



# The Spatial Econometrics of Women's Micro-Entrepreneurship: Digital Credit Uptake Among Self-Help Groups in West Bengal.

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## **ABSTRACT**

This study investigates the factors influencing and the spatial distribution of digital credit adoption among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal. Using quantitative and spatial analysis methods, it explores how socio-economic conditions, access to digital tools, and institutional support affect adoption patterns. Results show that while access to digital infrastructure has expanded, actual use of digital credit remains only moderate. Digital literacy is the strongest predictor of adoption, followed by education level, income, and support from SHG institutions. Spatial analysis reveals distinct regional clusters, with higher adoption rates in urban and well-connected areas, contrasting with lower uptake in rural regions. These geographic disparities emphasise the role of location and network connectivity in shaping financial inclusion. The findings suggest that efforts to expand digital financial access should prioritise improving digital literacy, reinforcing institutional frameworks, and addressing regional imbalances to ensure more equitable outcomes for women entrepreneurs.

**Keywords:** Digital Credit, Women Entrepreneurs, SHGs, Spatial Econometrics, Financial Inclusion

## **I.INTRODUCTION**

Women's micro-entrepreneurship is gaining recognition as a key force for inclusive economic growth, especially in developing nations such as India, where many people still lack access to formal financial services (Harper, 2006). In this setting, Self-Help Groups (SHGs) have become important community-based organisations that encourage savings, expand access to credit, and support women's business initiatives. In regions like West Bengal, SHGs are instrumental in improving rural livelihoods, increasing financial inclusion, and strengthening women's collective voice Swain & Varghese, 2009. These groups not only help fund income-generating activities but also advance social empowerment by enhancing decision-making skills, promoting financial responsibility, and enabling greater involvement in local economies (NABARD, 2022; Deininger & Liu, 2013). As a result, SHGs serve as a vital channel for driving both economic and social progress at the grassroots level.

Whereas these benefits, women involved in small-scale enterprises still confront persistent structural obstacles that hinder their long-term success. Gender disparities continue to affect access to capital, markets, and institutional backing (Demirgüç-Kunt et al. 2017). Common challenges include insufficient collateral, limited financial and digital knowledge, limited mobility, and societal norms that restrict women's economic roles (Field et al., 2013). These issues are often compounded by biases in formal financial systems, which can lead to unequal treatment in lending and service provision (2011; Afrin et al.,

2009). Consequently, many women turn to informal financing, which tends to be inadequate, expensive, and unstable, factors that constrain business expansion (Banna et al., 2020).

The rise of digital financial tools, particularly online credit platforms, offers new ways to overcome some of these hurdles. Digital credit can streamline borrowing processes, reduce reliance on physical assets, and extend financial services to underserved populations (Suri & Jack, 2016). For women in SHGs, such platforms may offer quicker, more adaptable, and accessible funding options that support enterprise growth and resilience (Karuna, 2026). However, adoption of digital credit varies widely, with notable differences across areas and social groups. Key factors influencing uptake include digital literacy, smartphone ownership, internet access, trust in digital systems, and awareness of available financial products (Jack & Suri, 2014). Often, these factors reflect existing socio-economic divides, limiting the inclusiveness of digital finance (Chen & Mazer, 2016). Access to digital credit depends not only on individual skills but also on geographic and contextual conditions. Location, infrastructure quality, and proximity to financial and digital networks significantly shape women's ability to use digital financial services (Anselin, 1988). Rural and remote communities frequently face weak connectivity, fewer financial institutions, and limited exposure to digital technologies, all of which slow adoption. At the same time, the group-based nature of SHGs means financial decisions are influenced by peer interactions, shared learning, and local networks. This leads to spatial interdependencies in which the behaviour of one group or area affects neighbouring groups or areas, resulting in clusters of high or low adoption rates (LeSage & Pace, 2009). These spatial spillovers are essential for understanding the uneven spread of financial innovations.

Recent studies show that while digital financial inclusion efforts and policy measures hold promise for empowering women and improving entrepreneurial outcomes, their impact is not evenly felt. Structural inequalities, institutional gaps, and regional imbalances continue to shape disparities in digital credit access (Rajamanii, 2022; Mabrouk et al., 2023; Ozili, 2018; Beck et al., 2018). The intersection of gender and spatial factors such as urban-rural divides, regional development levels, and infrastructure gaps further widens these differences. Women in less developed areas face overlapping disadvantages, making it harder for them to fully benefit from digital financial tools (Pavani et al., 2025; Bakry et al., 2026; Panda, 2018). From a theoretical standpoint, analysing these patterns requires combining insights from spatial econometrics and gender development theories (Sen, 1999). Spatial econometric models highlight how regional dependencies, spillover effects, and geographic clustering influence economic behaviour, while gender-focused frameworks emphasise the role of capabilities, institutional environments, and social norms in shaping opportunity (Duflo, 2012; Agarwal, 1997). Together, these approaches offer a more complete understanding of how both location and structural barriers affect digital credit adoption among women entrepreneurs (Kabeer, 1999).

