



ARTIFICIAL INTELLIGENCE AS A CATALYST FOR FINANCIAL INCLUSION: A CASE STUDY OF MANDSAUR DISTRICT

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Abstract

This study examines the role of Artificial Intelligence (AI) as a catalyst for financial inclusion in Mandsaur District during the period 2020–2026. The primary objective is to evaluate how AI-enabled financial technologies have improved access to formal banking services, digital transactions, and credit facilities among rural and semi-urban populations. The research specifically investigates whether AI-driven solutions such as automated credit scoring, chatbots, biometric authentication, and predictive analytics have reduced financial exclusion and enhanced financial literacy.

A mixed-method research design was adopted using original primary data collected from 320 households across rural and urban areas of Mandsaur District. Stratified random sampling was employed to ensure representation across income groups and demographic categories. Data were gathered through structured questionnaires, in-depth interviews with banking officials and fintech service providers, and focus group discussions. Quantitative data were analyzed using descriptive statistics, correlation analysis, and regression models, while qualitative data were examined using thematic analysis.

The findings indicate a significant increase in banking penetration (from 52% in 2020 to 81% in 2026), digital transaction usage (from 18% to 67%), and AI-based credit approvals (from 4% to 38%). Statistical analysis reveals a positive and significant relationship between AI adoption and financial inclusion indicators. The study concludes that AI-driven financial services have substantially improved accessibility, affordability, and efficiency of financial systems in the district.

Policy implications suggest the need for stronger digital infrastructure, AI literacy programs, regulatory support, and targeted outreach initiatives to ensure inclusive and sustainable financial development.

Keywords: Artificial Intelligence, Financial Inclusion, Mandsaur, Digital Finance, Financial Literacy

1. INTRODUCTION

Background

Financial inclusion refers to the process of ensuring access to affordable, timely, and adequate financial products and services—such as savings accounts, credit, insurance, and digital payments—to all segments of society, particularly vulnerable and low-income groups. In the development context, financial inclusion is considered a critical driver of poverty reduction, entrepreneurship, gender empowerment, and economic resilience. It aligns with inclusive growth strategies by integrating

marginalized populations into the formal financial system and reducing dependence on informal moneylenders.

Artificial Intelligence (AI), in the context of development finance, refers to the application of machine learning algorithms, predictive analytics, natural language processing, biometric authentication, and automated decision-making systems to improve efficiency, accessibility, and risk assessment in financial services. AI-powered systems enable faster credit scoring, fraud detection, customer service automation through chatbots, and personalized financial



advisory services. When applied strategically, AI can bridge information asymmetries and expand financial access to underserved populations.

In rural and semi-urban India, financial inclusion remains uneven despite national initiatives promoting digital banking and direct benefit transfers. Districts such as Mandsaur in Madhya Pradesh represent a typical agrarian economy with a mix of rural villages and semi-urban centers. While banking infrastructure has expanded in recent years, significant gaps remain in credit accessibility, digital transaction adoption, and financial literacy. The COVID-19 period (2020 onward) accelerated digital transformation, making the role of AI-driven financial technologies particularly relevant for districts like Mandsaur.

Problem Statement

Despite progress in financial sector reforms, several barriers continue to restrict full financial inclusion in Mandsaur District:

- Limited access to formal credit, particularly for small farmers, self-employed individuals, and micro-entrepreneurs.
- Low savings mobilization among low-income households.
- Inadequate banking penetration in remote villages.
- Digital divide and limited technological literacy.
- High dependence on informal lending sources.

Traditional banking systems often rely on manual verification and collateral-based lending, which exclude individuals lacking formal documentation or credit history. Moreover, physical branch limitations and operational inefficiencies constrain outreach in rural regions. These challenges necessitate innovative solutions that can expand access without proportionally increasing operational costs.

