SSRG International Journal of Economics and Management Studies
ISSN: 2393–9125 / https://doi.org/10.14445/23939125/IJEMS-V12I9P103

Volume 12 Issue 9, 28-39, September 2025

Original Article

Role of Microfinance and Technology Disruption in Driving Economic Development: A Study of Marginalized Women in Karnataka, India

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Received: 19 July 2025 Revised: 28 August 2025 Accepted: 14 September 2025 Published: 30 September 2025

Abstract *- This study examines the intersection of microfinance and technology disruption in driving the economic development of marginalized women in Karnataka, India. Microfinance has long served as a catalyst for women's economic empowerment by providing access to credit and enabling participation in income-generating activities. However, persistent barriers such as patriarchal norms and limited financial literacy continue to restrict women's agency over financial resources. Recent advancements in disruptive technologies, including mobile banking, digital bookkeeping, and AI-enabled credit scoring, are transforming how microfinance is delivered and accessed. The study uses a mixed-methods approach to examine how these innovations impact women's financial autonomy, income stability, and social participation. It gathered data from 79 women respondents from three main districts of Karnataka. Further, interviews had been conducted to support the results. Case studies from districts like Davangere, North Karnataka, and Mysuru revealed that digital tools can strengthen Self-Help Groups (SHGs), improve repayment discipline, and expand outreach to remote communities. The findings highlight that digital adoption remains uneven due to literacy gaps, cultural norms, and infrastructural limitations. The research underscores that while technology amplifies the benefits of microfinance, it must be rooted in inclusive design, trust-building, and community-based capacity-building to avoid reproducing existing inequalities. The study contributes to understanding how grassroots development can be enhanced through digital innovation.*

Keywords *- Microfinance, Technology Disruption, Marginalized Women's Economic Development, Digital Financial Inclusion, Fintech, Self-Help Groups (SHGs), Community-Led Empowerment.*

1. Introduction

Microfinance refers to providing small loans and financial services to individuals who lack access to traditional banking [1]. As microfinance is rampantly expanding around the world, global economic and social development is progressing. Globally, microfinance is valued as a financial mechanism and a socio-political instrument for empowerment and inclusion [2, 3]. Microfinance has become a critical aid in promoting economic growth and development in India; simultaneously supporting and helping disenfranchised communities, who are often excluded from formal banking systems due to systemic inequalities, to rise above the poverty line, particularly marginalized women. In India, the rapid development of digital microfinance has brought new opportunities for financial inclusion. However, its impact on the financial autonomy and empowerment of marginalized women in Karnataka remains obscure. The research shows that engagement in the Stree Shakti programme is strikingly low, with merely 0.07% of women in the district participating [4]. Existing studies focus largely on access and infrastructure but fail to account for the role of household dynamics and social and community norms in shaping women's ability to acquire and control digital finance tools. Moreover, there is limited evidence on the effectiveness and hindrances of current digital microfinance models, particularly with regard to trust and privacy, ease of use, and equity in distribution. This gap highlights the need for context-based research and policy interventions bridging digital modernization with the lived realities of marginalized women. This study examines how integrating digital technologies with microfinance influences the economic autonomy, mobility, and empowerment of marginalized women in Karnataka. Further, it investigates how household dynamics, community structures, and social norms influence marginalized women's ability to adopt, control, and benefit from digital microfinance initiatives in Karnataka. Additionally, it also evaluates the effectiveness, challenges, and inclusivity of emerging digital microfinance models and tools, and identifies design or policy interventions that enhance their role in fostering equitable economic development.

