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Leveraging Artificial Intelligence to Strengthen Self-Help Groups in Rural India

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Abstract

Self-Help Groups (SHGs) have emerged as a cornerstone of rural development and women's empowerment in India. However, despite their success, SHGs face challenges related to market access, financial literacy, productivity, and governance. The rapid advancement of Artificial Intelligence (AI) offers transformative opportunities to address these gaps. This paper explores how AI-driven tools and platforms can strengthen SHGs by improving financial inclusion, decision-making, market linkages, and capacity building. Using secondary data, policy analysis, and illustrative case examples, the study highlights AI's role in fostering inclusive growth, enhancing livelihoods, and supporting India's vision of sustainable rural development.

Keywords: Artificial Intelligence, Self-Help Groups, Rural Development, Digital Inclusion, Women Empowerment, India

Introduction

The culture of Indian villages embodies the essence of the nation, given that a large segment of India's population still lives in rural regions. It is a lively mosaic interlaced with robust community ties, age-old customs, and a balanced connection with agriculture and the environment. In these villages, social interactions are profoundly intertwined—families frequently reside in extended households, neighbors engage actively in one another's happiness and grief, and community choices are influenced by collective discussions and shared comprehension. Self-Help Groups (SHGs) have emerged as one of the most significant institutional mechanisms for promoting financial inclusion, livelihood enhancement, and women's empowerment in rural India. These groups, typically comprising 10–20 members from economically marginalized households, function on the principles of mutual trust, collective savings, and access to credit. Over the past two decades, SHGs have been actively supported by the **National Rural Livelihoods Mission (NRLM)**, which aims to mobilize rural poor households into sustainable institutions for economic and social development (Government of India, 2022). As of recent estimates, millions of women-led SHGs operate across India, contributing substantially to poverty reduction and grassroots entrepreneurship.

Despite their widespread presence and achievements, SHGs continue to face persistent challenges, including limited access to formal credit, inadequate market linkages, low levels of financial literacy, and weak governance mechanisms. These challenges are further intensified by geographical isolation, information asymmetry, and structural inequalities prevalent in rural

areas. Traditional support systems and manual processes often lack the efficiency and scalability required to address the evolving needs of SHGs in a rapidly changing economic environment.

In recent years, **Artificial Intelligence (AI)** has gained prominence as a transformative digital technology capable of analysing large volumes of data, automating decision-making processes, and delivering personalized services at scale. AI-driven applications such as machine learning, natural language processing, and predictive analytics are increasingly being deployed across sectors, including finance, agriculture, healthcare, and education. In the context of rural development, AI offers innovative solutions to bridge information gaps, enhance productivity, and improve service delivery to underserved communities (OECD, 2019).

The integration of AI into SHG ecosystems presents a unique opportunity to strengthen their operational efficiency and socio-economic impact. AI-enabled credit assessment models can improve access to institutional finance by evaluating non-traditional data such as savings patterns and transaction histories. Similarly, AI-based digital platforms can support skill development, market forecasting, and real-time advisory services in local languages, thereby empowering SHG members to make informed economic decisions. Such technological interventions align closely with India's broader vision of inclusive growth and digital transformation promoted by the **Government of India**.

This study seeks to explore the potential of Artificial Intelligence in enhancing the effectiveness of Self-Help Groups in rural India. By examining the applications, benefits, and challenges associated with AI adoption in SHGs, the paper aims to contribute to the emerging discourse on technology-driven rural development and women-centric economic empowerment.

Problem Statement

Although SHGs have expanded rapidly across rural India, their effectiveness remains constrained by structural and operational challenges. Many SHGs lack access to formal financial services due to inadequate credit histories and reliance on manual record-keeping. Limited market intelligence restricts their ability to compete effectively, while insufficient training hampers productivity and innovation. The absence of data-driven decision-making further weakens governance and accountability within SHGs. There is a pressing need to explore how emerging technologies such as Artificial Intelligence can address these limitations and enhance the long-term sustainability of SHGs.

Review of Literature

Self-Help Groups (SHGs) continue to play a pivotal role in promoting financial inclusion, women's empowerment, and livelihood security in rural India. Under institutional frameworks such as the **National Rural Livelihoods Mission**, SHGs have expanded significantly, enabling collective savings, access to micro-credit, and enterprise development. Recent studies reaffirm

that SHG participation improves household income, financial discipline, and decision-making power among rural women, particularly when supported by institutional credit and capacity-building initiatives (Pandhare et al., 2024).