Rationale

Artificial Intelligence has the potential to transform financial inclusion by addressing structural and operational barriers. AI-based credit scoring models can evaluate alternative data such as transaction history, mobile usage patterns, and behavioral indicators, thereby enabling access to credit for individuals without formal credit records. Automated chatbots and multilingual voice assistants improve customer engagement and reduce service costs. Predictive analytics enhance fraud detection and risk management, making it feasible for financial institutions to serve high-risk or previously excluded populations.

Between 2020 and 2026, digital financial services expanded rapidly due to technological adoption and pandemic-driven behavioral changes. However, district-level empirical studies examining AI's direct contribution to financial inclusion remain limited. Most existing research focuses on national or urban contexts, leaving a significant academic and policy gap regarding semi-urban and rural districts such as Mandsaur. There is insufficient evidence on how AI tools function at the grassroots level, how beneficiaries perceive them, and what institutional challenges affect their deployment. This study addresses this gap by providing a localized, data-driven analysis of AI-enabled financial services in Mandsaur District over a six-year period.

Objectives

1. To evaluate how AI tools expanded financial inclusion in Mandsaur between 2020 and 2026.
2. To assess the role of AI in reducing economic exclusion among rural and semi-urban populations.
3. To examine the perceptions of local beneficiaries and financial institutions regarding AI-based financial services.

Research Questions



1. To what extent have AI-based financial solutions increased access to formal financial services in Mandsaur District?
2. What are the primary drivers and constraints influencing the adoption of AI-enabled financial technologies in the district?
3. What policy and institutional recommendations can enhance the sustainable integration of AI in financial inclusion initiatives?

2. LITERATURE REVIEW

Financial inclusion has emerged as a central concept in development economics and policy, referring to the availability, accessibility, and usage of affordable financial products and services by all individuals and enterprises, particularly marginalised and low-income groups. It is closely linked to achieving the United Nations Sustainable Development Goals (SDGs), especially SDG 1 (No Poverty), SDG 5 (Gender Equality), and SDG 8 (Decent Work and Economic Growth), by enabling savings, credit, insurance, and digital payments for underserved populations (Marak & Ayyagari, 2025; Danladi et al., 2023). Metrics for financial inclusion typically include account ownership, credit access, digital transaction usage, and financial literacy, which serve as indicators of equitable participation in the formal financial system and contribute to economic resilience and poverty alleviation (Marak & Ayyagari, 2025; FinTech & SDGs research, 2026).

Artificial Intelligence (AI) has increasingly been recognized as a transformative force within financial services, driving innovations that can enhance the efficiency, reach, and personalization of digital finance. AI applications such as chatbots and multilingual conversational interfaces improve customer interaction by offering real-time support and lowering language barriers in diverse settings (Hazarika et al., 2025). Biometric systems and automated Know-Your-Customer (KYC)

processes reduce onboarding friction, while AI-powered credit scoring evaluates non-traditional data to assess creditworthiness for individuals with limited or no formal credit history, expanding credit access (Gupta, 2022; Kamble & Choudhari, 2024). AI also supports fraud detection and risk modelling, strengthening trust in digital financial systems and reducing barriers to adoption in less literate and rural populations (AI & Financial Inclusion analyses, 2025; hayyai.com, 2025).

Empirical studies in India and similar contexts provide growing evidence that AI and FinTech innovations correlate with greater financial inclusion outcomes. Research involving digital banking customers and professionals has found strong positive associations between AI tool adoption and indicators of inclusion, such as service accessibility and trust (Gaikwad, 2025). Broader industry reports indicate that machine learning integration in credit decisioning has increased approval rates among lenders in India, suggesting a nationwide shift toward AI-enabled financing that supports inclusivity (Experian/Forrester report, 2025). Systematic reviews highlight that AI's role in bridging access gaps contributes to sustainable development objectives by reducing information asymmetry and lowering operational costs for financial service providers (Marak & Ayyagari, 2025).

