence the decision-making process and argues that the theory of innovation cannot stand aloneand requires support from supplementary theories. Nevertheless, this theory is useful for driving the importance of innovation for maintaining sustainability and economic transformation. This implies that in the pursuit of transforming the economic status of vulnerable and financially disadvantaged individuals, it is imperative to promote a culture of ongoing innovation among fintech

companies that addresses the issue of financial exclusion in a holistic manner and contribute to comprehensive solutions (Ogunode & Akintoye, 2023).

9. **Human Capital Theory**: This theory underscores the significance of financial education and training initiatives to enhance digital FI among low-income households (Huang, et al., 2023). The mere existence of an inclusive financial system is inadequate if the underlying factors contributing to decreased human capital levels and economic vulnerabilities are not addressed (Tita & Aziakpono, 2017). Numerous studies have investigated the influence of FI on the human development index, with a focus on developed nations (Arimah, 2004; Matekenya, et al., 2021). Suri, Boozer, Ranis, and Stewart (2011) have demonstrated that an all-encompassing financial system enhances effectiveness and well-being by providing secure savings options and facilitating a widerange of efficient financial services which includes education. Without these essential measures, FI can exacerbate exclusion, particularly in underdeveloped regions, and perpetuate a destructive cycle of debt repayment. Therefore, FI entails more than just opening bank accounts and providing funding; it extends beyond the levels of human development within a country (Nanda & Kaur, 2016). Hence, it is crucial to establish arobust connection between the FI mechanism and the level of human capital (Lenka &Bairwa, 2016).

2.5 Empirical / Related Studies

Studies like Nandru et al. (2015) investigated factors impacting banking service usage for increased financial inclusion in Pondicherry, India. The authors had recognised that the purposeof bank account opening, ease of accessing bank products, convenience, and physical branch distance are important dimensions which impact financial inclusion. However, the result from their analysis using factor and multiple regression analysis revealed that easy access to bank products and the purpose of account opening significantly influenced banking service usage frequency. Surprisingly, physical branch distance and convenience did not have a substantial impact to enhance financial inclusion in the region.

In 2012, Bhanot et al. conducted a study focusing on financial inclusion in the northeastern Indian states of Assam and Meghalaya. The researchers aimed to investigate various factors, such as income levels, awareness of financial products, familiarity with Self Help Groups (SHGs), and the educational backgrounds of the respondents, which were identified as significant determinants of financial inclusion. Their findings also indicated that proximity to financial institutions, such as banks and post offices, played a crucial role in enhancing financial inclusion. In contrast, factors like geographical terrain and government support were not observed to have a significant impact on financial inclusion, except for government supportin plain areas, which was found to positively influence financial inclusion.

Agyekum et al. (2016) examined the impact of digital currency usage on financial inclusion inlower-income countries, focusing on Ghana between 2011 and 2014. Their analysis encompassed both bank-based and non-bank-based customers, employing ordinary least squares regression and logistic regression. The results indicated a significant positive effect ofdigital currency usage on financial inclusion for non-bank-based digital finance users, while bank-based digital currency users experienced a negative correlative effect. The study recommended synchronizing technological advancements to foster an inclusive financialsystem in Ghana. A similar study on the factors influencing the utilization of financial services in Tanzania, specifically focusing on household behaviour, highlighted the significance of behavioural factors in determining the adoption of financial services (Joachim, 2017).

In 2020, Ryu & Ko explored Fintech continuance usage and growth. They used a mixed methodapproach to explore the relationship between uncertainty and Information Technology qualityfrom a quality-based perspective (information, service, and system quality) and a trust-based model (Trust, perceived risk, perceived benefit). A set of seven survey items was crafted and categorized into three groups, assessing responses on a seven-point Likert scale. To analyse the data, the researchers employed the partial least squares (PLS) tool, drawing information from 218 targeted Fintech users who had actively utilized the technology for over three monthsand were deemed relevant for the study. Results indicated system quality's negative associationwith perceived risk and information quality's positive link to trust. Service quality emerged asthe key factor for managing uncertainty and encouraging Fintech use. Due to Fintech'scomplexity and unpredictability, addressing uncertainty becomes crucial, underscoring IT quality's pivotal role in Fintech success for financial inclusion.

