

Artificial Intelligence, Cybersecurity and Digital Financial Inclusion: a Theoretical Framework for Inclusive Financial Development

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ABSTRACT

Artificial intelligence (AI) has emerged as a transformative technology that is reshaping digital financial services by transforming how financial products and services are delivered, accessed and managed. Although previous studies have extensively examined AI-enabled applications, digital financial inclusion and cybersecurity but limited attention has been given to their integration with a comprehensive theoretical framework. The study develops a conceptual framework for explaining how AI-enabled financial technologies can contribute to inclusive financial development along with addressing cybersecurity and governance challenges. A Systematic literature review was undertaken using peer reviewed studies from scopus, web of science and ScienceDirect, together with reports from international financial and regulatory institutions published between 2015 to 2026. The selected studies were analysed using a thematic approach to identify three key dimensions related to AI application, digital financial inclusion, cybersecurity and governance. The review indicates that AI technologies, such as automated credit assessment, machine learning, predictive analytics, fraud detection systems, and intelligent customer support have significantly enhanced financial accessibility, operational efficiency and thereby expanding participation in formal financial services. At the same time, issues related to cybersecurity, data privacy, algorithmic bias, digital literacy gap and other regulatory challenges continue to constrain their effective adoption. Based on these findings, the study proposes the Artificial Intelligence Digital Financial Inclusion (AIDFI) Framework, which integrates AI applications, technological adoption, cybersecurity, digital financial inclusion and inclusive financial development within a single theoretical model. The framework contributes to the existing theoretical knowledge by indicating this dimension into a unified model and provides a foundation for future empirical study by informing policy initiatives aimed at strengthening secure, inclusive digital financial ecosystems.

Keywords: Artificial Intelligence; Digital Financial Inclusion; Cybersecurity; Inclusive Financial Development

1. INTRODUCTION

Financial inclusion has emerged as an important tool or mechanism of inclusive economic growth and sustainable development particularly in under development economies where a major proportion of the population are still excluded from formal financial system (Pal et al., 2025). Accessibility to effortless financial services include savings habits, credit facilities, insurance and payment facilities which is widely essential for poverty reduction, income generation and economic stability (Kumar & Jie, 2023). Regardless of substantial growth in expanding financial services many individuals are still dependent on informal financial mechanism due to geographical constraint, high transaction cost and inadequate infrastructural facilities which leads to limit the accessibility of formal financial facilities (Mignamissi et al., 2025). Consequently, financial accessibility and effective utilization of financial services remain a key

policy priority across both developed and developing economies.

The rapid growth of digital technology has significantly transformed the financial service landscape by creating new opportunities to address long standing difficulties to financial inclusion (Tay et al., 2022). Digital finance supported by effective governance mechanisms improves financial accessibility, reduces transaction costs, and enhances institutional efficiency, particularly for MSMEs and financially excluded populations (Saha et al., 2025). Among these technologies Artificial Intelligence (AI) has emerged as a most valuable and influential innovation which reshaped the services related to delivery, accessibility and efficiency of financial services (Aldasoro et al., 2025). AI driven applications such as automated credit scoring, machine learning based lending system, fraud detection mechanism, intelligent chatbots, personalised financial advisor services and risk predicting assessment model are highly demanded and been

integrated into financial ecosystem to enhance decision making and customer involvement (Raju, 2026). These technological capabilities are most effective when supported by robust IT governance, digital controls, cybersecurity mechanisms, and institutional oversight that ensure secure and trustworthy financial services (Saha et al., 2025). These innovations empowering the financial institutions to serve previously underserved populations more efficiently through reducing operational costs and by removing information asymmetries.

Despite these opportunities the integration of artificial intelligence with the financial system represents several difficulties in relation to cybersecurity vulnerability, data privacy, algorithmic bias, ethical decision approach and digital divide continue to influence the effectiveness of AI based financial services (Vuković et al., 2025). More the adoption of AI based financial services, continue to face several practical and real-time constraints due to digital literacy, internet connectivity and inadequate technological infrastructure, which reduce the ability of many individuals and enforcing to depends on traditional system, particularly in rural and underserved communities (Marak & Ayyagari, 2025). This challenge indicates that technological progress alone is insufficient to achieve inclusive financial development, so they should focus on strong regulatory framework, responsible AI governance and consumer protection measures to ensure the adoption of technological advancement and contribute to inclusive financial expansion (Papagiannis et al., 2025).