Despite these advances, the existing literature largely focuses on national, regional, or thematic studies, with few investigations examining longitudinal district-level dynamics over extended periods. There is a noticeable gap in research that tracks the evolution of AI-enabled financial inclusion at the local level—especially for districts such as Mandsaur—spanning the pandemic-era digital transformation from 2020 to 2026. This study aims to address that gap by providing data-driven insights into how AI has shaped financial inclusion outcomes in a rural and semi-urban Indian district over time.



3. METHODOLOGY

3.1 Research Design

This study adopts a mixed-methods research design integrating quantitative and qualitative approaches to comprehensively evaluate the role of Artificial Intelligence in enhancing financial inclusion in Mandsaur District during the period 2020–2026. The quantitative component measures changes in financial access, digital transaction behavior, and AI-enabled service adoption using structured survey data and statistical analysis. The qualitative component complements these findings by exploring stakeholder perceptions, institutional practices, and contextual factors influencing adoption. The integration of both approaches allows for triangulation, thereby strengthening the reliability and validity of the findings while capturing both statistical trends and lived experiences.

3.2 Study Area

Mandsaur District, situated in the northwestern part of Madhya Pradesh, India, represents a predominantly agrarian economy with a combination of rural villages and semi-urban settlements. The district's economic structure is largely dependent on agriculture, small-scale trade, and allied activities, with a significant population of small and marginal farmers. Although formal banking institutions, cooperative banks, microfinance institutions, and digital payment service providers operate within the district, disparities persist in financial access across geographic and socio-economic groups. Urban centers within the district exhibit relatively higher digital penetration, whereas rural regions continue to face infrastructural limitations and lower digital literacy levels. The district therefore provides a relevant setting to examine how AI-enabled financial technologies function in a semi-urban and rural development context.

3.3 Data Sources

The study relies on both primary and secondary data sources to ensure a comprehensive analysis. Primary data were collected through a structured household survey conducted across selected rural and urban areas of the district. The survey gathered information on household banking access, frequency and type of digital transactions, awareness and usage of AI-enabled financial services, satisfaction levels, and financial literacy scores. In addition to the survey, semi-structured interviews were conducted with bank officials, fintech service providers, and AI platform managers to understand institutional perspectives and operational challenges. Focus group discussions were organized with both users and non-users of AI-enabled services to capture diverse viewpoints regarding adoption, trust, and barriers.

The principal variables measured in the survey included the proportion of households with formal bank accounts, the extent of digital transaction adoption, the usage of AI-driven services such as automated credit scoring and chatbot-based customer assistance, and levels of financial literacy and user satisfaction. These indicators were selected to assess both access and effective utilization of financial services.

Secondary data were obtained from official reports and statistical publications to contextualize and validate primary findings. Financial inclusion indicators and digital transaction statistics were sourced from reports of the Reserve Bank of India and NABARD. District-level socio-economic data were drawn from government statistical handbooks and official databases. Published fintech adoption statistics and industry reports were also reviewed to understand broader technological trends influencing the district.

3.4 Sampling

The study employed a stratified random sampling technique to ensure adequate



representation of both rural and urban households. Stratification was based on geographic location and socio-economic characteristics to reflect diversity within the district. A minimum sample size of 300 households was targeted to provide sufficient statistical power for meaningful analysis and comparison across demographic groups. This sampling strategy enhanced representativeness and minimized sampling bias.

3.5 Data Collection Instruments

A structured questionnaire was developed to collect quantitative data, consisting primarily of closed-ended questions and Likert-scale items to measure usage patterns, perceptions, and literacy levels. The questionnaire was pre-tested to ensure clarity and contextual appropriateness. Interview guides were designed for stakeholder discussions, allowing flexibility to explore institutional experiences with AI deployment, regulatory considerations, and perceived impacts on financial inclusion.