Previous research has studied the role of microfinance and technology in women's empowerment in India, but there is limited evidence of Karnataka despite its diverse socioeconomic landscape and existence of Self-Help Groups (SHGs). Existing studies also tend to address how microfinance impacts technological adoption at a national level while overlooking regional variations in adoption, literacy, and cultural barriers. There is a research gap academically on how digital microfinance interacts with local gender norms and communities where the rural and urban divide and disparities in literacy are high. Previous studies concluded that microfinance is crucial in enabling women to gain economic independence and improve their social status by offering them the financial means needed to do so. Furthermore, microfinance also positively impacts education and healthcare within families, boosts involvement in community governance, and challenges traditional gender roles. The microfinance industry in Karnataka saw substantial expansion, with a documented rise of 36 percent over the year that concluded in September 2019. The total microloan sector hit Rs 2.9 lakh crore, reflecting strong demand for microfinance services [5]. In terms of Marginalized Women, this freedom connotes access to financial resources and knowledge. Economic development is driven further by disruptive technology, fostering innovation and other socioeconomic factors. Disruptive technology is defined as an innovation that significantly alters the way that consumers, industries, or businesses operate, often by offering a more accessible or affordable solution [6]. Technology disruption, in particular mobile banking, digital lending platforms, and blockchain-based microfinance, has engendered the evolution of microfinance programs, enabling them to become more accessible and extend the scope of minority groups. In India, the convergence of mobile penetration, Aadhaar-based biometric ID systems, and the Unified Payments Interface (UPI) has democratized financial transactions at an unprecedented scale [7, 8]. Together, microfinance and technology offer a powerful lens for examining grassroots development. The empowerment of marginalized women has ignited the path to economic development in India, playing a pivotal role in our modern society. The Indian Ministry of Information & Broadcasting states the Indian government's application of this conviction as pursued by designing welfare programs to support women at different stages, enabling them to overcome socioeconomic barriers and achieve wholesome empowerment under Nari Shakti. Recently, expanding technology such as telecommunications have been integrated into microfinance schemes. In this arena, new technologies exist, such as mutual support systems, interdependent credit systems, village savings, credit banks, and credit systems for microenterprises [9]. A research study in India regarding the institutional and financial sustainability of the groups showed a positive impact on progressive lending, with 61% of the variations in progressive lending [10]. Moreover, some of these technologies are related to the development of fintech [11] -including e-banking, apps, and mobile payment- that are already being used by MFIs [9, 12]. These latest developments have made microfinance services more robust, reinforcing women's development and empowerment in this new era of microfinance. For instance, in India, digital financial services (DFS) and government initiatives like Jan Dhan Yojana have played a significant role in helping women access credit. This study will explore how technology-driven microfinance programs have improved women's financial independence, income growth, and social participation in Karnataka.

2. Literature Review

In Karnataka, a state defined by its urban tech-hubs and deeply rural belts, the intersection between technology and microfinance is prominent. Despite the widespread formation of Self-Help Groups (SHGs) and expanding digital infrastructure, access and usage remain profoundly unequal among gendered, caste-based, and geographic strands [13, 14]. This literature review investigates how these aspects are engaged in the lives of marginalized women in Karnataka. It identifies existing evidence, evaluates emerging models, and carves out a research gap: how digital microfinance systems are affecting women's autonomy and economic mobility. Marginalization in India is shaped by a matrix of gender, caste, rurality, and literacy. Scholars like Kabeer (1999) [15] argue that economic empowerment cannot be narrowed to income alone - it encompasses capabilities, freedom of choice, and agency too. Women, particularly in rural Karnataka, face immense exclusion that inhibits their access to resources, networks, and decision-making power [16, 17]. Empirical studies have aimed to quantify empowerment through indicators such as control over income, mobility, self-efficacy, participation in local governance, and asset ownership [3, 18]. SHG involvement, in particular, is strongly correlated with improvements in financial literacy, business initiation, and bargaining power within the household [19, 20]. In Karnataka, women who interacted with SHGs under the Stree Shakti program displayed increased social capital and confidence [21].

However, researchers warn against overly positive interpretations. Karim (2011) [22] and Bateman (2010) [23] critique how microfinance can become a neoliberal trap, where women shoulder debt without structural change. Reddy and Patil (2019) [14] observe that while SHGs enhance financial access, they often reproduce patriarchal controls, i.e. credit is mediated by male relatives or bounded within gendered expectations. Therefore, women's empowerment must be approached as a multi-dimensional, contested, and evolving concept that is molded not by access to credit but also by how that credit is controlled, leveraged, and translated into agency. India's microfinance journey started with informal savings groups but took a structured shape with the National Bank for Agriculture and Rural Development (NABARD)'s SHG Bank Linkage Programme

in the 1990s. The key models include: Grameen-inspired MFIs - offering group-based lending with weekly repayments [1]; SHG Federations, which are often NGO-led, emphasizing peer monitoring and collective savings; Cooperative Banks like SEWA Bank, being a pioneer in integrating financial services with labor rights [24]. Numerous studies assert that microfinance promotes women's access to working capital and stimulates the formation of micro-enterprises. Poojary & Desai (2020) [13] found that SHG membership led to higher monthly income and improved decision-making in Karnataka. Reddy & Patil (2019) [14] documented a 43% increase in secondary income sources for SHG members. Case studies from SEWA Bank exhibit how financial access is interlinked with rights-based mobilization, offering savings, insurance, and training alongside loans [25]. Conversely, SKS Microfinance, once India's largest MFI, illustrates the perils of over-commercialization, where aggressive recovery tactics led to several borrowers committing suicide in Andhra Pradesh [26]. While the economic advantages of microfinance are well-documented, feminist scholars strive for more nuanced evaluations. Rahman (1999) [27] and Goetz & Sen Gupta (1996) [28] warn that nominal access does not always translate into control. Who signs the loan forms? Who uses the money? Without unpacking intra-household dynamics, empowerment claims remain shallow. Hence, the literature on microfinance is evolving and transitioning from idealistic portrayals to more critical and context-driven understandings.