From a developmental standpoint the effectiveness of AI based financial services should be evaluated not based on accessibility but also in terms of how it is significantly associated with financial inclusion and long term economic sustainable growth (Akhtar et al., 2024). According to some recent studies on digital financial inclusion highlights enhancing financial stability, encouraging economic participation and supporting more broader developmental objectives (Tay et al., 2022). However limited understanding has been given to AI application, technological adoption and cybersecurity concerns which collectively affect digital financial inclusion and sustainable financial growth within a single theoretical framework.

Therefore, the present study examines the role of AI supporting digital financial inclusion and to identify the opportunities and risks related to cybersecurity challenges related to AI based services and proposing a theoretical framework that connects AI based application, technology adoption and digital financial inclusion which results in inclusive and sustainable financial development. This study also adds perspective from financial inclusion, digital technology, artificial intelligence and cybersecurity-based literature which offer insights to policy makers, financial institutions, Fintech companies and researchers looking for promoting inclusive and sustainable digital financial ecosystem.

Theoretical Background

Financial Intermediation Theory provides the fundamental theoretical foundation for AI enabled financial inclusion in advancing digital financial inclusion. The theory suggests that some institutions enable the efficient allocation of financial resources by reducing transaction

cost, mitigating information asymmetry and improving symmetry between with lenders and borrowers (Gyau et al., 2024). Traditionally, financial institution lending decisions are heavily depends on collateral requirements, formal credit histories and manual risk assessment limiting access to finance for individuals and small enterprises with limited financial records. The integration of AI into financial intermediation significantly altered this conventional approach. AI power credit scoring system, adoption of machine learning algorithms and alternative data sources which includes digital transaction, mobile phone usages, behavioural pattern and payment histories to assess more accurate creditworthiness of borrowers (Amato et al., 2024). Consequently, AI application has enhanced and improve efficiency and inclusiveness of evaluation and outreach the capability of institutions by enabling access to credit individuals and enterprise that often exclude from conventional banking systems and thereby strengthening digital financial inclusion and supporting broader objectives of sustainable financial development.

The Technology Acceptance Model (TAM) provide another important theoretical foundation for understanding the adoption of AI-enabled financial services (Fel et al., 2025). According to TAM, the intention of adopting a technology is primarily influenced by their perception of its usefulness and ease of use (Davis, 1989). Within the context of AI driven financial services, customers are more likely to adopt financial platforms which are efficient, reliable and personalised financial solution. Techniques like intelligent chatbots, automated customer support, AI based financial recommendation and predictive financial management system, improved the services, accessibility, reduce response time and enhance customer experience and thereby enhancing user to adopt digital financial platforms (Graham et al., 2025). Furthermore, the success of AI based financial services is based on trust in AI system, confidence in automatic decision-making and concern regarding privacy, transparency and security play critical factor in AI adoption, particularly when financial decisions are influenced by algorithmic system and automatic decision-making processes.

From an innovation perspective, the Diffusion of Innovation Theory explains how AI-enabled financial technology across individuals, organizations, and financial ecosystems (Rogers, 2003). The theory suggest that the diffusion of technology innovation depends on user perception of the relative advantage, compatibility with existing practice, complexity, trialability and observability. Financial application, including digital credit assessment, fraud deduction, system analysis, and automatic Customer support represent technological innovation that gradually influence by social acceptance, institutional supports and technological infrastructure and policy initiatives that have the potential to transform financial service delivery and improve digital financial inclusion (Iqbal et al., 2026). In many developing economies, supporting government policies in advancing financial digital infrastructure, accelerate the diffusion of AI-enabled financial services, financial accessibility, promoting wider participation, in formal financial system

and contribute with the expansion of AI driven financial inclusion across diverse social economic contexts (Basnayake et al., 2024).