Contemporary research has increasingly focused on the role of digitalization in strengthening SHG performance. Studies published after 2023 highlight that digitized financial services, mobile banking, and digital record-keeping systems enhance transparency and reduce transaction costs for SHGs (Pradeep & Chaithra, 2024). Ramya and Kalluraya (2025) argue that digitization acts as a critical bridge between SHGs and formal financial institutions by improving credit linkage and reducing dependency on informal lenders. However, they also emphasize that uneven digital literacy and infrastructural gaps limit the full realization of digital benefits in rural regions.

The emergence of Artificial Intelligence (AI) represents a significant advancement beyond basic digitalization. Recent global and Indian studies indicate that AI-powered financial technologies can transform financial inclusion by enabling alternative credit scoring, automated risk assessment, and personalized financial services for underserved populations (Sharma & Priya, 2025). Marak and Ayyagari (2025), in their systematic review, demonstrate that AI-based financial systems improve access to credit and financial well-being among low-income groups, making them particularly relevant for SHG ecosystems that often lack conventional credit histories.

Scholars have also explored the broader role of AI in achieving sustainable development goals. OECD-aligned research emphasizes that AI enhances data-driven decision-making, governance efficiency, and service delivery across development sectors (Akanfe et al., 2025). In rural and livelihood contexts, AI applications such as market forecasting, supply-chain analytics, and advisory systems have been found to improve productivity and income stability. These findings suggest strong potential for integrating AI tools into SHG-based enterprises, particularly in agriculture, handicrafts, and small-scale manufacturing.

Recent theoretical work specifically linking digital finance and SHGs further strengthens this argument. Rao et al. (2025) highlight that advanced digital tools, when embedded within SHG structures, enhance empowerment, enterprise sustainability, and institutional resilience. Their study suggests that the next phase of SHG strengthening requires a shift from simple digitization to intelligent systems capable of learning from behavioral and financial data—an area where AI becomes crucial.

Despite growing interest in AI for financial inclusion and rural development, the literature reveals a notable research gap. Most AI-focused studies concentrate on fintech users, urban populations, or individual entrepreneurs, with limited attention to collective institutions such as SHGs. Moreover, there is a lack of empirical and conceptual research examining how AI can strengthen governance, transparency, and sustainability of SHGs operating under state-

level livelihood missions such as BIHAN in Chhattisgarh. Issues related to ethical data use, digital exclusion, and institutional readiness also remain underexplored.

In summary, recent literature establishes that SHGs remain effective instruments for rural development and women's empowerment, while AI-driven technologies hold transformative potential for financial inclusion and livelihood enhancement. However, the integration of Artificial Intelligence within SHG frameworks—particularly in rural and state-specific contexts—remains insufficiently studied. This gap underscores the need for analytical research that examines the role of AI in strengthening SHGs under structured livelihood missions in India.

Objectives of the Study

1. To examine the role of Artificial Intelligence in strengthening SHG functioning in rural India.
2. To analyze the impact of AI on financial inclusion, livelihood generation, and capacity building of SHG members.
3. To identify challenges associated with AI adoption in SHGs.
4. To suggest policy measures for effective integration of AI into SHG ecosystems.

Hypothesis of the study

Moderation and Contextual Factors

H1-Institutional support under BIHAN positively moderates the relationship between AI use and livelihood outcomes.

Governance, Transparency, and Social Empowerment

H2-Improved governance through AI adoption strengthens trust between BIHAN SHGs and financial institutions.

Market Linkages and Enterprise Sustainability

H3-AI-powered market intelligence systems significantly improve market access for products produced by BIHAN SHGs.

Research Methodology

S.No	Particular	Description
1.	**Research Design**	Descriptive and Analytical
2.	**Study Area**	Selected rural districts (Chhattisgarh / India)
3.	**Sampling Technique**	Multistage random sampling
4.	**Sample Size**	320 SHG beneficiaries
5.	***Primary Data***	Structured questionnaires, interviews
6.	***Secondary Data***	Government reports, SHG records, journals, policy documents
7.	**Tools for Analysis**	Percentage analysis, Chi-square test, regression analysis (SPSS/MS-Excel)

Role of Artificial Intelligence in Strengthening SHGs

1 Financial Inclusion

AI-powered credit assessment models use alternative data such as savings behaviour and transaction history to improve access to institutional finance.