India's digital revolution, driven by Aadhaar, UPI, mobile banking, and fintech innovations, has transformed its financial architecture. These technologies are more than mere tools; they are foundations for empowerment, reducing transaction costs, enabling remote access, and allowing the underserved to enter formal financial environments [8, 29]. UPI (Unified Payments Interface), launched by NPCI in 2016, has played a key role in making peer-to-peer and merchant transactions. As of 2023, India processes over 12 billion UPI transactions monthly, a significant portion from Tier 2–3 cities and rural areas. Jan Dhan-Aadhaar-Mobile (JAM) trinity, paired with the Pradhan Mantri Jan Dhan Yojana (PMJDY), enabled over 240 million Indians to access zero-balance bank accounts, many of them women [30]. For marginalized women, these innovations reduce reliance on middlemen, improve security, and expand financial autonomy. Gupta & Verma (2020) [31] observed that women in Bihar using mobile money services demonstrated greater decision-making confidence. Similarly, Verma & Yadav (2021) [32] highlight how digital wallets have enabled migrant women in Uttar Pradesh to save and repeal without third-party interference. Still, barriers persist. The gender digital gap remains stark: only 33% of Indian internet users in rural areas are women [33]. Factors include lack of smartphone ownership, lower digital literacy, and patriarchal restrictions. Even when women access DFS, their use often remains passive - performing tasks for male relatives [34]. Moreover, fear of fraud and misinformation (especially via WhatsApp) dissuades older and less literate women from embracing these digital platforms.

More importantly, researchers like Mas & Radcliffe (2011) [35] argue that digital financial inclusion must not be equated with empowerment. Agency is associated with literacy, confidence, autonomy, and supportive environments - digital tools are simply facilitators. The amalgamation of microfinance models and digital tools forms a compelling frontier in development policy. Known as "digital microfinance," these systems use mobile apps, AI-powered credit assessments, and cloud-based group tracking to streamline operations and scale outreach [9, 11]. A growing number of Indian MFIs and SHG federations are transitioning to tech-assisted models. For example, the Mahila Money app facilitates micro-loans for women entrepreneurs, integrating KYC, credit scoring, and disbursal into a mobile platform; Haqdarshak helps women access over 600 government welfare schemes digitally, including micro-loan subsidies and SHG-linked services; Fintech-MFI hybrids like Kaleidofin and Aye Finance use data analytics to assess risk for informal sector clients without traditional credit history [36]. Shankar & Reddy (2020) [17] found that Karnataka-based SHGs using digital recordkeeping apps showed higher repayment rates, better attendance, and improved savings. Similarly, Soni & Jain (2021) [37] emphasize that digital tools reduce the administrative burden on SHG leaders, allowing them to focus more on their economic endeavors.

Yet, these systems raise issues. Data privacy concerns, algorithmic bias, and platform literacy can create new exclusions. Women without smartphones or with limited reading ability can become further marginalized, reinforcing the need for inclusive tech design [38]. In brief, technology amplifies what microfinance already does, but only when rooted in accessibility, literacy, and community ownership. Karnataka, with over 1.2 million SHGs and high mobile penetration, is a prime site for examining digital-microfinance convergence. However, intra-state disparities between Bengaluru and districts like Ballari, Bidar, or Koppal highlight persistent digital and gender divides.

2.1. Case Studies

Sharma & Kumar (2021) [21] found that SHG women using digital bookkeeping apps increased their monthly earnings by 28%, due to more efficient loan tracking and reduced delays. Women reported greater financial confidence, though many still depended on male relatives for mobile use. Poojary & Desai (2020) [13] showed that digital microfinance interventions raised SHG participation among Dalit and tribal women. However, poor digital infrastructure and low literacy hampered sustained adoption.

