

FinTech Development and Its Role in Financial Inclusion: The Enabling Role of Artificial Intelligence in Digital Financial Services

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ABSTRACT

FinTech helps those who are excluded from official financial services. However, due to the lack of information for everyone, high transaction cost and different needs of users, there are still problems. This hinders real inclusion. This study focuses on how artificial intelligence (AI) can change digital financial services (DFS) to improve financial inclusion. It uses the ideas of information economics, transaction cost theory and long tail theory. Artificial intelligence technologies-such as machine learning for credit rating, personalized natural language processing, and predictive analysis for managing risks before they arrive-allow the transformation from standard, response and manual models to predictable, intelligent and automated personalized systems. Specific cases such as intelligent risk control, intelligent marketing (providing targeted microfinance) and improving customer experience show that access and efficiency are improving. However, algorithm deviation, data privacy risk, digital skill gap and rule lag all bring major problems. These problems may duplicate or aggravate exclusion. Looking ahead, the focus will be on ethical rules, transparency, links with existing digital tools, and good governance. According to the analysis, if we pay attention to fairness, transparency and artificial control, artificial intelligence financial technology can really help everyone get financial services more easily. This will also help to achieve the goal of sustainable development.

Keywords: Artificial Intelligence; Fintech; Financial Inclusion; Digital Financial Services; Alternative Data; Credit Scoring; Algorithmic Bias; Transaction Cost Reduction

1. INTRODUCTION

About 1.4 billion adults around the world have no bank accounts or little access to banking services. Most people live in low-income and middle-income countries, where ordinary banks find it too expensive to provide services to remote customers who have no official credit or guarantee^[1]. These problems are typical market failures: the huge difference in information leads to problems such as adverse selection and moral hazard, the cost is too high, small transactions cannot be profitable, and products are made for “normal” customers, not long queues for different customers who make money in an irregular way^[5].

FinTech’s innovations, especially mobile money and digital platforms, have helped to reduce some problems, require less physical infrastructure, and allow fast and cheap transactions, but to go beyond the first visit and achieve regular use and diversified products, more advanced information processing and management operations are needed. The machine learning model based on surrogate data training is helpful to better evaluate the risk of people without credit history. Natural language processing creates custom interfaces. The prediction system has changed from the service of waiting for problems to the service of predicting problems^[2].

Based on information economics, transaction cost theory and long tail theory, this review analyzes the transformation path, application and limitations of AI-enhanced DFS. It uses empirical and conceptual evidence, and until 2023, it maintains a good balance between the benefits shown and the unresolved risks. The discussion is based on the theoretical basis, four interrelated transformation paths, three main application fields, and the challenges and prospects for the future^[3].

2. THE THEORETICAL FOUNDATION OF ARTIFICIAL INTELLIGENCE AND DIGITAL FINANCIAL SERVICES

2.1 The Connotation and Characteristics of Digital Financial Services

Digital financial services refer to payment, savings, loans, insurance and remittance by using digital tools such as telephone applications, USSD, proxy network and application programming interface (API). These services are usually placed on non-financial platforms, which makes them special. When you have many new customers, the cost of each new customer is almost zero. They create and use data in real time, they let people meet through the platform, and they change traditional channels by deleting or adding middlemen.

From the perspective of transaction cost, DFS greatly reduces the cost of finding, negotiating, signing contracts and enforcing rules, which previously prevented the poor or people far away from the city from using these services. Through digital authentication, e-KYC and automatic settlement, we have replaced the tedious paper work. Information economics tells us that

the digital trace of the transaction creates a signal that the official lender did not have before, which helps to avoid wrong choices. All this is consistent with the idea of long-term economics: once you pay the fixed cost of creating a platform, you can serve millions of infrequent small transactions, and the market becomes larger than ordinary customers ^[4,6].

2.2 The Theoretical Logic of Artificial Intelligence Empowering Financial Services

Artificial intelligence (AI) helps DFS to work better. It can recognize patterns, make predictions, and automate things with unstructured data or data from other places. Through supervised learning, we can better evaluate the credit risk of people without normal documents. Using unsupervised learning, we can find behavior groups that are invisible to regular systems. Using natural language processing, you can provide personalized advice for almost anything.