The rapid growth of artificial intelligence has influence financial services and highlights relevance of institutional theory, which emphasis that digital practice are governance by regularly framework, governance structure and policy framework in shaping user behaviours and technological adoption (Kumari et al., 2022). AI based application has become an integral part which influencing lending decision, customer engagement, fraud detection and risk management are required to operate within the regulatory framework for the balance adoption technological innovation with transparency, accountability and ethical use of data (Clement & Colley, 2026). Regulatory institutions like Central Bank and other financial regulatory authorities can play a critical role in forming policies and developing governance framework that encourage responsible AI adoption with protection of consumer rights and ensuring financial stability, market integrity, and consumer confidence in adoption of AI based financial services (Falope, 2026).

Artificial intelligence has transformed the adoption of digital finance and its opportunities but with this

widespread adoption also significant concern about cybersecurity, ethical and governance challenges. AI powered financial system depends heavily on collection of personal and financial data which make them more vulnerable to cyberattacks, privacy violations, identity theft, algorithmic bias and unauthorised access to data (Ridzuan et al., 2024). These risk concern may weekend, customer confidence and reduce trust in AI-driven financial services system, and disparities like digital literacy, internet connectivity, and technological infrastructural issues continue to limit the ability of many backward community's people to participate fully in digital financial ecosystem. which promote the concept of digital divide (Adel, 2024). Consequently, achieving inclusive financial inclusion requires and combine approach, which integrate technological innovation with strong cyber mechanism, responsible AI governance, ethical standard and effective regulatory framework, which ensure the secrecy, transparency and enhancing inclusive financial accessibility (Khalil & Ali, 2026).

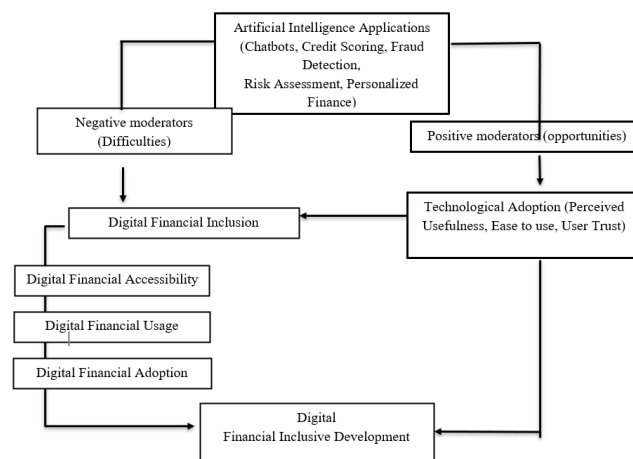


Figure: Artificial Intelligence– Digital Financial Inclusion Framework (source: Develop by the author).

The performance based on AI enable financial services is largely depends on the level of technological adoption among the users. According to Technology Acceptance Model (TAM), technological adoption is very much influenced by the perception of the usefulness and ease of use and trust among the user (Davis, 1989). Users are more likely to accept AI based financial services when they consider that such services or technologies are reliable, secure, safe and user friendly and these are benefit for managing their financial activities. Therefore, technological adoption act as a critical meditating factor which link AI application with digital financial inclusion. AI powered chatbots, personalised guidance, and predictive financial management system can improve user engagement and confidence, which leads to greater utilisation of digital financial services (Graham et al., 2025).

The framework also proposed that greater digital financial inclusion indicates financial accessibility, usage and adoption that contribute to inclusive and sustainable financial development. Better accessibility to financial services enables individuals, households and small enterprise to participate more actively in economic activities which improve financial stability and enhance their social economic conditions (Mwakalila & Muba, 2025). In addition, factors like innovation, operational efficiency, and personalised financial services can improve the relationship between AI based applications and digital financial inclusion. Furthermore, issues related to cybersecurity threats, data privacy, algorithmic matters, and unequal digital access and low digital literacy may reduce the effectiveness of AI based financial services and delay the overall objective of inclusive financial development (Xiao et al., 2024). Therefore, the framework explains the comprehensive mechanism of

how artificial intelligence can support digital financial inclusion while contributing to the broad objective of inclusive and sustainable financial development.