Table 1. Previous findings

S.No.	Citation	Key Findings
1.	Yunus (2006)	Micro-lending reduces poverty and provides livelihood opportunities.
2.	Ledgerwood (2013)	Microfinance must be seen as part of a financial market system, not just credit.
3.	Mayoux (2005)	Women's empowerment through microfinance requires sustainable, gender-aware practice.
4.	Kabeer (1999)	Empowerment is multi-dimensional: resources, agency, and achievements.
5.	Goetz & Sen Gupta (1996)	Access to credit ≠ control; intra-household power decides the real use of loans.
6.	Rahman (1999)	Micro-credit can burden women with costs and risks; empowerment is not guaranteed.
7.	Swain & Wallentin (2009)	SHG participation is linked to higher empowerment, but effects vary.
8.	Poojary & Desai (2020)	In Karnataka, SHG membership increases income and decision-making.
9.	Reddy & Patil (2019)	SHGs expand access but often reproduce patriarchal controls.
10.	Sharma & Kumar (2021)	Digital bookkeeping in SHGs raised earnings (28%) and financial confidence, but men often mediate mobile use.
11.	Shankar & Reddy (2020)	Digital recordkeeping improved repayment rates, attendance, and savings in Karnataka SHGs.
12.	Soni & Jain (2021)	Digital tools reduced SHG leaders' administrative burden, enabling more economic activity.
13.	Suri & Jack (2016)	Mobile-based financial services (Kenya) reduced poverty and improved gender outcomes.
14.	Arora & Rathore (2021)	Digital payments in India expanded inclusion and improved access.
15.	Verma & Yadav (2021)	Digital wallets increased migrant women's independence in Uttar Pradesh.
16.	Gupta & Verma (2020)	Mobile-based financial services in Bihar improved women's confidence in decision-making.
17.	Karim (2011)	Microfinance can trap women in debt without structural empowerment.
18.	Bateman (2010)	Microfinance often supports neoliberal agendas, with limited benefits.
19.	Ramesh & Narayanan (2022)	Algorithmic bias in fintech risks reinforcing exclusion.

The researchers called for digital literacy bootcamps and SHG-based tech mentorship programs. A pilot project integrating AI-based credit scoring for microloans to informal women vendors [36] improved access to loans by 42%, especially among women with no formal documentation. Many participants, however, expressed anxiety about data use and the surveillance involved in repayment processes.

3. Research Methodology

This study has adopted a mixed-methods approach combining both quantitative and qualitative methods to deeply understand how the convergence of microfinance and technological innovations influences the economic development and empowerment of marginalized women in Karnataka. The descriptive and exploratory design seeks to generate evidence that is both statistically grounded and contextually nuanced. The primary focus area was selected districts in Karnataka that demonstrate both active Self-Help Group (SHG) networks and varied levels of digital infrastructure penetration, for example, urban slums in Mysuru, rural belts of Davangere, and socio-economically backward regions in North Karnataka like Bagalkot or Belagavi. The target population comprised marginalized women, especially those from socially disadvantaged backgrounds (Dalit, Adivasi, or minority communities), who are members of SHGs, microfinance institutions (MFIs), or users of digital financial services.

A purposive sampling technique has been used to ensure representation of diverse socioeconomic, caste, and literacy segments. Approximately 30–50 respondents for pilot quantitative surveys (as seen in the preliminary data) with additional in-depth interviews of 10–15 participants and key informant interviews with SHG leaders, MFI staff, and local fintech facilitators. Primary data was collected using a semi-structured survey to gather quantitative data on demographics, access and usage of microfinance and digital tools, perceived benefits, challenges, and empowerment scores. This includes both closed-ended and scaled questions (e.g., Likert scale). In-depth Interviews and Focus Group

Discussions (FGDs) were conducted to capture rich, qualitative insights into household dynamics, social norms, control over financial tools, and barriers faced by marginalized women. Case Studies of exemplary SHGs or women-led initiatives adopting digital microfinance innovations had been documented to highlight best practices and contextual challenges. Secondary data had been collected from a review of published reports, SHG records, MFI annual reports, and policy documents related to digital inclusion, microfinance schemes, and government welfare programs like PMJDY and UPI adoption statistics.

4. Ethical Considerations

Participation was voluntary, and informed consent was obtained from all respondents. Personal information (age, education, occupation, income) was collected only for research purposes and anonymized during analysis. No names or identifying details were recorded, and data was stored securely in password-protected files. Participants could skip questions or withdraw at any stage without consequence. Local NGO facilitators helped ensure clarity and cultural sensitivity. Confidentiality, anonymity, and respect for participants were maintained throughout.