Lutfi et al. (2021) examined mobile payment acceptance for Digital Financial Inclusion (DFI)in Jordan. Their model integrated TAM variables and perceived financial cost. Data from 304Jordanian citizens were analyzed using Partial Least Squares-Structural Equation Modelling PLS-SEM. Results showed perceived usefulness and financial cost significantly and positively influenced behavioral intention to use the m-payment system. Perceived ease of use did not have a significant positive impact. This highlights the challenge of low acceptance of DFI- based products in some developing countries like Jordan. Understanding user perspectives is crucial to foster greater acceptance of mobile money and payment systems for DFI.

Asif, et al., (2023) conducted a comprehensive analysis of India's financial inclusion, focusingon individuals with bank accounts using a mixed method approach. The primary objective wasto assess the impact of fintech and digital financial services on rural India's financial inclusion.The study delved into the behavioural intentions of people, exploring factors like trust, usability, and social influence in their adoption of fintech services. Data was gathered through a stratified judgmental sampling approach, selecting 400 participants from 3 district in Haryanastate. Subsequently, this data was subjected to regression analysis to explore the correlations between the different constructs. The findings indicated that DFS played a crucial role in enhancing financial inclusion, particularly for the middle class. To ensure more widespread inclusivity and a stable environment for DFS, the study suggest that India must prioritize further measures.

In this study, an attempt was made to explore the determinants of financial inclusion as measured by access (Nandru et al., 2015; Nandru et al., 2015a), social network or influence (Asif et al., 2023), TAM variable like Perceived ease of use, perceived usefulness, and affordability (Perceived financial cost), (Lutfi et al., 2021), percieved risk (Ryu & Ko, 2020) Relative Advantage, compatibility (Siddik, et al., 2014) and Education (Bhanot et al (2012). Complexity was added to access the level of digital literacy of the respondence in using DFS for FI among low-income households in Kiyawa LGA of Jigawa state north-west Nigeria.

3.0 RESEARCH METHODOLOGY

3.1 Research Model and Hypotheses

The research framework of this study based on theories of access, social capital, diffusion of innovation, human capital and technology as seen in the figure below. Perceived Risk was added because of the security concerns individuals might have in adopting DFS for financial inclusion (Siddik, et al., 2014).