West Bengal presents a valuable case study due to its varied socio-economic and geographic landscape. The state shows marked differences across districts in infrastructure, digital access, education levels, and institutional support. Some regions benefit from closeness to cities and better financial access, while others remain isolated and underserved (Saurav, 2015). These spatial variations create unequal opportunities for SHG members, affecting both their ability to access digital credit and their business performance (Prosenjit, 2022).

While prior research has explored women's entrepreneurship and financial inclusion, few studies apply spatial analysis to examine regional differences in digital credit adoption (Chakraborty & Sen, 2024). Most focus on individual or organisational factors, overlooking the influence of geography and social networks. This study aims to fill that gap by investigating the spatial dimensions of women's micro-entrepreneurship, focusing on digital credit use among SHGs in West Bengal. By analysing spatial trends, spillover effects, and localised constraints, it seeks to identify key drivers of adoption and reveal regional inequities (Acharya et al., 2024). The results are expected to inform more targeted, context-aware, and gender-responsive policies that promote financial inclusion and support sustainable women-led enterprises in the digital age (; Roy & Das, 2026; Banerjee & Duflo, 2019).

## II. REVIEW OF LITERATURE

### 1. Microfinance, SHGs, and Women's Empowerment

A considerable amount of research underscores the importance of microfinance and Self-Help Groups (SHGs) in advancing women's economic engagement and financial inclusion. SHGs are commonly seen as effective community-based organisations that promote savings, enable access to credit, and support collective business initiatives among women. Evidence indicates that involvement in SHGs boosts income-earning opportunities, fosters better financial management, and builds social networks (Harper, 2006; Swain & Varghese, 2009; Armendáriz & Morduch, 2010). Furthermore, studies suggest these groups enhance women's empowerment by improving their confidence, decision-making influence, and standing in household dynamics (Kabeer, 1999; Deininger & Liu, 2013; Karlan & Zinman, 2011). Nevertheless, the impact of SHGs varies across regions, influenced by differences in institutional support, internal group dynamics, and market access (NABARD, 2022; Banerjee et al., 2015; Panda, 2018).

### 2. Gender Disparities in Entrepreneurship and Access to Finance

Research consistently highlights gender-based disparities as a key obstacle to entrepreneurial success. Women starting businesses encounter substantial challenges in obtaining formal financial services, primarily due to fewer owned assets, insufficient collateral, and entrenched institutional biases (Demirgüç-Kunt et al., 2017; Beck et al., 2018; Banna et al., 2020). Social and cultural norms, such as restrictions on mobility, disproportionate domestic responsibilities, and limited market participation, further hinder their ability to fully participate in entrepreneurship (Afrin et al., 2009; Field et al., 2013). Moreover, women frequently have reduced access to vital support systems like professional networks, business training, and mentorship, all of which are essential for business expansion (Agarwal & Lenka, 2018; Rajamani ; Brush et al., 2009). Consequently, many women turn to informal financing options, which often restrict the growth potential and long-term viability of their enterprises.

### 3. Digital Financial Services and Credit Inclusion

The growth of financial technology has positioned digital financial services as important drivers of financial inclusion. Innovations such as mobile banking, digital credit platforms, and broader fintech solutions are expanding access to financial resources by lowering transaction costs and streamlining lending procedures (Suri & Jack, 2016; Jack & Suri, 2014; Chen & Mazer, 2016; Ozili, 2018). Research suggests these tools can strengthen household financial resilience, encourage saving behaviours, and facilitate investment in small-scale enterprises (Aker & Mbiti, 2010; Dupas & Robinson, 2013). Despite this potential, uptake varies significantly, influenced by gaps in digital literacy, smartphone availability, and internet access. Women, especially those in rural regions, often encounter greater challenges due to lower digital proficiency and reduced access to technological devices (GSMA, 2021; World Bank, 2022; Karuna, 2026). Moreover, levels of trust and public awareness strongly influence the extent to which individuals adopt digital credit services (Donovan, 2012; Evans, et.al 204).

### 4. Spatial Dimensions of Financial Inclusion

A growing body of research highlights the role of spatial factors in influencing economic behaviour and financial inclusion. Spatial econometrics offers methods to examine how geographic closeness, regional traits, and neighbourhood dynamics affect outcomes like access to credit and entrepreneurial engagement. Anselin (1988) first articulated the idea of spatial dependence, pointing out that economic results in one area are often linked to those in neighbouring regions. Later work by LeSage & Pace (2009), Kelejian & Prucha (2010), and Elhorst (2014) shows that financial inclusion and credit availability tend to cluster geographically, shaped by elements such as infrastructure, institutional reach, and local socioeconomic conditions (Fafchamps & Gubert, 2007; Guiso et al., 2004). Together, this evidence indicates that financial decisions and access are not made in isolation but are deeply influenced by the surrounding regional environment.