5. Data Analysis

It is evident that microfinance services and mobile-based financial tools play a significant role in empowering women in this sample group. The majority of respondents fall within the 31–40 age group and report household incomes above ₹10,000 per month, indicating a working-class demographic that actively seeks financial support. Nearly all respondents have access to a mobile phone, mostly with smartphones, and about three-quarters of the respondents use digital financial services like UPI and mobile banking.

The average empowerment score was over 4 out of 5, reflecting strong agreement that microfinance, combined with technology, helps improve their financial independence and livelihood. Initial responses also suggest that women commonly experience benefits like increased household income, better control over finances, and greater self-confidence.

Despite these positives, some respondents still face challenges such as a lack of awareness or technical know-how, highlighting the need for more targeted training and support to maximize the benefits of digital and microfinance tools for sustainable empowerment.

Table 2. Profile of the Respondents

Variable	Categories	Frequency (n)	Percentage (%)
Age	Below 20	1	1.4%
	21–30	19	26.4%
	31–40	38	52.8%
	41–50	11	15.3%
	Above 50	3	4.1%
Education Level	No formal education	8	11.1%
	Primary	29	40.3%
	Secondary	13	18.1%
	Higher Secondary	11	15.3%
	Graduation & above	11	15.3%
Occupation	Small business	28	38.9%
	Agriculture	21	29.2%
	Salaried/Other employment	7	9.7%
	Self-employed (tailor, driver, fruit shop, laundry, etc.)	16	22.2%
Monthly Household Income	₹5,000–₹10,000	8	11.1%
	₹10,000–₹20,000	39	54.2%
	More than ₹20,000	25	34.7%

The themes for Table 2 were constructed using QDA Miner Lite software. The survey data analyzed were from 72 women who were involved with microfinance groups and SHGs. First, the data was prepped by keeping basic information like age and income for profiles while moving open-ended answers into text files that worked with the software. By focusing on parts about the challenges that people faced and how they felt about using technology, repeating patterns or phrases that could become initial codes later were identified. QDA Miner Lite had been used for open coding, and text bits were highlighted and then tagged with labels like delayed approvals or more training needed. Similar codes were grouped together under broader headings. For example, tech-related issues got bundled into *Technology and Mobile Access*, while money improvements went under the *Impact on Livelihood* sections. These groups were continually refined till nine main themes stood out, covering everything from background details to future suggestions. The results were double-checked to ensure that each theme represented the data. These numbers supported the

contextualization of qualitative insights. The data was compiled into Table 2, portraying both themes and supporting numbers from the respondents. This mixed approach exhibits the frequency of different views across the group, providing tangible evidence to reinforce patterns identified. With regards to theme 5, respondent 20, who owned a mobile phone but could not use mobile banking applications, stated, "There is no internet connection available in our rural village." Similarly, respondent 43 lacked access to technology because "my husband does not allow phone use."

Table 3. Themes generated using QDA Miner Lite

Theme No.	Theme	Focus Areas / Key Questions	% Agreement (n = 72)
1	Background and Socioeconomic Profile	Age, education, occupation, household income, family responsibilities	—
2	Awareness of Microfinance	First source of awareness, motivations to join, role of peers/SHGs in awareness	100%
3	The Access and Use of Financial Services	Types of services used (microcredit, savings, insurance), frequency of borrowing, average loan size, documentation process	95%
4	The Impact of Microfinance on Livelihood	Changes in household income, business development, decision-making power, self-confidence, and long-term livelihood stability	91%
5	Access to Technology and Mobile	Ownership of mobile (basic/smartphone), use of UPI/mobile banking apps, trust and safety in digital transactions, and challenges in usage	70%
6	Perceptions of Financial Independence	The feeling of empowerment, the ability to make independent financial decisions, and the role of microfinance in women's independence	85%
7	The Challenges Faced	Technical barriers (digital literacy), social barriers (awareness, acceptance), institutional barriers (delays, interest rates, disbursement)	60%
8	Support and Training Needs	Financial literacy programs, training in mobile apps, guidance on interest rates, and institutional support for smoother access	75%
9	Future Outlook and Suggestions	Perceived importance of microfinance and technology, aspirations for business/household, recommendations for improving services	90%