Research Gap

Despite several studies on artificial intelligence, digital financial inclusion and cybersecurity are increasing, but most have examined this area separately. Existing research highlights the role of AI driven technology in improving financial efficiency, credit assessment and expanding financial accessibility. While other studies focused on financial inclusion and cyber security risk within digital financial ecosystem. However, limited attention has been given to their combine relationship within a single framework. The role of technological adoption, cybersecurity risks, data privacy, digital literacy, and user trust remain insufficiently under-explored. Therefore, a comprehensive framework is needed to examine how AI driven financial technologies can promote digital financial inclusion and ensuring cybersecurity resilience and support inclusive and sustainable financial development which will also provide guidance for AI governance in the evolving digital financial landscape.

METHODS AND MATERIALS

The study adopts a systematic literature review to analyse the existing knowledge on the contribution of Artificial Intelligence, Digital Financial Inclusion and Inclusive Financial Development. The review was drawn from International recognised database, which includes Scopus, ScienceDirect and Web of Science along with report published by World Bank, Reserve Bank of India and other regulatory institutions. The study was guided by predefined inclusive criteria to ensure reliability and quality and focused on peer-reviewed studies published between 2015 and 2026 topics related to Artificial Intelligence, FinTech, Digital Financial Inclusion, Cybersecurity, Technological Adoption, and Inclusive Sustainable Financial Development.

A Thematic analysis was undertaken to interpret the selected literature in accordance with the objective of the study. The literature were systematically organised into three majors' dimensions. Firstly, the role of AI application in enhancing digital financial accessibility, usages and adoption. Secondly, opportunities and cybersecurity challenges associated with AI based financial services and thirdly, policy and governance measures required for promoting inclusive digital financial ecosystem. These insights derived from these thematic categories, provided the conceptual base for developing the Artificial Intelligence - Digital Financial Inclusion Framework (AIDFI), which explain the relationship among AI application, technological adoption, digital financial inclusion, cybersecurity consideration, and sustainable financial development.

DISCUSSION

The discussion is organized in accordance with the three objectives of the study and integrates insights from existing literature, theoretical perspectives, and policy discourse to explain the role of Artificial Intelligence (AI) in promoting digital financial inclusion.

1. Role of Artificial Intelligence in Promoting Digital Financial Inclusion.

The existing literature suggests that Artificial Intelligence as emerged as a transformative important role in expanding digital financial inclusion by enhancing accessibility, efficiency and personalisation of financial services. AI driven applications such as automated credit scoring, machine learning based lending system, intelligent chatbots, predictive analysis and personalised financial advisory services system have significantly transformed the ability of financial institution to serve the undeserved and financial excluded population more effectively. This technology facilitates faster decision-making, improve operational efficiency and support the provision of tailoring product to diverse need of customer. Unlike traditional financial system rely heavily on collateral and formal credit histories but AI powered credit assessment models leverage alternative data source which includes transaction records, mobile phone usages, payment behaviours and other behaviours which helps to evaluate borrower's creditworthiness more accurately and efficiently (Essien et al., 2019).

The findings further indicate that AI enhanced the efficiency of financial services by reducing information asymmetry and lowering transactional cost and improving the speed and accuracy financial decision making. AI powered chatbots and virtual assistant improving customers engagement by offering real time assistant, personalised financial guidance and continuous support by improving the overall user experience and fostering trust in digital financial platforms (Ledro et al., 2025). In addition, predictive analytics enable financial institutions to better understand the consumers behaviour and their financial needs which helps in delivering customised financial product and services which enhance both accessibility and effective utilisation of digital financial services. These findings also reinforce the growing evidence that technological innovation specifically AI based financial technology plays a positive role in expanding digital financial inclusion and promoting more participation in formal financial system (Islam et al., 2026).

2. Opportunities and Cybersecurity Challenges of AI-Enabled Financial Services.

The study identifies that the integration of AI into financial services have improved operational efficiency by automating routine processes, reducing administrative cost, enhancing risk assessment and supporting the accessible delivery of financial services. Machine learning algorithms future benefiting the lending decision by analysing large and diverse datasets and enabling financial institutions to identify complex pattern and assess creditworthiness more accurately and evaluating them. Moreover, AI driven innovation facilities expand the outreach of financial institutions by improving access to credit and other financial services for individuals and micro-enterprises that have traditionally faced barriers to formal financial services. This technological improvement not only improved the efficiency of financial intermediation but also contribute largely to accelerate the financial accessibility and inclusion by

enabling more responsive, data-driven and customer-centric financial service delivery (Avickson & Ogunola, 2024).