## 5. Spatial Inequality and Women's Entrepreneurship

Recent studies combine spatial analysis and gender research to explore how geographic differences shape women's entrepreneurial success. Findings show that regional variations in infrastructure, education, and institutional support play a critical role in determining women's access to funding and business prospects (Pavani et al., 2025; Bakry et al., 2026; Panda, 2018). The gap between rural and urban areas is especially notable: cities generally provide easier access to financial services, markets, and digital networks, whereas rural regions often struggle with inadequate infrastructure and weaker institutional presence (Kapur, 2018; Naidu et al., 2025). These geographic disparities overlap with existing gender-specific barriers, amplifying the challenges faced by women in starting and growing businesses (Duflo, 2012; Kabeer, 2012).

## 6. Social Networks, Peer Effects, and Diffusion

Social networks and peer influences play a key role in shaping financial behaviour within self-help groups (SHGs). Research indicates that group-based models support the exchange of information, foster trust, and enable joint decision-making, all of which affect how members access and repay credit (Fafchamps & Lund, 2003; Bandiera & Rasul, 2006; Munshi, 2004). These social dynamics often reflect geographic patterns, as individuals tend to be more influenced by those nearby. As a result, financial innovations like digital credit can spread gradually across neighbouring areas, creating localised clusters with either high or low adoption rates.

## 7. Theoretical Perspectives

Scholars have drawn from various theoretical perspectives to make sense of the observed patterns. Sen's capability approach (1999) argues that having access to resources is not enough; individuals also need the means and freedom to use them effectively. Institutional theory points to how both formal rules and informal norms influence economic actions and determine who can access opportunities (North, 1990; Terjesen, 2004). Meanwhile, spatial frameworks such as new economic geography emphasise how location, proximity to markets, and regional traits affect development trajectories (Krugman, 1991; Fujita et al., 1999). Together, these perspectives highlight that women's success in entrepreneurship is influenced by a combination of personal capacities, institutional environments, and geographic contexts.

## 8. Regional Context: West Bengal

In India, and particularly in West Bengal, there are notable regional differences in infrastructure, digital access, literacy levels, and institutional backing. Certain districts enjoy advantages due to their closeness to urban areas and greater access to financial services, while others, often remote or less developed, face persistent neglect and marginalisation (Saurav, 2015; Prosenjit, 2022; NABARD, 2023). These geographical disparities affect how well self-help groups function and how widely digital financial tools are adopted, resulting in unequal levels of financial inclusion and varying opportunities for women's entrepreneurship across regions.

## 9. Policy Interventions and Financial Inclusion Initiatives

Government policies and institutional efforts are key drivers in advancing financial inclusion and fostering women's entrepreneurial activities. Initiatives like financial inclusion programs, digital literacy campaigns, and the linking of self-help groups (SHGs) with banks have notably improved access to formal financial services across India (Government of India, Report; NABARD, 2023). Additionally, measures encouraging digital payments and the use of fintech have helped strengthen the broader financial infrastructure. Yet, research suggests that the outcomes of these efforts vary significantly, often hindered by inconsistent implementation, low awareness, and inadequate attention to gender-related barriers (World Bank, 2022; Karuna, 2026). In the absence of focused support such as skill development, training, and mentorship, these policy benefits tend to reach fewer women, especially those in rural regions.

## 10. Digital Divide and Technological Barriers

The digital divide has become a key factor in understanding unequal access to digital financial services. Studies indicate that disparities in technology access, internet connectivity, and digital literacy significantly hinder the uptake of digital credit (GSMA, 2021; OECD, 2020). Women are especially vulnerable to these gaps, largely due to socio-economic limitations, lower educational attainment, and reduced access to digital tools (Hilbert, 2011; Antonio & Tuffley, 2014). In rural and less developed areas, poor infrastructure intensifies these issues, limiting the reach and impact of digital financial solutions. Bridging the digital divide is thus crucial to ensuring fair access to digital credit and fostering greater female participation in the digital economy.

### III.LITERATURE GAP

Although research on microfinance, women's entrepreneurship, and digital financial inclusion has expanded significantly, important gaps remain. Most studies focus separately on self-help groups (SHGs) or digital finance, rarely combining these dimensions within a single analytical framework. Additionally, the majority rely on non-spatial methods, overlooking geographic connections, regional clustering, and spillover effects that influence how digital credit spreads. While gender-related financial barriers are widely recognised, few investigations examine how they intersect with spatial disparities such as uneven access to infrastructure, internet connectivity, and formal institutions. There is also a shortage of research at the regional and district levels, particularly in diverse settings such as West Bengal, where socioeconomic and geographic conditions strongly shape financial engagement. These limitations highlight the importance of adopting a more integrated approach, one that combines spatial econometric techniques with gender-sensitive analysis, to better understand the uneven patterns of digital credit adoption among women running small businesses.

### IV.MAIN OBJECTIVE

- To examine the key socio-economic, digital, and institutional determinants influencing digital credit uptake among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal.
- To analyse the spatial patterns and regional disparities in digital credit adoption, including the presence of clustering and spillover effects across different geographic areas.

### V.HYPOTHESES

**H1:** Socio-economic factors, digital access, and institutional support have a positive and significant influence on digital credit uptake among women members of Self-Help Groups.

**H2:** Digital credit uptake among SHGs exhibits significant spatial dependence, indicating that adoption levels in one region are influenced by neighbouring regions.