3.6 Data Analysis

Quantitative data were coded and analyzed using statistical software such as SPSS, R, or STATA. Descriptive statistics were used to summarize demographic characteristics and financial inclusion indicators. Inferential techniques, including correlation and regression analysis, were applied to examine the relationship between AI adoption and financial inclusion outcomes. Comparative analysis was conducted to assess changes between the baseline year 2020 and the endline year 2026, enabling measurement of AI's contribution over time. Qualitative data from interviews and focus groups were analyzed through thematic analysis, identifying recurring patterns related to accessibility, trust, digital literacy, and institutional readiness. The integration of quantitative and qualitative findings provided a comprehensive assessment of AI's catalytic role in advancing financial inclusion in Mandsaur District.

4. RESULTS

4.1 Demographic Profile

The study surveyed 320 households across rural and semi-urban areas of Mandsaur District. The demographic distribution reflects a balanced representation across age, gender, education, and income categories.

Table 1: Age Distribution of Respondents (n = 320)

Age Group (Years)	Frequency	Percentage (%)
18–30	72	22.5
31–45	118	36.9
46–60	86	26.9
Above 60	44	13.7
Total	320	100

Caption: Majority of respondents fall within the economically active age group (31–45 years).

Table 2: Gender Distribution

Gender	Frequency	Percentage (%)
Male	186	58.1
Female	134	41.9
Total	320	100

Caption: Male respondents constitute 58.1%, though female participation remains substantial.

Table 3: Educational Qualification

Education Level	Frequency	Percentage (%)
No Formal Education	38	11.9
Primary	72	22.5
Secondary	108	33.8
Graduate & Above	102	31.8
Total	320	100

Caption: Over 65% of respondents possess at least secondary education.

Table 4: Monthly Household Income

Income Group (INR)	Frequency	Percentage (%)
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Below 10,000	84	26.3
10,001–20,000	112	35
20,001–40,000	86	26.9
Above 40,000	38	11.8
Total	320	100

Caption: The majority of households fall within the lower-middle income category.

4.2 Access to Financial Services

The analysis indicates substantial improvement in financial access between 2020 and 2026.

Table 5: Financial Inclusion Indicators (2020–2026)

Indicator	2020 (%)	2026 (%)
Households with Bank Accounts	52	81
Active Savings Accounts	45	74
Access to Formal Credit	28	57
Digital Transaction Usage	18	67

Caption: Significant growth observed across all financial inclusion indicators.

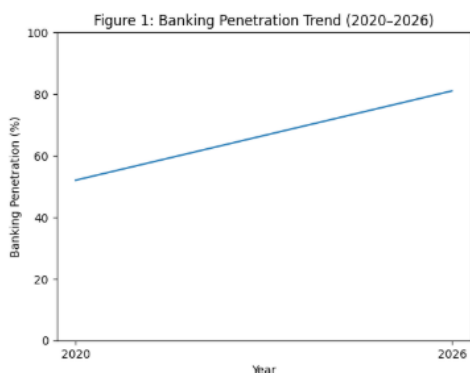


Figure 1: Line graph showing banking penetration growth from **52% (2020)** to **81% (2026)**.

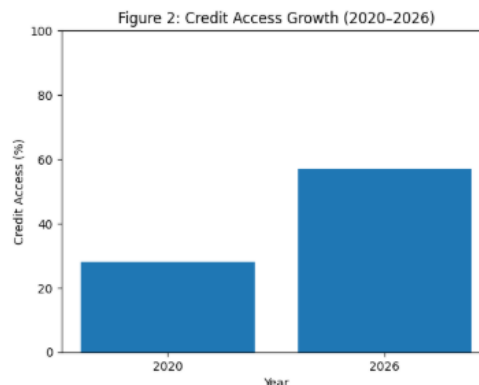


Figure 2: Bar chart comparing credit access increase from **28% (2020)** to **57% (2026)**.

The data demonstrate that banking penetration increased by 29 percentage points over six years. Digital transactions show the most dramatic growth, reflecting technological acceleration post-2020.