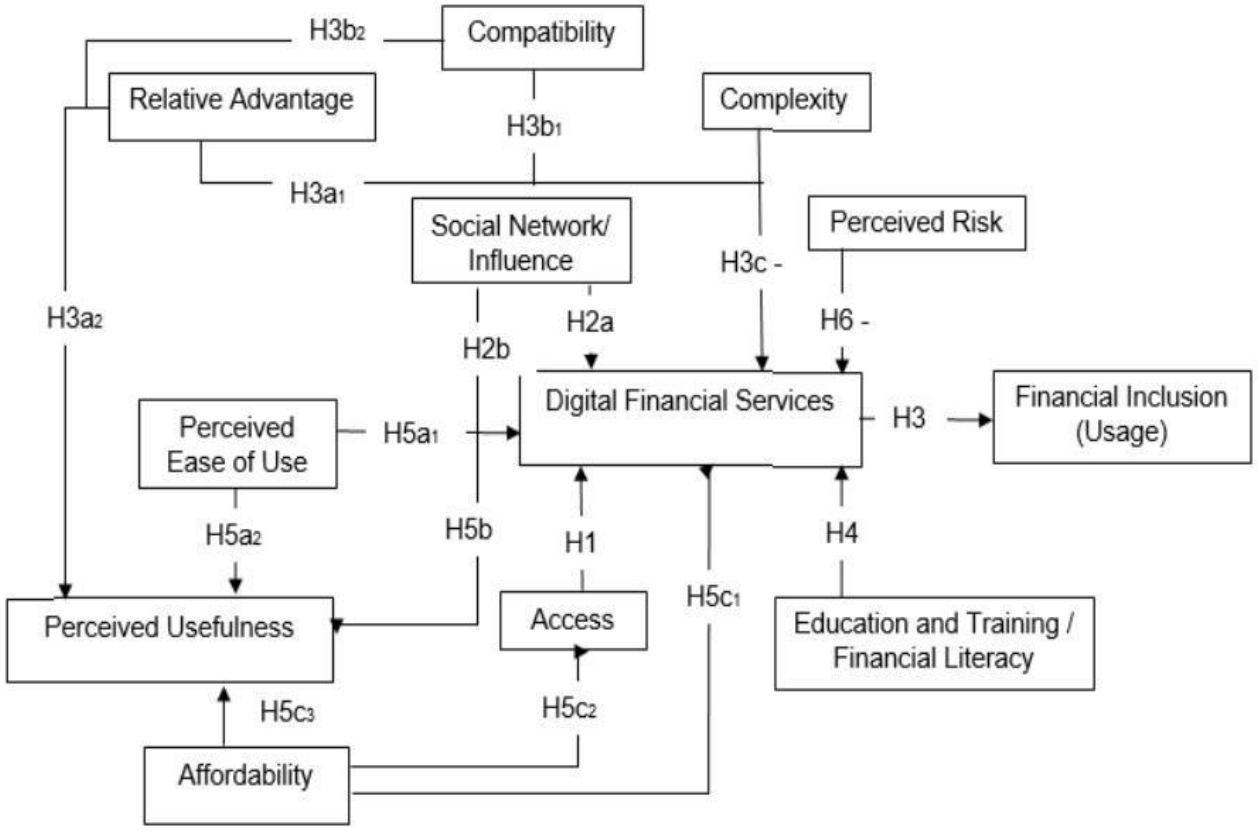


Figure 3.1: Research framework source: Author

These theories offer insights into the factors and mechanisms influencing financial behavioursand outcomes providing theoretical underpinnings with empirical evidence that support their application relevant to the research focus.

1. Access Theory: Ogunode and Akintoye (2023) employed this theory although refered to as access opportunity frontier, expands upon the economic theory of demand and supply proposed by Beck and De la Torre (2006) in their research on FI. However, Ramji (2009) countered this viewpoint by suggesting that sustained access problems may persist for the vulnerable

and financially disadvantaged due to issues of financial indiscipline, thereby criticizing the theory. Nonetheless, this theory remains significantin the current study as ensuring access to financial services is a fundamental element inattaining the objective of FI.

H1: Access is positively influences DFS for FI among low-income households.

2. Social networks theory lay emphasises on the importance of social influence and trust in driving FI through digital channels. It suggests that individuals are more likely to adopt DFS if they observe their peers or trusted individuals within their social networksusing and benefiting from these services (Suri & Jack, 2016). However, Aziz and Naima (2021) have contended that the limited accessibility to information can further marginalize individuals, emphasizing the importance of enhanced access to informationand resources for fostering the social inclusion of lower-income and marginalized members of society (Caidi & Allard, 2005). Within the realm of social inclusion, the utilization of social capital and social networks can reinforce the sharing of financial information and resources not only within one's community or group but also beyond.

H2a: Social Network/ Influence has positive impact on DFS.

H2b: Social Network/Influence is positive towards perceived usefulness.

3. Diffusion of Innovation: It is also important to note that the adoption behaviour of an innovation and its usage is based on the social system, time, communication channels as well as the technology itself (Rogers, 1983). This behaviour can be tied to the attributes of relative advantage, compatibility, and complexity as observability in finance according to Siddik, et al. (2014) is considered irrelevant because of issues related to privacy and trialability not useful for testing financial related studies.

- Relative Advantage: This refers to whether the DFS is perceived to offer more value and better, than the idea of what low-income households in Northern Nigeria are accustomed with which can encourage faster adoption.

.H3a$_1$: Perceived relative advantage is positive toward DFS. H3a$_2$: Perceived relative advantage is positive towards perceived usefulness.

- Compatibility: This usually would influence the adoption of innovative productpositively especially when it is considered consistent with the current values, past experiences and needs of the potential adopters.

H3b$_1$: Perceived compatibility is positive towards the adoption of DFS.

H3b$_2$: Perceived compatibility is positive towards perceived usefulness of DFS.

- Complexity: This refers to the difficulty individuals experience in understanding the use of DFS. This implies that Innovations that are easy to understand and use are likely to be quickly adopted.

H3c: Perceived complexity is negative towards the use of DFS.

H3 –continuous innovative DFS among low-income households positively influence FI in North-Western Nigeria

4 Human Capital Theory: It focuses on the role of education, skills, and knowledge in promoting FI through DFS. It suggests that individuals with higher levels of educationand digital literacy are more likely to adopt and effectively utilize DFS.