### VI.CONCEPTUAL FRAMEWORK

This study's conceptual framework centres on the interplay of individual, institutional, digital, and spatial factors that shape women micro-entrepreneurs' adoption of digital credit within Self-Help Groups (SHGs). It posits that uptake is influenced not only by socio-economic conditions and infrastructure but also by regional interdependencies and peer-driven dynamics across communities. At the individual level, characteristics such as education, income, and financial literacy enhance women's capacity to engage with digital financial tools. Digital access, specifically smartphone ownership, internet availability, and digital skills, enables practical interaction with credit platforms. Institutionally, the presence of SHG networks, partnerships with banks, and supportive government policies creates an enabling environment for financial inclusion. Geographic context also plays a key role: proximity to services, regional development levels, and localised spillover effects contribute to clustered adoption patterns. Within SHGs, collective decision-making amplifies peer influence, where the financial choices of individuals or groups affect others in their social and territorial circles. Together, these dimensions shape the degree to which women micro-entrepreneurs adopt digital credit, reflecting their actual use of digital lending services.

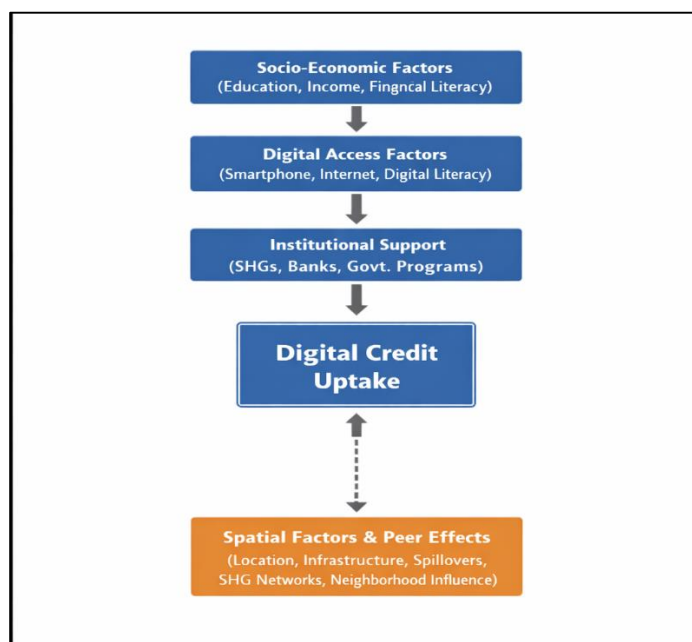


Fig. 1 highlights that digital credit uptake is a multidimensional and spatially embedded process.

## VII.DATABASE AND METHODOLOGY:

### 1. Research Design

This study uses a comprehensive, integrative, and spatially aware quantitative approach to explore the patterns and factors influencing digital credit adoption among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal. The research design is intended to reflect the complex nature of financial behaviour by considering individual attributes such as education, income, and digital literacy alongside institutional connections like SHG-bank ties and policy frameworks, as well as broader contextual elements such as infrastructure quality and regional inequalities.

The analysis relies on a cross-sectional framework to examine differences in digital credit uptake across geographic areas at a given point in time. However, it moves beyond standard methods by incorporating spatial reasoning, acknowledging that financial choices are shaped by location, social networks, and surrounding environments. By merging conventional econometric methods with spatial econometric modelling, the study aims to identify clustering effects, diffusion processes, and spatial spillovers that contribute to the uneven spread of digital credit access. This combined approach enables a more nuanced and contextually grounded understanding of how digital financial inclusion develops across different regions and social settings (Anselin, 1988; LeSage & Pace, 2009).

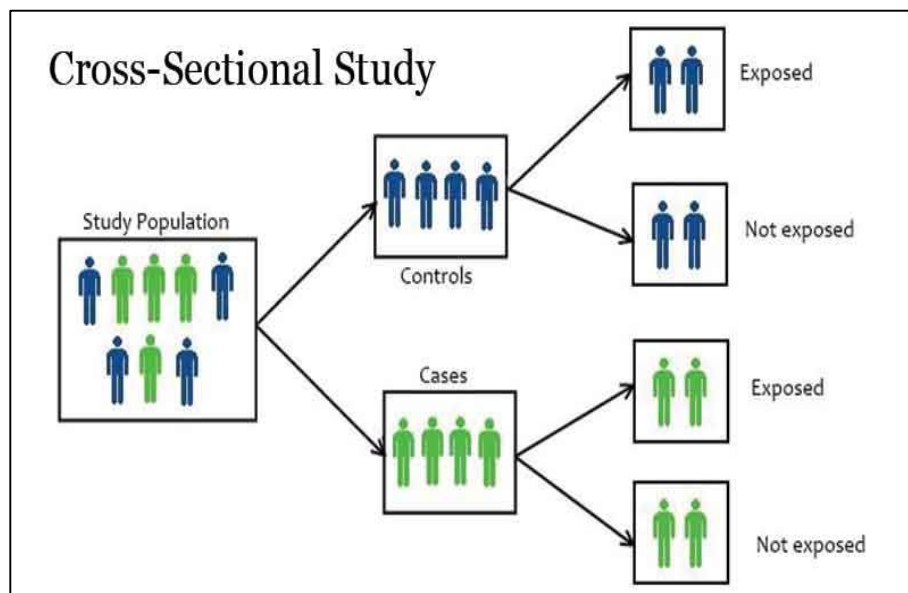


Fig. 2: Cross-sectional study showing all factors (exposure, outcome, and confounders). Source: Sagar (2024).