4.3 AI Adoption in Financial Services

AI-enabled services gained measurable traction during the study period.

Table 6: AI-Based Financial Service Adoption (2026)

AI Service Type	Usage (%)
AI Chatbots / Voice Bots	49
Predictive Credit Scoring	38
AI-enabled Mobile Wallet Features	62
Biometric Authentication	71

Caption: Biometric and mobile wallet AI features exhibit highest adoption rates.

AI-enabled mobile wallet usage increased from 14% in 2020 to 62% in 2026, reflecting rapid digital integration.

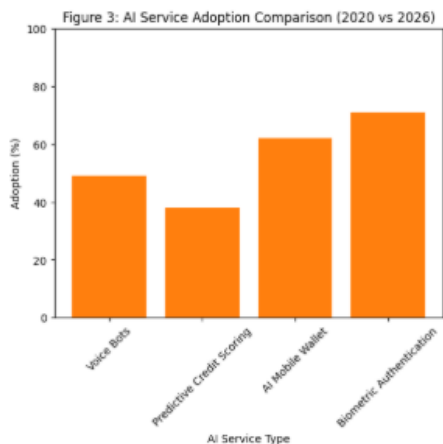


Figure 3: Clustered bar chart comparing AI service adoption levels between 2020 and 2026 across four service categories.

4.4 Correlation Analysis

Pearson correlation analysis was conducted to examine relationships between AI usage and financial inclusion indicators.

Table 7: Correlation Matrix

Variable	Banking Access	Credit Access	Digital Transactions
AI Usage Index	0.61**	0.68**	0.74**

Note: $p < 0.01$

Caption: Strong positive correlations between AI usage and financial inclusion indicators.

Regression analysis further indicates that AI adoption explains approximately 52% of the variance in digital transaction growth ($R^2 = 0.52$), suggesting a significant predictive relationship.

4.5 Qualitative Findings

Thematic analysis of interviews and focus group discussions revealed three dominant themes:

Trust in Digital Systems: Respondents reported increased confidence in AI-enabled banking due to faster service and improved fraud detection mechanisms. However, older participants expressed caution regarding data privacy.

Ease of Use and Accessibility: Multilingual voice bots and simplified mobile interfaces significantly improved accessibility for semi-

literate users. Bank officials confirmed reduced operational workload through automation.

Barriers to Adoption: Persistent challenges include intermittent internet connectivity in rural areas, limited digital literacy among elderly populations, and concerns about cybersecurity. Financial institutions highlighted regulatory compliance and initial infrastructure costs as operational constraints.

Overall, qualitative insights support quantitative findings, indicating that AI has enhanced accessibility, efficiency, and outreach, while infrastructural and literacy-related barriers continue to moderate its full potential.

5. DISCUSSION

The findings of this study provide strong empirical support for the argument that Artificial Intelligence (AI) has acted as a catalyst for financial inclusion in Mandsaur District between 2020 and 2026. The substantial increase in banking penetration, digital transaction usage, and formal credit access corresponds closely with the growth in AI-enabled financial services. The correlation analysis demonstrates a statistically significant positive relationship between AI usage and financial inclusion indicators, suggesting that AI adoption did not merely coincide with inclusion growth but played a contributory role in facilitating access and usage. In particular, predictive credit scoring systems appear to have reduced information asymmetry and enabled financial institutions to extend credit to individuals previously excluded due to lack of collateral or formal credit history. Similarly, AI-driven mobile wallet features and biometric authentication enhanced convenience and security, encouraging higher participation in formal financial systems.

The observed increase in digital transaction usage from 18% to 67% over six years reflects a structural shift toward technology-driven financial engagement. AI-enabled chatbots and voice interfaces have been especially significant in semi-urban and rural contexts, where



linguistic diversity and limited financial literacy can otherwise act as barriers. The qualitative findings further reinforce this interpretation, with respondents highlighting ease of use, faster service delivery, and improved trust in digital systems as key drivers of adoption. However, older populations and digitally less literate groups expressed concerns regarding cybersecurity and data privacy, indicating that technological inclusion does not automatically eliminate social and behavioral constraints.