Financial literacy typically refers to an awareness and grasp of fundamental financial concepts,encompassing money management and financial planning (Mufarih et al., 2020). Studies by Lusardi (2019) and Varkey (2020) indicate a positive link between financial literacy and Fintech adoption.

H4 – Education and training / the spread of Financial Literacy has a positive impact on the useof DFS for FI.

5 Technology: The adoption and usage of DFS among low-income households are influenced by the availability and accessibility of technology, cost-effectiveness (affordability), perceived usefulness, and ease of use.

- Perceived ease of use can be defined as the "extent to which users believe that applying a specific system would be free of efforts'' (Davis, 1989; Venkatesh, et al., 2003). Perceived ease of use has been used in previous studies as a vital factor in the intention to use DFS (Singh & Srivastava, 2018; Alalwan, et al., 2017).

H5a$_1$: Perceived ease of use is positive towards DFS.

H5a$_2$: Perceived ease of use is positive towards perceived usefulness of DFS.

- Perceived usefulness as defined by Davis (1989) "is the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived usefulness same as performance expectancy (Venkatesh, et al., 2003) is theoretically identified as an important predictor ofthe behavioural intention to use DFS (Ameen, et al., 2020; Venkatesh, et al., 2012).

H5b: Perceived Usefulness is positive towards the use of DFS.

- Affordability: Safe, accessible, and affordable finance is crucial for acceleratingincome and economic growth, reducing income disparity and poverty. It createsequal opportunities, encourages social inclusion, and enables active participation in economic development, guarding against economic shocks(Aduda & Kalunda, 2012; Melubo & Musau, 2020).

H5c1: Affordability is positive towards DFS for FI.

H5C2: Affordability is positive toward easy access of DFS. H5C3: Affordability is positive towards perceived usefulness.

6 Perceived Risk: It relates to the sense of risk associated with divulging personal and financial information (Tan & Teo, 2000). Security and privacy concerns are significantbarriers in e-commerce, leading to adoption primarily by those who perceive internet banking as low risk (Tan & Teo, 2000). Studies by Luarn and Lin (2005), Rao and Troshani (2007), among others, confirm that the perception of a secure environment and customer privacy positively influences the adoption of mobile banking. Similarly,Polatoglu and Ekin (2001), Yahaya et al. (2014), Siddik et al. (2014), and Rasheed andSiddiqui (2022) also find that perceived risk is a crucial factor affecting the adoption and customer satisfaction of mobile banking services, stemming from uncertainty.

H6: Perceived Risk has a negative effect on the use of DFS for FI.

3.2 Research Instrument

Questionnaire is the survey instrument used in this research. The research design was divided into two sections. The first section consists of demographic profile and the DFS usage of the respondent. The second section consist of 33 questions; 2 questions on perceived ease of use, 4 questions on perceived usefulness, 4 questions on Education and Training/Financial Literacy,4 questions on social network/influence, 2 questions on compatibility, 3 questions on relative advantage, 3 questions on access, 2 question perceived risk, 3 question on complexity, 2 question on affordability, 2 question on DFS and 2 questions on FI. The different construct used from the theories studied as well as the corresponding questions asked are as seen in Table

3.3 below:

Table 1. Research Instrument

Construct	Measurement Items (Questions)	Reference
Access (AC)	I can easily assess a DFS. DFS have adequate productssuited to my needs. DFS facilities is available to provide answers to financequestions	(Ryu & Ko, 2020;Vaid, et al., 2020)
Social Network /Influence(SNF)	The use of digital financial services has a promising future in this environment. My social network recommend that I use DFS for financial inclusion. I am more likely to use DFS if they are judged well by people whose opinion I trust. Among my peers, am usuallythe first to try out new DFS products.	(Asif, et al., 2023; Nugraha, et al., 2022)
Relative Advantage (RA)	Adopting DFS will allow me to conduct more finance transactions conveniently. Using DFS will allow me to accomplish financial transactions more quickly. DFS is useful for managing my financial transactionseffortlessly.	(Siddik, et al., 2014)