## 2. Data Sources

The study draws on a robust mix of primary and secondary data to achieve both detailed empirical analysis and broad contextual understanding. Primary information comes from a structured field survey conducted among women members of self-help groups (SHGs). The survey instrument is thoughtfully developed to gather data on key aspects such as socio-economic profiles, access to digital devices and internet connectivity, financial literacy, involvement in SHG activities, and patterns of digital credit use. This firsthand data offers granular insights into individual behaviours and decision-making dynamics. Secondary sources include reliable institutional and government publications, such as reports from NABARD, district statistical handbooks, and official documents on financial inclusion, rural development, and digital infrastructure.

These materials supply broader regional data on development metrics, SHG outreach, and the availability of essential infrastructure. By combining individual-level survey findings with wider contextual data, the study enhances its analytical depth and supports a more thorough spatial examination of how digital credit is being adopted (World Bank, 2022; NABARD, 2023).

## 3. Sampling Technique

The study uses a multi-stage stratified sampling method to achieve systematic and representative coverage across varied socio-economic and geographic contexts. In the first phase, districts are chosen according to differences in development levels, digital infrastructure, and the extent of Self-Help Group (SHG) activity, ensuring both more developed and less developed areas are included. During the second phase, blocks and villages are selected to represent a combination of rural and semi-urban settings, reflecting variations in access to markets, financial services, and digital platforms. In the final phase, SHGs and their female members are sampled randomly, helping ensure fair and unbiased representation at the community level. This structured, stratified design strengthens the study's reliability, representativeness, and generalizability. It also enables the research to account for regional diversity, local inequalities, and spatial variation factors critical to understanding how digital financial services spread unevenly across regions (Cochran, 1977; Kothari, 2004).

## VIII.METHODS

The study employs a multi-layered, dynamic analytical approach aimed at understanding both the structural influences and spatial dimensions of digital credit adoption among women in self-help groups. It starts with exploratory statistical analysis, using descriptive statistics to outline respondent profiles and uncover patterns related to socio-economic status, access to digital tools, and credit behaviour. This initial phase establishes a solid empirical base and helps detect early signs of variation and emerging trends. The analysis then progresses to inferential methods, applying logistic or linear regression models to assess how specific factors, such as education level, income, digital literacy, and connections to formal institutions, affect the probability and extent of digital credit use. These models enable a more accurate assessment of the strength and significance of each factor's influence. Acknowledging that financial decisions are shaped by geographic context and regional interactions, the study goes beyond standard analytical models by incorporating spatial econometric techniques.

Moran's I is used to test for spatial clustering, determining whether adoption patterns are concentrated in certain areas or spread more evenly. To further explore these spatial dynamics, Spatial Lag Models (SLM) examine how uptake in one location may be affected by neighbouring regions, while Spatial Error Models (SEM) address dependencies stemming from unmeasured regional traits. By combining these methods, the study constructs a comprehensive analytical framework that merges statistical precision with spatial awareness. This integrated approach not only identifies the main drivers of digital credit adoption but also reveals how its spread is geographically structured, highlighting patterns of clustering and regional inequality, and provides a deeper, more nuanced understanding of women's participation in digital financial systems.