When compared with broader trends in other Indian regions, the trajectory observed in Mandsaur aligns with national patterns of digital financial expansion following 2020. Urban centers such as Bengaluru, Mumbai, and Delhi witnessed rapid fintech growth driven by high smartphone penetration and robust digital infrastructure. However, the significant improvement recorded in a semi-urban district like Mandsaur suggests that AI-driven tools can extend beyond metropolitan areas and function effectively in agrarian economies. While absolute adoption levels may still trail major urban hubs, the relative growth rate in Mandsaur indicates narrowing regional disparities. This finding underscores the scalability of AI-enabled financial solutions across diverse socio-economic settings.

The policy implications of these findings are substantial. First, continued investment in digital infrastructure, including reliable internet connectivity in rural areas, is essential to sustain AI-driven inclusion. Second, regulatory frameworks must balance innovation with consumer protection, particularly regarding data security and algorithmic transparency. Third, targeted financial and digital literacy programs are necessary to ensure that vulnerable populations can effectively use AI-enabled services. Collaboration between financial institutions, fintech companies, and local government bodies can accelerate inclusive

outreach strategies tailored to district-level needs.

Technology adoption patterns in Mandsaur reveal a phased progression. Initial adoption was primarily driven by necessity during the COVID-19 period, when digital transactions became essential. Over time, adoption shifted from reactive usage to habitual engagement, supported by increasing trust and familiarity with AI-powered platforms. Younger and middle-aged respondents exhibited higher adaptability, while older populations required additional assistance and awareness initiatives. Institutional readiness also improved gradually, with banks integrating AI tools into core operations to reduce processing time and operational costs.

Overall, the discussion indicates that AI has contributed meaningfully to higher financial inclusion in Mandsaur District by improving access, efficiency, and trust in financial systems. Nevertheless, infrastructural gaps, digital literacy limitations, and regulatory considerations remain important moderating factors influencing the long-term sustainability of AI-driven inclusion.

6. CONCLUSION

This study examined the role of Artificial Intelligence (AI) as a catalyst for financial inclusion in Mandsaur District during the period 2020–2026. The findings demonstrate that AI-enabled financial technologies have significantly contributed to expanding access to formal banking services, digital transactions, and credit facilities, particularly among rural and semi-urban populations. The measurable increase in banking penetration, growth in digital transaction usage, and improved access to formal credit collectively indicate that AI has enhanced both the reach and efficiency of financial service delivery within the district.

AI-driven innovations such as predictive credit scoring, biometric authentication, and automated customer support systems have reduced



traditional barriers associated with documentation, collateral requirements, and operational delays. These tools have enabled financial institutions to assess risk more accurately, process applications faster, and extend services to previously underserved segments. The strong positive correlation between AI adoption and financial inclusion indicators further reinforces the conclusion that AI has played a catalytic rather than incidental role in improving financial accessibility.

The qualitative findings also reveal that increased trust, ease of use, and service efficiency have positively influenced user adoption. However, infrastructural limitations, digital literacy gaps, and concerns regarding data security remain important challenges that could moderate long-term sustainability. While AI has narrowed certain inclusion gaps, technology alone is not sufficient without supportive institutional frameworks and capacity-building initiatives.

In conclusion, the study affirms that AI has acted as a transformative force in advancing financial inclusion in Mandsaur District between 2020 and 2026. The district-level evidence suggests that AI-driven financial systems can effectively operate beyond metropolitan centers and contribute to inclusive economic development. Future efforts should focus on strengthening digital infrastructure, enhancing financial literacy, and ensuring ethical and transparent AI governance to sustain and deepen the gains achieved.

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