Despite these advantages, the findings also highlight several cybersecurity, ethical and governance challenges which limit the effectiveness of AI enabled financial services. As financial institution relies heavily on digital datasets and automatic decision-making concern regarding cybersecurity, data breaching, identify theft, digital financial fraud, and unauthorized access to sensitive information have become a propounding (Shpachuk et al., 2026). In addition, issues such as algorithmic bias, lack of transparency, and data privacy and the protection of consumer rights, which may underline user trust and willingness to adopt AI enabled financial services (Balasubramaniam et al., 2023). The persistence of digital divide further, characterised by inadequate digital literacy, limited internet connectivity, and in efficient technological infrastructure. Further restrict the benefit of AI driven financial inclusion, marginalised population (Vesna et al., 2025). These findings also suggest that technology advancement alone is insufficient to achieve inclusive development unless a strong complimentary investment in digital infrastructures, robust cybersecurity frameworks, responsible AI governance, regulatory oversight and initiative that strengthen digital literacy and consumer trust.

3. Measures to Strengthen AI-Driven Financial Services for Financial Inclusion Development.

The study further emphasis on adoption of a compressive policy and governance framework to maximise the benefit of AI enable services while effectively addressing to minimise the associates' risks. Establishing cybersecurity infrastructure, data protection mechanism and promoting responsible AI governance are critical for ensuring transparency, accountability and public trust within digital financial ecosystem. Regulator institutions including Central Bank and other financial authorised agencies should play a wider role in developing a clear supporting guideline for the ethical use of AI, algorithmic transparency, consumer protection, and data privacy which ensure inclusive and sustainable financial development (Mohammed, 2026).

The effective adoption of AI enabled financial services are consistently dependent on digital literacy and financial education, which act as a key factor. Strengthening users, digital capabilities and technological awareness can improve their understandability, trust and encourage them in great participation in digital financial adaptability. However, the benefit of AI based financial innovation cannot be fully realised without adequate digital infrastructural development. In many rural and under

develop region due to limited internet connectivity and inappropriate technological facilities continue to limit the accessibility of digital financial services and thereby exist inequalities digital financial inclusion. Addressing these structural constraints, there should be sustained investment in internet connectivity, digital infrastructure and innovative technological ecosystem which will expand the reach of AI based financial solution and reduce the digital divide which will promote more inclusive participation in formal digital financial inclusion.

Finally, for encouraging and secure inclusive digital system government, financial institution, FinTech firms, other technological regulatory authorities and their collaboration can enhance the governance and strengthen AI governance framework by improving cybersecurity resilience, promote regulatory harmonisation and encouraging innovation which save that consumer interest and data privacy. Such coordination also enhances public trust, improve digital infrastructure and support the responsible adoption of AI based financial services across diverse social economic region. Overall, the findings indicates that Artificial Intelligence has potential to transform digital financial inclusion by expanding the accessibility, efficiency and personalisation of financial services. However, these benefits require a balance policy approach that collaboratively integrate technological innovation with cybersecurity and ethical AI governance, digital literacy and effective regulatory framework to ensure long-term inclusive and financial accessibility.

CONCLUSION AND FUTURE RESEARCH

Future study may focus on identifying and examining the long-term social economic impact of AI based digital financial inclusion, and its long-term social economic impact, particularly in relation to poverty reduction, income generation, entrepreneurship development, and financial resilience among marginalised community overtime. Future work can be extended the current knowledge by exploring the factors that shape the adoption and effectiveness of AI based technology, institutional, social, economic and demographic groups. Further research can also be warranted on application of emerging technology, including generative AI, Blockchain advance predictive analytics, transforming financial services result in expanding digital financial. Additionally, greater attention is required to understand the issues related to algorithmic fairness, transparency and ethical AI governance, cybersecurity resilience, consumer trust, and behavioural response to AI based financial adoption. Addressing these issues contribute to the development of secure transparent and digital system, which provide valuable insight to policy makers, financial institutions and technology developers.

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