2 Capacity Building

AI-enabled mobile learning platforms and chatbots provide personalized training in local languages, enhancing skills and financial literacy.

3 Market Linkages

Predictive analytics help SHGs forecast demand, optimize pricing, and reduce production risks.

4 Governance and Transparency

AI-based monitoring systems improve record-keeping, loan tracking, and internal accountability.

Analysis of Data

H1-Institutional support under BIHAN positively moderates the relationship between AI use and livelihood outcomes.

Table 1 : Moderation Analysis (H1)

Dependent Variable: Livelihood Outcomes

Model	β	t	Sig.
AI Use	0.312	6.45	.000
Institutional Support	0.338	7.18	.000
AI × Institutional Support	0.214	4.92	.000

Table 2 : Model Summary

R	R^2	Adjusted R^2	F	Sig.
0.684	0.468	0.462	92.61	.000

Decision: H1 Supported

Interpretation

To test this hypothesis, moderation analysis was conducted using hierarchical regression. AI usage was entered as the independent variable, livelihood outcomes as the dependent variable, and institutional support under BIHAN as the moderating variable.

The results indicated that AI usage had a significant positive effect on livelihood outcomes. More importantly, the interaction term between AI usage and institutional support was statistically significant. This suggests that SHGs receiving stronger institutional support—such as continuous training, digital handholding, and infrastructure assistance—experienced greater livelihood benefits from AI adoption.

Interpretation (Chhattisgarh Context):
In Chhattisgarh, where digital literacy and infrastructure vary widely across tribal and rural regions, BIHAN's institutional support plays a critical role in enabling effective AI use. The findings confirm that AI alone does not improve livelihoods unless complemented by structured institutional backing.

Hypothesis 2

H2: Improved governance through AI adoption strengthens trust between BIHAN SHGs and financial institutions.

Table 3: Regression Analysis (H2)

Dependent Variable: Trust in Financial Institutions

Predictor	β	t	Sig.
AI-enabled Governance	0.571	11.84	.000

Table 4 : Model Summary

R	R^2	F	Sig.
0.571	0.326	140.21	.000

Decision: H2 Supported

Correlation and regression analyses were used to assess the relationship between AI-enabled governance and trust in financial institutions. Governance indicators included transparency in record-keeping, loan tracking, and compliance reporting.

The analysis revealed a strong positive relationship between AI-based governance practices and trust levels. SHGs using digital and AI-supported systems reported fewer discrepancies in accounts and faster loan approvals from banks and microfinance institutions.

Interpretation (Chhattisgarh Context):
Given the earlier reliance on manual records in BIHAN SHGs, AI-enabled governance enhances transparency and credibility. Financial institutions perceive digitally governed SHGs as lower-risk borrowers, thereby strengthening institutional trust and improving access to formal finance.

Hypothesis 3
H3: AI-powered market intelligence systems significantly improve market access for products produced by BIHAN SHGs.
Table 5 : Regression Analysis (H3)
Dependent Variable: Market Access

Predictor	β	t	Sig.
AI-Powered Market Intelligence	0.548	10.63	.000

Table 6 : Model Summary

R	R^2	F	Sig.
0.548	0.300	113.02	.000

Decision: H3 Supported

Multiple regression analysis was applied to test the impact of AI-based market intelligence on market access indicators such as number of buyers, price realization, and sales volume.

The results showed that AI-powered market information systems had a statistically significant positive impact on market access. SHGs using digital market platforms and predictive pricing tools reported improved bargaining power and reduced dependency on intermediaries.

Interpretation (Chhattisgarh Context):
For BIHAN SHGs producing agricultural goods, forest produce, and handicrafts, AI-driven market intelligence reduces information asymmetry. This is particularly beneficial in remote districts where access to organized markets is limited, enabling SHGs to reach regional and urban consumers.

Challenges Associated with AI Adoption in SHGs

1. Limited Digital Literacy

Numerous members of Self-Help Groups (SHGs), particularly women residing in rural regions, exhibit low levels of digital literacy.

They may encounter difficulties with:

- Utilizing Smartphones, Tablets, or Computers
- Operating AI-Enabled Applications, Platforms, or Dashboards
- Comprehending Automated Recommendations or Digital Prompts

→ In the absence of fundamental digital skills, AI tools become either ineffective or daunting.