Compatibility (COM)	Using DFS fits well into mylifestyle. The use DFS fit well into how I like to manage my finance.	(Siddik, et al., 2014)
Complexity (CMX)	DFS is difficult to use. DFS requires a lot of effortand consumes time. DFS can be frustrating.	(Siddik, et al., 2014)
Education and Training/ Financial Literacy (ETFL)	I am aware of DFS. I have basic knowledge ofDFS.	(Nugraha, et al., 2022; Varkey, 2020; Vaid, et al., 2020)
	There is adequate awareness about the DFS products. Education is important to be to use DFS.	
Perceived ease of use (PEOU)	DFS is easy to use. It is easy to get the information I want from using DFS system.	(Ryu & Ko, 2020; Nandru, et al., 2015; Lutfi, et al., 2021)
Perceived Usefulness (PU)	DFS enables me to accomplish my financial transactions. DFS provides helpful functions for my financial transactions. Using DFS systems saves time. I usually look forward to g new product of DFS.	(Ryu & Ko, 2020; Lutfi, et al., 2021; Nugraha, et al., 2022)
Affordability (AFD)	The cost of using a DFS is affordable. The minimum required for maintaining DFS is affordable.	Nandru et al. (2015);
Perceived Risk (PR)	Using DFS has many unexpected problems. There is high possibility of losing funds with the use of	(Ryu & Ko, 2020)
Digital Financial Services (DFS)	is possible to employ DFS to expand access for FI among Jigawa's state low-income households.	(Asif, et al., 2023)
	ervices that are based on al Finance are important to me.	
Financial Inclusion (Usage) (FIU)	When it comes to financial inclusion, I am more likely to use DFS. I regularly make use of DFS because it promotes financial inclusion. I will continue to contribute to FI by using DFS. It is convenient to use DFS.	(Asif, et al., 2023; Vaid, et al., 2020)

The participants were asked to indicate their perception on a liker scales (1-5) with response ranging from "strongly agree" to "strongly disagree". The collected data were analysed basedon descriptive statistics using statistical package for social sciences (SPSS version 28). SPSS is statistic package with a comprehensive nature that provides opportunity to extract exhaustively all desired information and statistics. It specifically helps in performing highly complex data manipulation and analysis with simple instructions. The data was analysed using Frequency distribution table, Factor analysis, Reliability test, Normality test, Linear Regressionanalysis and Pearson correlation analysis.

3.3 Sample Population and Data

The survey was administered to selected Local Government Area (LGA) of Jigawa state in North-West Nigeria, ensuring proper data quality control measures. This is because Jigawa State is eight largest states by population with the highest unbanked people in Nigeria. With the state having a record of 10 to 15 percent current rate of FI, it is considered the most financially excluded state

in the nation with no presences of financial institution in about five
(5) of its Local Government Area (LGA) before its Apex Bank through the state government carried out an inclusion sensitisation program within the state (Omorogbe, 2021).

Table 2.Determining sample size from a given population

Table for Determining Sample Size from a Given Population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

Source: (Krejcie & Morgan, 1970)

The research population was narrowed down to Kiyawa local government area (L.G.A) of Jigawa State, with much focus on the Kiyawa municipal with a population of 297,400. Data was collected using a digital means (google forms) from 400 households using (Krejcie & Morgan 1970) sample table to determine sample size and rounding up to nearest hundreds placevia stratified random sampling method and 387 was returned. Thus, the sample size used for the study comprised of 387 questionnaires gathered from the respondents.

3.4 Methodology

To provide a comprehensive understanding of the topic, answer the research questions as wellas achieve the research objectives this study adopts qualitative research using inductive approach to build theory and quantitative i.e., the deductive approach to develop hypotheses based on identified theory and tested (Barczak, 2015).

The qualitative aspect offered a comprehensive analysis of existing literature, synthesized findings to generate meaningful insights, including the impact of specific digital financial service interventions and adoption patterns among low-income households, identified gaps in the current knowledge and provided a theoretical framework for the study (Herath & Herath,2018; Rizvi & Narian, 2019; Abrahim & Prasad, 2019; Basu & Srivastav, 2020). This included gathering data from news websites, library books, recent and relevant publications, as well as reports from multilateral organizations such as the World Bank, UN, International Monetary Fund, and Development Banks, etc., which were relevant to the study.

Quantitative research lay emphasises on quantifying both the data collected and its analysis and therefore belongs to the positivism paradigm. The quantitative phase includes a survey design where a structured questionnaire is used to gather data that captures the demographic information, access to digital financial services, usage patterns, financial behaviours, and perceptions of FI among low-income households in Jigawa State North-West Nigeria based onthe concepts defined in the research model. The empirical study employed survey questionnaires designed to collect data for testing the reliability and validity of the model and

research hypothesis using descriptive statistics techniques, regression analysis, and correlationanalysis (Nandru et al., 2015; Siddik, et al., 2014). Ethical considerations, such as informed consent and confidentiality, was strictly followed throughout the research process. This data collection instrument offers advantages such as scalability, anonymity, practicality, and ease of collection through digital platforms.