In the information economy, artificial intelligence greatly reduces asymmetric information. It turns things that people can't see or observe at high cost (such as fluctuations in capital flows or signs of social capital) into usable risk signals. This reduces the adverse selection of loans and insurance. Transaction cost theory is developing, because artificial intelligence replaces expensive human judgment and manual monitoring with learning calculations and models, making small-scale finance cheaper. When artificial intelligence allows very different products (such as variable refund plans or use-based insurance) to suit everyone, long-term theory becomes possible, even if it is too expensive to make them by hand.

A new idea put forward here is that artificial intelligence is changing intermediaries: we are not signing contracts between two people who need a lot of relationships, but coordinating with many parties. By coordinating data, risks and funds among ecosystem partners, artificial intelligence can solve the coordination cost that pure market or hierarchical solutions could not solve before, so it can include more agents ^[1].

3. THE TRANSFORMATION PATH OF DIGITAL FINANCIAL SERVICES MODE DRIVEN BY ARTIFICIAL INTELLIGENCE

3.1 Transition from Standardized Services to Personalized Services

Traditional DFS often copies products for everyone, with little customization. Artificial intelligence can achieve super personalization through behavior embedding, collaborative filtering and machine learning models, which can dynamically change product parameters. Special artificial intelligence technology includes neural network and method set for separating users and creating quotations.

A concrete example is the machine learning credit platform, which provides personal loans based on mobile metadata and transaction patterns, rather than fixed scores. In India, microfinance institutions have created a model to see whether someone can repay the loan through social media and public utility payment, and provide loans to people who have never had loans before ^[1].

A new idea in this framework is that personalization constructs a portable "financial identity" from behavioral data. These identities are credible signals for other participants in the ecosystem, further reducing the cost of future transactions and expanding the long-term opportunity set. The risk is that models based mainly on observing people may wrongly classify the most vulnerable people; Therefore, it is necessary to carry out fair cognition training and continuous audit.

3.2 Transition from Passive Response to Active Prediction

The old model responds to customer requests or events. Artificial intelligence provides active forecasting through time series forecasting, causal machine learning and multimodal models, which can predict liquidity demand or default risk before they occur. Specific artificial intelligence technology includes decision tree, set method and neural network to make prediction model.

In the context of agricultural loans and micro-credit, the forecasting model using surrogate data is helpful to bid actively. A financial technology company in Kenya has created a credit scoring model, which analyzes the usage habits of mobile phones (the frequency of calling and texting, the use of applications, and mobile money transactions) in order to provide small loans to people without official credit records ^[1]. This predictive change makes the logic of transaction cost bigger, because it makes the previously unseen state part affordable, and it helps to include more people by avoiding the exclusion spiral. The limitation is that the model drifts in an unstable environment. Reliable testing and human supervision are still very important.

3.3 Transition from Manual Driving to Intelligent Driving

Artificial intelligence can automatically perform complex tasks that require a lot of judgment-insufficient writing, compliance monitoring and login-which frees human experts to do more important things. Specific AI technologies include machine learning algorithms for automatic decision-making and natural language processing for processing documents.

The real example is the AI system, which helps to log in remotely faster and better. In the Philippines, using mobile phone data in artificial intelligence model improves the accuracy of credit score by 20% compared with traditional methods ^[1]. The new idea here is the emergence of "hybrid intelligent intermediary", in which AI magnifies human judgment, rather than replacing it, while retaining remedies. If you use too many automatic systems without enough explanations, you may lose confidence.

3.4 Transition from Single Scenarios to Ecological Integration

Finance is increasingly entering a larger economic track. AI provides an orchestration layer to dynamically match and group things among partners. Special artificial intelligence technology includes machine learning suite to distribute risks among platforms.

Examples include the first integration of financial tests, and artificial intelligence to assess credit risk in real time when needed. By expanding the transaction cost and the idea of long-term lag, ecological integration reduces the coordination cost between all parties. The main risks include platform centralization and interoperability issues, which may create new exclusive guardians. Therefore, open standards and anti-competitive protection are essential to achieve inclusive results ^[2].

4. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN DIGITAL FINANCIAL SERVICES

4.1 Application in Intelligent Risk Control

Intelligent risk control is the most important application of inclusiveness, because traditional guarantee and credit record requirements systematically exclude most micro-entrepreneurs and low-income families. The AI model based on surrogate data obviously expands the accessibility of credit. Specific AI technologies include machine learning algorithm, neural network, decision tree and method set ^[7,8].

Experience deployment shows benefits. In Kenya, the defect rate of AI-based model is reduced by 85%, while the defect rate of traditional model is 65%. In India, credit scoring based on artificial intelligence has increased the approval rate of microfinance by 30%. In Mexico, the adoption of psychometric tests in the AI framework has increased the loan approval rate of people without credit scores by 15% ^[1].

Nevertheless, opacity, agency discrimination and feedback loop are still major problems. Mitigation strategies-fair restraint, periodic audit and humanized loop review-are considered to be the key to responsible expansion ^[3].

4.2 Application in Intelligent Marketing

Low popularity and product complexity are non-price obstacles that intelligent marketing can solve. Speculative models and machine learning determine which users are most likely to benefit from certain products. The specific AI technology includes positioning method set and decision tree.

Targeted offers based on alternative data increase both adoption and usage intensity. Such marketing increases depth of inclusion while building experiential trust. The counter-risk is aggressive design that induces over-indebtedness. Ethical guardrails and transparent value propositions are required ^[1].

4.3 Application in Intelligent Customer Service and User Experience Optimization

Trust depends heavily on service quality. Conversational AI and natural language processing provide scalable, low-cost support and plain-language explanations. Specific AI technologies include machine learning for sentiment analysis and natural language processing for query handling.

Early deployments of AI-assisted interfaces improved consistency for first-time users. Limitations include potential bias in training data and lack of empathy in complex cases. Hybrid architectures with clear escalation paths are essential safeguards ^[2].

5. CHALLENGES AND PROSPECTS OF ARTIFICIAL INTELLIGENCE EMPOWERING DIGITAL FINANCIAL SERVICES

5.1 Current Main Challenges

AI deployment in DFS faces interrelated challenges. Algorithmic bias arising from skewed training data can reproduce discrimination. The problem of data privacy and consent is very strong with surrogate data. The gap in digital culture means that the most excluded people may be the least able to participate in artificial intelligence decision-making. Rules and laws lag behind, resulting in uncertainty of responsibility and interpretation. The initial high cost can be added as a cost, making things less affordable ^[1,4].

In short, these risks mean that exclusion can be replicated in new forms.

5.2 Prospects for Future Development Trends

The promising trajectory focuses on technology and governance until 2023. An ethical framework that emphasizes transparency, fairness and accountability can reduce prejudice. The progress of interpretable artificial intelligence and periodic audit can meet the requirements of the rules. Integration with the existing digital public infrastructure provides a way for trusted identity, thus reducing the coordination cost. It will be very important to track the impact measurement framework of welfare and institutional results.

An original idea in the future is that the responsible integration of AI and verifiable data infrastructure can create portable evidence of financial behavior, thus unlocking services between different providers and completely changing the service economy. In order to realize this potential, sustainable multi-stakeholder governance is needed^[3].

6. CONCLUSION

Artificial intelligence (AI) is changing the operation of digital financial services and the way to make money. It really helps people to get financial services. By using different data to better understand people, make things cheaper and even provide personalized services for small customers, AI makes financial services bigger and deeper. By 2023, we have seen emerging countries make tangible progress in risk management, marketing and customer experience.

These benefits do not appear alone, and there are risks. Algorithm bias, privacy issues, lack of knowledge and poor rules can still exclude people. To do this, you must make a deliberate choice: use the fairness model (fairness perception modeling), give people the opportunity to question the decision (transparent litigation), and keep artificial control (human supervision), all of which are in the adaptive rules. When all this is in place, FinTech with AI will become a powerful tool to build a fairer and more inclusive financial system. Research and inclusive policy experiments that will last until 2023 will prove whether we can really use all these on a large scale.

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