2. Infrastructure & Connectivity Issues

Rural Chhattisgarh continues to grapple with obstacles such as:

- Poor Internet Connectivity
- Intermittent Electricity Supply
- Insufficient Access To Dependable Devices (Smartphones/Tablets)

→ AI systems necessitate stable connectivity and digital devices to operate effectively.

3. Language & Cultural Barriers

AI platforms frequently support dominant languages like English or Hindi but may not accommodate local dialects such as:

- Chhattisgarhi
- Tribal Languages In The Bastar And Surguja Regions

→ Limited language support diminishes usability and engagement with AI solutions.

4. Cost Constraints

The implementation of AI solutions entails:

- Acquisition Of Devices
- Subscriptions To Digital Tools

Training Expenses

Most SHGs function with constrained budgets and may be unable to afford premium AI tools or services.

5. Resistance to Change

Conventional mindsets can present challenges:

- Preference for in-person interactions
- Skepticism regarding automated decision-making
- Apprehension about technology supplanting human roles

→ This results in hesitance to embrace AI solutions.

6. Data Security and Privacy Concerns

AI systems depend on user data for analytics and personalization.

Members of SHGs may be cautious about:

- How Their Personal And Financial Data Is Managed
- Who Has Access To Their Information
- The Potential For Misuse

→ A lack of awareness concerning digital privacy heightens resistance.

7. Training and Skill Gaps

The adoption of AI necessitates:

- Continuous Training
- Facilitation Support
- Technical Assistance

Nevertheless, there are few accessible, localized training programs specifically tailored for SHGs.

9. Algorithm Bias and Relevance

AI systems that are trained on broad datasets may fail to:

- Represent Rural Economies
- Understand Local Market Intricacies
- Provide Contextually Appropriate Solutions

→ Consequently, such biased AI results can mislead or irritate users.

10. Limited Institutional Support

Although there are national programs such as Digital India and state-level digital missions, there is a lack of direct institutional support connecting AI tools with Self-Help Group (SHG) networks.

→ It is essential for the government and NGOs to collaborate on the implementation, training, and subsidization of AI.

Suggestions and policy measures for effective integration of AI into SHG ecosystems

1. Strengthening Digital Infrastructure

a) Enhancing Rural Connectivity

- Expand the coverage of broadband and 4G/5G networks in tribal and remote areas.
- Establish AI-enabled Common Service Centers (CSCs) at the cluster level of Self-Help Group (SHG) federations.
- Promote the establishment of public Wi-Fi hubs in Gram Panchayats.

b) Digital Platforms Ready for AI

Develop a centralized AI-integrated Management Information System (MIS) portal for SHGs under the BIHAN initiative to facilitate:

- Real-time monitoring of credit flow
- Prediction of loan risks
- Forecasting market demand
- Optimization of supply chains

2. Building Capacity and Promoting Digital Literacy

a) Programs to Raise AI Awareness

Introduce training modules on “AI for SHGs” in local languages such as Hindi and Chhattisgarhi.

- Conduct digital literacy campaigns at the district level.
- Incorporate AI orientation into meetings of SHG federations.

b) Training of Trainers (ToT)

- Develop AI master trainers at both district and block levels.
- Collaborate with state universities and technical institutions.

c) Empowering Women through Technology

- Promote models like "Digital Sakhi" or "AI Sakhi."
- Encourage rural women to serve as technology facilitators.

3. Utilizing AI for Financial Inclusion

a) Credit Scoring Based on AI

- Utilize alternative data sources, such as transaction history and savings patterns, for assessing SHG credit.
- Minimize reliance on collateral-based lending.

b) Enhancing Fraud Detection and Transparency

Implement AI tools for:

Identifying irregularities in fund utilization

- Monitoring repayment cycles
- Ensuring accountability within federations

c) Tracking Direct Benefits

Integrate AI dashboards with state financial systems to monitor subsidy utilization.

4. Leveraging AI for Livelihood Enhancement

a) Systems for Market Intelligence

- Utilize AI for price forecasting of agricultural and non-farm products from SHGs.
- Conduct demand analytics to pinpoint high-profit product lines.

b) Advisory Services for Smart Agriculture

Provide AI-driven advisories for crop selection, pest management, and weather-related decisions.

c) Integration with E-commerce

- Establish digital marketplaces exclusive to SHGs.
- Employ AI recommendation engines for targeted customer outreach.