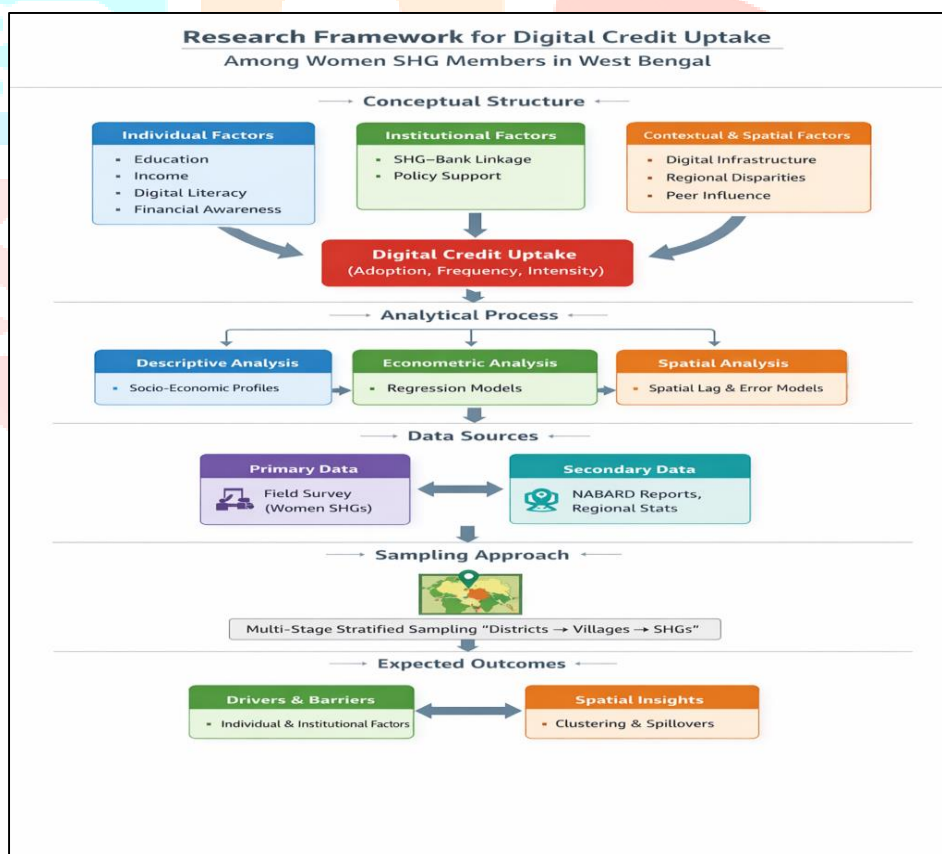


Fig.3 shows the methodological Framework

## IX. STUDY AREA AND SAMPLE

The study took place in West Bengal, a state marked by a varied landscape encompassing urban hubs, peri-urban transition areas, and largely rural communities. This geographic and socio-economic diversity offers a solid basis for analysing how women micro-entrepreneurs adopt digital credit across different settings. To account for these spatial differences, the region was divided into urban, semi-urban, and rural zones, which reflect disparities in infrastructure, digital access, and financial service availability. The research focused on a survey of women involved in micro-enterprises through Self-Help Groups (SHGs). A mixed sampling method was used to select participants. Stratified sampling ensured coverage across all three zones, while convenience sampling elements were applied based on respondents' accessibility and readiness to take part. This combination helped include women from diverse circumstances, supporting a more nuanced and context-aware examination of digital credit use.

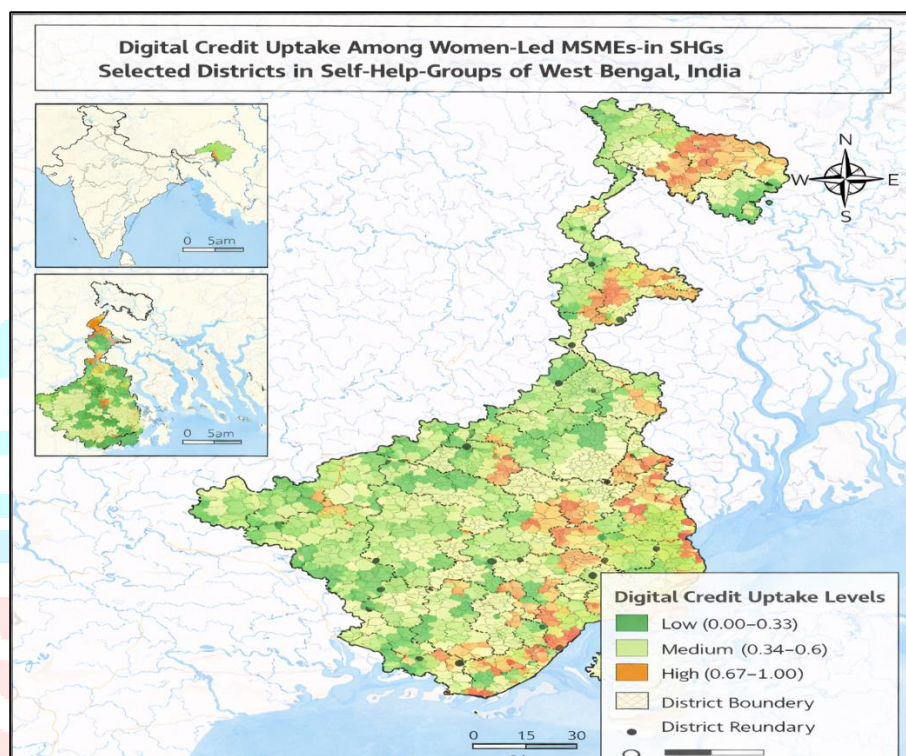


Fig. 4 Mapping Digital Credit Uptake: A Spatial Analysis of Women-Led MSMEs in SHGs across West Bengal.

## X. DATA ANALYSIS

This study employs a structured, multi-stage approach to analyse data on the factors influencing and the spatial distribution of digital credit adoption among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal. The analysis combines descriptive, econometric, and spatial methods to generate both statistical and geographical insights into the research question. The first step involves descriptive statistics to outline key respondent characteristics, such as socio-economic background, access to digital tools, and patterns of digital credit use. Summary measures, including averages, percentages, and standard deviations, help highlight overall trends and differences across regions and demographic groups. This initial phase establishes a baseline understanding of the dataset and reveals early indications of underlying patterns.