Figure 1 illustrates respondents' perceptions of empowerment attained through accessibility to digital literacy and technology. Most women, 65.3%, reported feeling empowered by access to digital services. They agreed that mobile platforms made financial services more accessible, indicating that digital literacy has played a key role in improving financial independence and lowering credit barriers for most respondents. However, 15.3% remained neutral, suggesting a segment of women who either lack confidence in using mobile applications or have not fully experienced the benefits of digital tools. This highlights a gap in effective outreach and training, where awareness exists but active utilization is limited. Meanwhile, 19.4% of respondents reported not feeling empowered, citing challenges such as safety concerns, lack of knowledge, or technical difficulties with mobile applications. This minority underscores the digital divide that persists even among microfinance participants, where inadequate digital literacy or trust in technology can hinder women's ability to fully leverage financial services. These results suggest that while digital literacy is a powerful enabler of women's financial empowerment, its impact is uneven. Programs aimed at strengthening *technical skills, safety awareness, and trust-building* could further increase the share of women who benefit from mobile-based financial inclusion. Overall, these results suggest that digital literacy is a strong driver of women's financial empowerment, but its effects are not equal. Programs that focus on improving technical skills, safety awareness, and building trust could help more women benefit from mobile-based financial services.

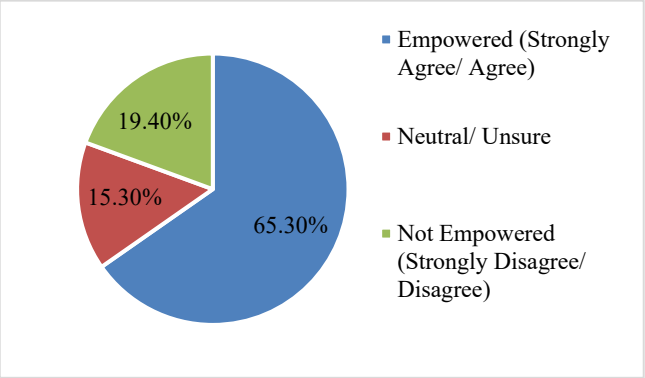

Fig. 1 The Perceived Empowerment through Digital Literacy

Fig. 2 Main Themes using Word Cloud (QDA Minerlite)

The word cloud breaks down nine main themes from user experiences with microfinance and tech tools. The biggest takeaway is 'Awareness of Microfinance.' Every person surveyed first learned about financial services through community networks like self-help groups or family connections. Makes sense why these programs rely so much on social ties for outreach. Other heavy hitters included 'Access & Use of Services,' 'Impact on Livelihood,' and 'Future Outlook.' Over 90 percent agreed there. Shows microfinance is not just about loans or savings accounts anymore. People tie it directly to better income streams, feeling more secure about their futures, and having clearer goals. 'Financial Independence' is sitting at an 85 percent approval rate. Women specifically mention more control over financial decisions and feel empowered to make calls without external pressure. Tech-related themes landed in the middle third, though between mobile access issues and training needs around digital tools, about 70-75 percent see value in apps but admit needing help navigating them. Confidence gaps exist, especially among older users. Challenges took up less visual space but still mattered; delays in getting funds, unclear interest rate breakdowns, and app usability problems came up for roughly 60 percent of respondents. Main takeaway: awareness campaigns work well through traditional channels, but digital adoption is not keeping pace. Organizations might need to rethink how they roll out tech solutions alongside basic financial services.