4.0 DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Demographic profileTable 3: Demographic

VARIABLES		FREQUENCY	PERCENTAGE
Gender	Male	192	49.6
	Female	178	46.0
	Prefer Not to say	17	4.4
	Total	387	100.0
Age	<=20	17	4.4
	21 – 30	219	56.6
	31-40	109	28.2
	41-50	33	8.5
	>50	9	2.3
	Total	387	100.0
Qualification	MSc	39	10.1
	HND/BSc	166	42.9
	OND	52	13.4
	School Cert	100	25.8
	Others	30	7.8
	Total	387	100.0
Occupation	Student	153	39.5
	Private Servant	62	16.0
	Public Servant	39	10.1
	Civil Servant	60	15.5
	Others	73	18.9
	Total	387	100.0
Awareness	Yes	225	58.1
	No	119	30.7
	Not Sure	43	11.1
	Total	387	100
Purpose	Payment	183	47.3
	Business	101	26.1
	Communication	28	7.2
	Complaints	8	2.1
	Savings	30	7.8
	Not Applicable	37	9.6
	Total	387	100.0
Frequency of Use	Daily/Weekly	198	51.2
	Monthly	59	15.2
	Yearly	19	4.9

	Never Used	111	28.7
	Total	387	100
Average Income per Annum	<=50,000	71	18.3
	>50,000 <100,000	153	39.5
>100,000 <500,000		93	24.0
>500,000 <1,000,000		39	10.1
<1,000,000		31	8.0
Total		387	100.0

Examining survey responses offers vital insights into factors influencing DFS adoption amonglow-income households in Jigawa State. Findings reveal complex determinants rather than a single driver, emphasizing a multifaceted approach considering demographics. DFS users spanage, occupation, education, and income groups, indicating potential for broader adoption. Tailored strategies can tap into this diversity. Varied adoption patterns demand specific interventions; awareness efforts for less educated, highlighting benefits for different income levels. These findings impact policymakers, urging user-friendly platforms and tailored financial products. Collaboration can harness digital finance's potential for enhancing financialinclusion among low-income families

4.2 Correlation Analysis

A Correlation analysis was conducted on all variables to explore the relationship between variables. The analysis of bivariate correlation was subject to two tailed tests of statistically significant at 0.01% and 0.05% levels of significant. The result of the Pearson's Correlation and interpretation is computed as seen table below.

Table 4. Hypothesis Interpretation of Pearson's correlations output

Hypothesis	N	p value	r	COD (%) (r^2 x 100)	Sig level	Relationship positive/negative	Decision (accept H_0 or H_1)
H1	387	<0.001	0.395	15.60	0.01	Positive	H_1
H2a	387	<0.001	0.446	19.89	0.01	Positive	H_1
H2b	387	<0.001	0.496	24.6	0.01	Positive	H_1
$H3a_1$	387	<0.001	0.436	19.01	0.01	Positive	H_1
$H3a_2$	387	<0.001	0.647	41.86	0.01	Positive	H_1
$H3b_1$	387	<0.001	0.377	14.21	0.01	Positive	H_1
$H3b_2$	387	<0.001	0.564	31.81	0.01	Positive	H_1
H3c	387	0.356	0.047	.0.22	Null	Null	H_0
H3	387	<0.001	0.518	26.83	0.01	Positive	H_1

H4	387	<0.001	0.372	13.83	0.01	Positive	H_1
H5a1	387	<0.001	0.358	12.81	0.01	Positive	H_1
H5a2	387	<0.001	0.598	35.76	0.01	Positive	H_1
H5b	387	<0.001	0.508	25.81	0.01	Positive	H_1
H5c1	387	<0.001	0.282	7.95	0.01	Positive	H_1
H5c2	387	<0.001	0.487	23.71	0.01	Positive	H_1
H5c3	387	<0.001	0.493	24.30	0.01	Positive	H_1
H6	387	0.009	0.132	1.74	0.01	Positive	H_0