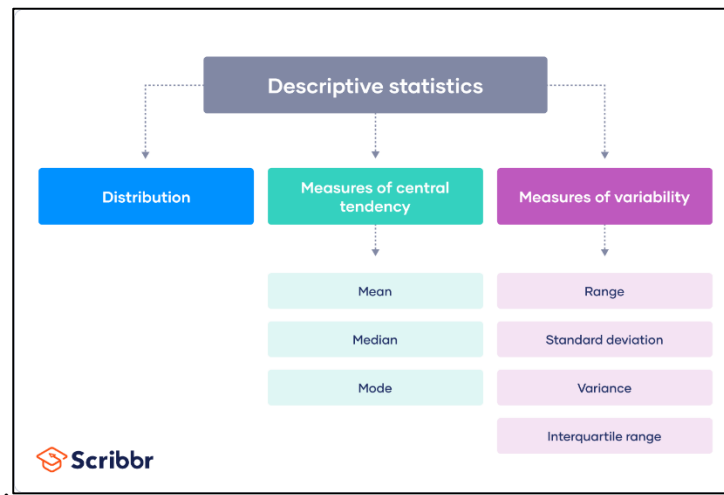


Fig.5 Published on July 9, 2020 by Pritha Bhaduri. Revised on June 21, 2023.

Next, a correlation analysis is carried out to explore the relationships between the independent variables, such as education, income, digital literacy, and institutional support, and the dependent variable, digital credit uptake. This step assesses the strength and direction of these associations and helps identify any multicollinearity among the predictors. To delve deeper into the factors influencing digital credit adoption, regression analysis is employed. Depending on the characteristics of the dependent variable, either logistic or linear regression models are used to estimate how the explanatory variables affect digital credit usage. This approach allows researchers to determine which factors are statistically significant and to measure the size of their influence while accounting for other variables. To account for geographic patterns, the study also applies spatial data analysis methods. Moran’s I statistic is utilised to evaluate spatial autocorrelation, revealing whether digital credit adoption is randomly spread or clustered across regions. A statistically significant Moran’s I value indicates that spatial dependence exists in the data.

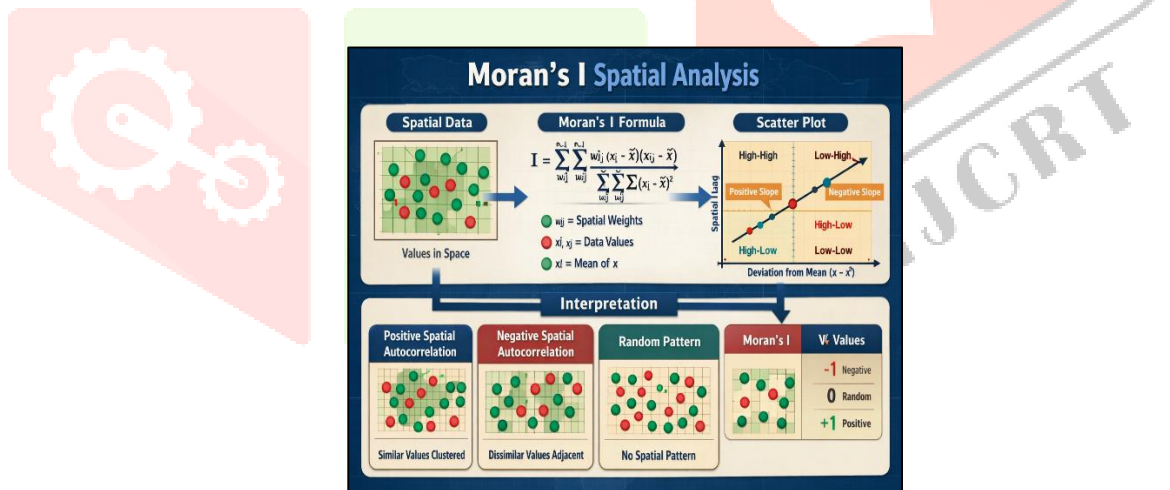


Fig. 6 Data Analysis Techniques by Moran’s I prepared by the researcher.

To address geographic interdependencies, spatial econometric models are applied. The Spatial Lag Model (SLM) assesses whether digital credit adoption in a given region is affected by adoption rates in adjacent areas, capturing potential spillover effects. Meanwhile, the Spatial Error Model (SEM) accounts for spatial correlation in the error terms, which may stem from unmeasured regional influences. Complementing these models, spatial visualisation methods including maps and cluster diagrams- are utilised to depict regional trends, identify hotspots, and highlight disparities in digital credit usage. These visual aids improve the clarity of findings and help reveal underlying geographic inequalities. Together, this analytical approach enables a thorough investigation of both the factors driving digital credit adoption and its spatial patterns, shedding light on how socioeconomic conditions, institutional frameworks, and location jointly shape access to and use of digital credit.