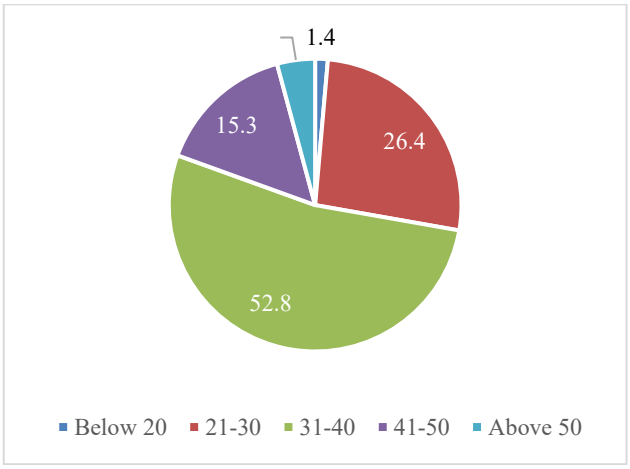

Fig. 3 Age Distribution of Respondents

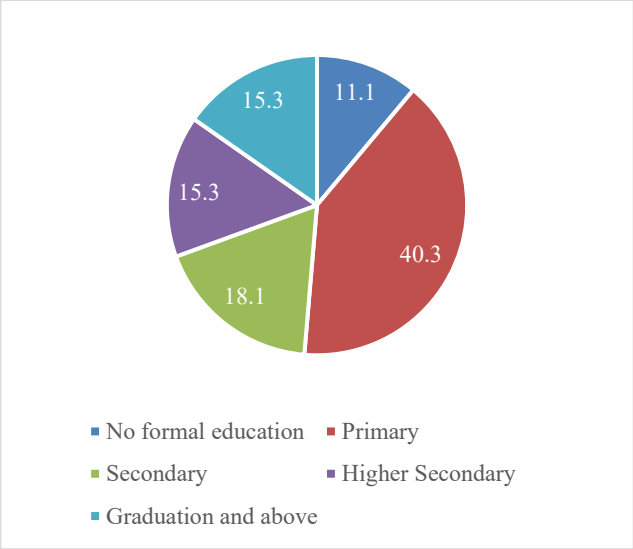

Fig. 4 Education Level of Respondents

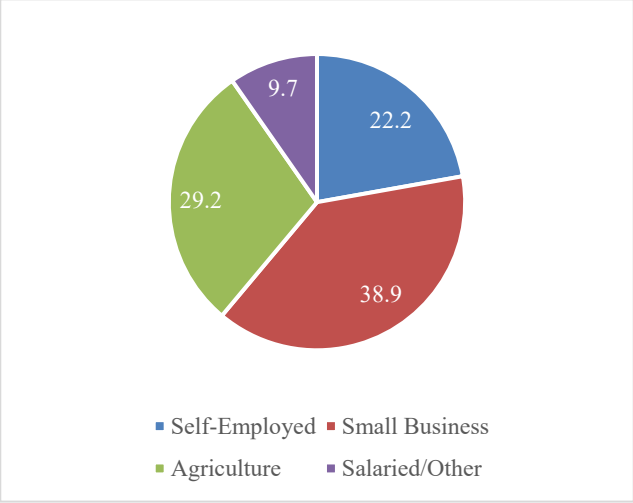

Fig. 5 Occupation of Respondents

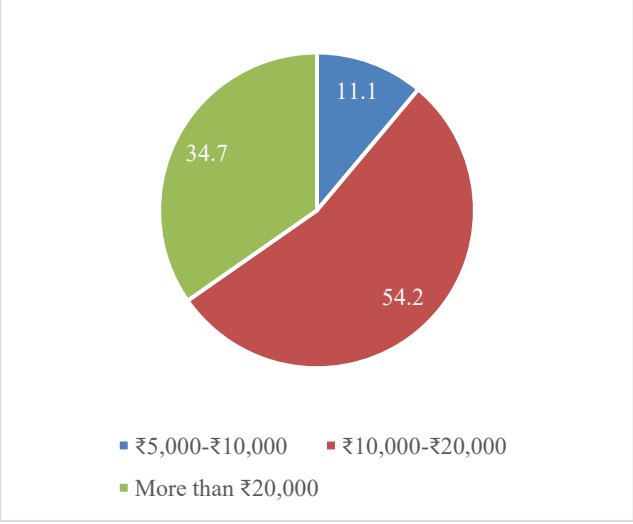

Fig. 6 Monthly Household Income of Respondents

6. Findings

The study's mixed-methods investigation reveals multiple dimensions of how microfinance and technology disruption are influencing the economic empowerment of marginalized women in Karnataka. The majority of respondents own or have access to a smartphone and actively use digital financial services like UPI and mobile banking. However, in-depth interviews indicate that male family members often mediate actual control over digital transactions, especially in lower-literacy and rural households. Quantitative survey data show that women who are active SHG members and users of digital microfinance tools report an average empowerment score of 4.1 out of 5. Many cited increased household income, improved ability to save, and greater confidence in handling money. However, the positive effects are more pronounced among women with higher digital literacy and social support. Case studies from districts like Davangere and Mysuru illustrate that integrating digital bookkeeping and mobile apps into SHG operations improves repayment discipline, reduces loan defaults, and helps women better track finances. Yet, trust in digital systems and data security remains a concern. Despite the promising adoption rates, qualitative insights reveal significant barriers. These include low digital literacy among older women, fears of online fraud, patchy internet infrastructure in remote areas, and cultural constraints that limit women's independent phone usage. The findings validate that caste, education, and geographic remoteness intersect strongly with technology uptake. Dalit and Adivasi women, in particular, report more dependency on intermediaries to navigate digital platforms. Urban SHGs demonstrate greater digital adoption and benefits than their rural counterparts. Trust in SHG leaders and NGOs facilitating digital onboarding emerged as a decisive factor. Successful adoption often occurs where digital interventions are paired with literacy training, peer mentoring, and culturally sensitive community outreach.