Correlations

AC			SNF	RA	COM	CMX	ETFL	PEOU	PU	AFD	PR	DFS	FIU
AC	Pearson Correlation	1	.556**	.504**	.488**	.051	.510**	.523**	.563**	.487**	.146**	.395**	.430**
	Sig. (2-tailed)		<.001	<.001	<.001	.313	<.001	<.001	<.001	<.001	.004	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
SNF	Pearson Correlation	.556**	1	.552**	.528**	.062	.493**	.459**	.496**	.426**	.093	.446**	.443**
	Sig. (2-tailed)	<.001		<.001	<.001	.221	<.001	<.001	<.001	<.001	.068	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
RA	Pearson Correlation	.504**	.552**	1	.593**	-.109*	.526**	.505**	.647**	.441**	.092	.436**	.448**
	Sig. (2-tailed)	<.001	<.001		<.001	.032	<.001	<.001	<.001	<.001	.071	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
COM	Pearson Correlation	.488**	.528**	.593**	1	-.044	.423**	.486**	.564**	.395**	.053	.377**	.467**
	Sig. (2-tailed)	<.001	<.001	<.001		.389	<.001	<.001	<.001	<.001	.296	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387

CMX	Pearson Correlation	.051	.062	-.109*	-.044	1	.002	-.026	-.121*	.005	.488**	.047	-.004
	Sig. (2-tailed)	.313	.221	.032	.389		.962	.611	.018	.923	<.001	.356	.933
	N	387	387	387	387	387	387	387	387	387	387	387	387
ETFL	Pearson Correlation	.510**	.493**	.526**	.423**	.002	1	.533**	.603**	.457**	.113*	.372**	.406**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.962		<.001	<.001	<.001	.027	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
PEOU	Pearson Correlation	.523**	.459**	.505**	.486**	-.026	.533**	1	.598**	.485**	.036	.358**	.371**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.611	<.001		<.001	<.001	.486	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
PU	Pearson Correlation	.563**	.496**	.647**	.564**	-.121*	.603**	.598**	1	.493**	.065	.508**	.513**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.018	<.001	<.001		<.001	.205	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
AFD	Pearson Correlation	.487**	.426**	.441**	.395**	.005	.457**	.485**	.493**	1	.136**	.282**	.352**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.923	<.001	<.001	<.001		.007	<.001	<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
PR	Pearson Correlation	.146**	.093	.092	.053	.488**	.113*	.036	.065	.136**	1	.132**	.139**
	Sig. (2-tailed)	.004	.068	.071	.296	<.001	.027	.486	.205	.007		.009	.006
	N	387	387	387	387	387	387	387	387	387	387	387	387

DFS	Pearson Correlation	.395**	.446**	.436**	.377**	.047	.372**	.358**	.508**	.282**	.132**	1	.518**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.356	<.001	<.001	<.001	<.001	.009		<.001
	N	387	387	387	387	387	387	387	387	387	387	387	387
FIU	Pearson Correlation	.430**	.443**	.448**	.467**	-.004	.406**	.371**	.513**	.352**	.139**	.518**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	.933	<.001	<.001	<.001	<.001	.006	<.001	
	N	387	387	387	387	387	387	387	387	387	387	387	387