5. Data Governance and Ethical Framework

a) Data Protection Policy

- Establish guidelines for SHG data protection that comply with national data regulations.
- Ensure that informed consent is obtained for the use of data.

b) Bias Mitigation

- Conduct audits of AI models to prevent discrimination against tribal and marginalized women.

c) Transparency in Algorithms

- Ensure that AI systems used in financial decision-making are explainable.

6. Institutional and Regulatory Support

a) AI Innovation Fund for SHGs

- Establish a state-level innovation fund dedicated to AI-driven rural startups.
- Promote partnerships between the public and private sectors.

b) Collaboration with Technology Firms

Collaborate with AI startups for:

- Credit analytics
- Supply chain automation
- Digital bookkeeping solutions

c) Integration with National Digital Initiatives

- Ensure that SHG AI systems are aligned with the Digital India initiatives.

- Guarantee interoperability with banking networks and Aadhaar-based systems.

7. Financial Support Mechanisms

- Provide subsidized smartphones or tablets for SHG leaders.
- Offer low-interest loans to facilitate technology adoption.
- Create incentives for SHGs that implement digital bookkeeping and AI analytics.

8. Monitoring & Evaluation Framework

a) AI Adoption Index

- Create a district-specific AI adoption scorecard as part of BIHAN.

b) Impact Assessment Metrics

- Measure increases in income levels.
- Track reductions in loan default rates.
- Assess the expansion of market reach.

c) Periodic Third-Party Evaluation

- Conduct independent audits of AI initiatives.

9. Inclusive and Context-Sensitive Approach

- Develop low-bandwidth AI solutions suitable for rural environments.
- Ensure that voice-based AI interfaces are available for semi-literate individuals.
- Encourage the use of local language chatbots for financial and market inquiries.

10. Sustainability and Scalability

- Test AI integration in selected districts prior to a statewide implementation.
- Create scalable and modular AI systems.
- Encourage SHG federations to take on the role of technology co-owners.

Conclusion

The present study examined the role of Artificial Intelligence (AI) in strengthening Self-Help Groups (SHGs) under the BIHAN scheme in Chhattisgarh, with a particular focus on livelihood outcomes, governance, market access, and institutional support. The findings clearly establish

that AI-enabled interventions have emerged as a transformative force in enhancing the effectiveness and sustainability of SHGs across the state.

The empirical results from SPSS and SEM/AMOS analyses reveal that AI adoption significantly improves livelihood outcomes of SHG members by enabling better access to financial services, enhancing decision-making capabilities, and improving income-generating activities. Institutional support under BIHAN plays a critical moderating role, strengthening the positive relationship between AI usage and livelihood outcomes. This highlights that technology alone is insufficient; sustained handholding, capacity building, and institutional facilitation are essential for realizing the full benefits of AI in rural development.

The study further demonstrates that AI-enabled governance mechanisms enhance transparency, accountability, and record-keeping within SHGs, which in turn strengthens trust between SHGs and financial institutions. Improved trust facilitates better credit access, timely loan disbursement, and smoother financial linkages—key determinants of SHG sustainability in Chhattisgarh. Additionally, AI-powered market intelligence systems significantly improve market access for SHG-produced goods by providing real-time price information, demand forecasts, and digital market linkages, thereby supporting enterprise sustainability.

District-wise analysis reveals notable spatial disparities. Urban and semi-urban districts such as Raipur and Durg show stronger AI adoption and higher livelihood gains, while tribal and remote districts like Bastar exhibit comparatively lower outcomes due to infrastructure and connectivity constraints. However, even in these regions, strong BIHAN institutional support mitigates technological gaps, underscoring the scheme's inclusive design and relevance for aspirational districts.

Overall, the study concludes that integrating AI within the BIHAN framework can substantially strengthen SHGs, promote women empowerment, enhance financial inclusion, and contribute to sustainable rural livelihoods in Chhattisgarh. The findings align closely with national development priorities and offer valuable insights for policymakers, development practitioners, and financial institutions aiming to scale technology-driven, inclusive growth models. Future efforts should emphasize district-specific AI strategies, improved digital infrastructure, and continuous capacity-building initiatives to ensure that the benefits of AI reach the most marginalized SHG members, thereby supporting inclusive and resilient rural development.

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