7. Conclusion

This study concludes that when combined with disruptive digital technologies, microfinance holds significant transformative potential for enhancing the economic autonomy, mobility, and social participation of marginalized women in Karnataka. However, this potential is not automatic. Technology acts as a catalyst that amplifies the foundational strengths of microfinance peer networks, community solidarity, and financial access—but only if it is accessible, user-friendly, and embedded in trusted local structures. The findings show that digital microfinance models improve income stability, financial literacy, and confidence, yet they also risk reinforcing existing exclusions of literacy, household power dynamics, and intersectional barriers that are not addressed. The research underscores that empowerment must be understood as more than access, considering legitimate agency, i.e. the ability to control,

decide, and benefit from financial tools independently and sustainably. Therefore, future interventions must prioritize targeted digital literacy programs, especially for older and less literate women; inclusive and gender-sensitive tech design that considers low literacy and shared phone use; strong community-based support systems through SHGs and NGOs to build trust and guide adoption; policy safeguards around data privacy and ethical use of algorithmic decision-making. This study affirms that when microfinance institutions and policymakers align technological innovation with grassroots realities, they can drive meaningful and equitable economic development for Karnataka's marginalized women—transforming them from passive borrowers to empowered financial agents of change.

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Appendix

Survey Instrument

Dear Respondents,

Thank you for taking part in this survey. This study explores how microfinance and technology are helping marginalized women in Karnataka improve their livelihoods. Your responses will remain confidential and are for academic research purposes only. Participation is voluntary, and you may skip any question. There are no right or wrong answers—we just ask for your honest opinions and experiences.

SECTION A: Demographic Profile

1. Name (Optional): _____
2. Age:
   - Below 20
   - 21–30
   - 31–40
   - 41–50

- Above 50

3. Education Level:
   - No formal education
   - Primary
   - Secondary
   - Higher Secondary
   - Graduation and above
4. Occupation:
   - Agriculture
   - Small business
   - Domestic work
   - Unemployed
   - Other (please specify): _____
5. Monthly Household Income:
   - Less than ₹5,000
   - ₹5,000–₹10,000
   - ₹10,000–₹20,000
   - More than ₹20,000

SECTION B: Access and Usage of Microfinance

6. How did you first learn about microfinance services?
   - SHGs/SHG Federation
   - NGO
   - Government Scheme
   - Friends/Family
   - Others: _____
7. What type of financial services have you used? *(Select all that apply)*
   - Microcredit
   - Savings
   - Insurance
   - Remittances
   - Others: _____
8. How frequently do you borrow from microfinance institutions (SHG)?
   - Never
   - Once
   - Occasionally
   - Regularly
9. What is the average loan amount you have received?
   - Less than ₹10,000
   - ₹10,000–₹25,000
   - ₹25,000–₹50,000
   - More than ₹50,000
10. Have microfinance services helped improve your income or livelihood?
    - Yes
    - No
    - Not Sure

SECTION C: Technology Access and Usage

11. Do you own or have regular access to a mobile phone?
    - Yes – Basic phone
    - Yes – Smartphone
    - No
12. Do you use any mobile-based financial services (e.g., UPI, mobile banking)?
    - Yes
    - No
13. If so, what services do you use? *(Select all that apply)*
    - Money transfer (e.g., UPI)
    - Savings apps
    - Loan applications
    - Digital literacy or training platforms
    - Others: _____
14. Has mobile technology made it easier for you to access financial services?
    - Strongly agree

- Agree
- Neutral
- Disagree
- Strongly disagree

15. Do you feel safe using mobile-based financial services?
    - Strongly agree
    - Agree
    - Neutral
    - Disagree
    - Strongly disagree

SECTION D: Empowerment and Economic Development

15. Since accessing microfinance and mobile-based financial services, have you experienced any of the following changes/improvements in your life? *(Select all that apply)*
    - Started a business.
    - Increased household income
    - Better control over family finances
    - Improved self-confidence
    - Participated more in community decision-making.
16. Do you feel more financially independent now than before?
    - Yes
    - No
    - Unsure
17. What challenges do you face when using mobile applications to access microfinance?

    _____
    _____
18. What kind of support or training do you feel would help you more?

    _____
    _____
19. In your view, how important are microfinance and technology in empowering women like you? *(Scale of 1 to 5)*
    - 1 – Not important
    - 2 – Slightly important
    - 3 – Moderately important
    - 4 – Important
    - 5 – Very important
20. Any additional comments or suggestions:

    _____
    _____