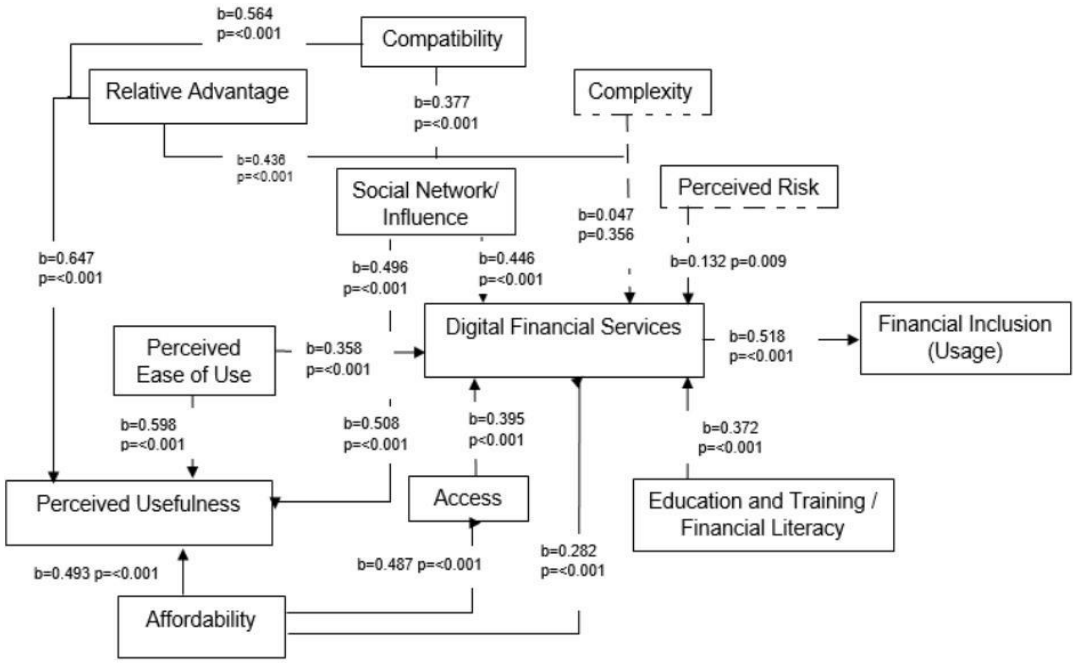
**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The result of the correlation analysis shows all positive figures (see Table 4.3.1b above). Thissuggests that there is a positive and significant relationship between low-income household attitude to the use of DFS for financial inclusion and its determinant variables and therefore reject all null hypotheses accepting the alternative as they are within the acceptable benchmarkof <0.001, <0.01 and <0.05 except for the path between complexity (CMX) and DFS in H3 with perceived risk (PR) and DFS.

Although a non-significant relationship exists in H3c because it is higher than 0.05% level (p = 0.356, r=0.047), the null hypothesis cannot be rejected because there is no statistical evidencethat the differences among low-income households adopting DFS for financial inclusion is notdue to chance. Another is the path between perceived risk (PR) and DFS which reveals a surprising positive significance (0.009 at 0.01 level) as against the predicted negative outcomewith a relatively low strength (r = 0.132, COD = 1.74%) among variables, the null hypothesisis accepted as against the alternate because perceived risk usually affect the adoption of DFS for financial inclusion.

Figure 2. Result of the Regression Analyses on the tested Model



Where

-------- Represent significant variable

-------- Represent non-significant variable

5.0 CONCLUSION & RECOMMENDATION

This study has shed light on the potential factors influencing users' adoption of DFS for financial inclusion (FI). The outcomes of statistical analysis underscore that the factorsassessing users' inclination toward adopting digital financial services for enhancing financial inclusion have a notable impact on actual mobile technology usage.

The findings of this research distinctly indicate that prospective users within Kiyawa LGA of Jigawa state in Northwest Nigeria are more likely to embrace a digital financial services system when it demonstrates relative advantage, affordability, accessibility, compatibility, usefulness, convenience, ease of use devoid of complexity, and minimal associated risk. Nonetheless, future investigations could delve into the influence of contextual aspects such as cultural norms, regulatory conditions, religious beliefs, and social networks on the substantial adoptionof DFS among low-income households (Jack & Suri, 2014; Kusuma & Rosidin, 2019; Arotile, 2022; Ozili et al., 2022). Additional areas that warrant exploration encompass the long-term impact, particularly for designing effective interventions (Suri & Jack, 2016; Cull et al., 2012),gender and social inclusion, encompassing marginalized groups like people with disabilities, rural communities, refugees, and women (Duflo et al., 2015; World Bank, 2017). Addressing measurement and evaluation metrics is crucial due to the lack of consensus on key indicators and methodologies, which hinders cross-study and cross-regional comparisons (Demirgüç- Kunt et al., 2015; Christensen et al., 2019).

Further avenues of inquiry involve digital literacy and financial education, ethical considerations, and policy and regulatory frameworks concerning low-income households (Van et al., 2011; Klapper et al., 2013; World Bank, 2014; Mersland & Strøm, 2015; Rask, 2017; Adeoti, 2018). Addressing these gaps in the existing literature will contribute to a morecomprehensive and robust comprehension of DFS's effectiveness in promoting financialinclusion among low-income households. This, in turn, will inform policy decisions and guidethe formulation and implementation of interventions within this domain.

Conflict of Interest Disclosure Statement

I have nothing to disclose.

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