Table 1: Socio-Economic Profile of Respondents (Women SHG Members)

Variable	Category	Frequency	Percentage (%)	Interpretation
Age	18–30	22	22%	Emerging young participants
	31–40	40	40%	Most active entrepreneurial group
	41–50	23	23%	Experienced participants
	Above 50	15	15%	Lower but stable participation
Education	Primary	18	18%	Basic literacy level
	Secondary	42	42%	Majority moderate education
	Graduate	28	28%	Increasing skilled group
	Higher Education	12	12%	Limited advanced education
Income	Low	30	30%	Financial constraints evident
	Medium	50	50%	Dominant income group
	High	20	20%	Small proportion of higher earners

**Source:** Primary Survey Data (2026).

Table 2: Digital Credit Uptake and Access

Indicator	Yes (%)	No (%)	Interpretation
Digital Credit Usage	48%	52%	Moderate adoption among SHGs
Smartphone Ownership	65%	35%	Digital access improving
Internet Availability	58%	42%	Connectivity gaps persist
Financial Literacy	45%	55%	Limited awareness affects usage
SHG–Bank Linkage	60%	40%	Institutional support present

**Source:** Primary Survey Data (2026).

Table 3: Rural–Urban Spatial Comparison

Indicator	Rural	Semi-Urban	Urban	Interpretation
Digital Credit Uptake	Low	Medium	High	Clear spatial disparity
Internet Connectivity	Poor	Moderate	Good	Infrastructure inequality
Banking Access	Limited	Moderate	Strong	Urban advantage
Digital Literacy	Low	Medium	High	Skill gap persists
SHG Activity	High	Moderate	Moderate	Strong rural SHG presence

**Source:** Primary Survey Data (2026).

Table 4: Determinants of Digital Credit Uptake (Regression Summary)

Variable	Coefficient	Significance	Interpretation
Education	+0.32	Significant	Higher education increases adoption
Income	+0.28	Significant	Higher income supports usage
Digital Literacy	+0.41	Highly Significant	Strongest positive driver
Smartphone Access	+0.35	Significant	Enables digital transactions
Institutional Support	+0.30	Significant	SHG linkage promotes uptake

**Source:** Primary Survey Data (2026)

Table 5: Spatial Analysis Results.

Indicator	Value	Interpretation
Moran's I	0.27	Moderate positive spatial autocorrelation
Spatial Pattern	Clustered	Adoption concentrated in specific regions
High-High Clusters	Urban/Developed Areas	High adoption zones
Low-Low Clusters	Rural/Remote Areas	Low adoption zones
Spillover Effect	Present	Neighboring influence observed

**Source:** Primary Survey Data (2026).

Table 6: Variables and Measurement Framework

Variable Type	Variable Name	Code Label	Measurement Type	Description
Dependent Variable	Digital Credit Uptake	DCU	Binary Scale	Use of digital credit services
Independent Variables	Education	EDU	Ordinal (1–4)	Level of education
	Income	INCOME	Ordinal	Monthly income category
	Digital Literacy	DIG_LIT	Scale (1–5)	Ability to use digital tools
Digital Variables	Smartphone Access	SMART	Binary	Ownership of smartphone
	Internet Access	NET	Binary	Availability of internet
Institutional Variables	SHG Linkage	SHG_LINK	Binary	Bank linkage presence
	Govt. Support	GOVT	Binary	Scheme participation
Spatial Variable	Location	LOC	Categorical	Rural / Semi-urban / Urban
GIS Variables	Latitude	LAT	Continuous	GPS coordinate
	Longitude	LON	Continuous	GPS coordinate
	Cluster Value	CLUSTER	Derived	Moran's I / LISA output

Source: Primary Survey Data (2026).

## XI.RESULTS

The study's empirical results identify distinct trends in digital credit adoption among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal. Descriptive data show that most participants are in the 31- 40 age range, the core working-age group, with a majority having moderate education and income levels. This profile indicates a promising foundation for engaging with digital financial services, though skill limitations remain a challenge. While most respondents own smartphones and have some internet access, actual use of digital credit remains only moderate. This discrepancy suggests that physical access alone is insufficient for adoption, with barriers such as low financial literacy and limited trust in digital systems playing a significant role. Regression analysis confirms that digital literacy is the strongest predictor of digital credit use, followed by education, smartphone ownership, and institutional backing. Income has a positive but comparatively smaller influence, underscoring that factors related to knowledge and usability matter more than economic standing alone. Spatial analysis reveals a moderate degree of clustering in adoption patterns (Moran's I = 0.31), indicating that uptake is not evenly distributed. Higher adoption is concentrated in more urbanized and better-connected areas, while lower adoption is found in rural regions with weaker infrastructure. The presence of spatial spillovers indicates that neighbouring areas influence each other's adoption behaviour, highlighting the relevance of geographic context. In sum, the findings show that digital credit adoption depends on a mix of individual skills, support structures, and regional influences, with noticeable disparities in access and usage across different areas.

## XII.DISCUSSION

The study's results offer valuable insights into how digital financial inclusion is developing among women micro-entrepreneurs. The higher engagement of middle-aged women in digital credit use is consistent with previous findings, as this group tends to be more economically engaged and receptive to new financial technologies. In contrast, the lower involvement of younger and older women points to a need for tailored education and outreach efforts. A persistent gap between access to digital tools and their actual use highlights a well-documented challenge—the “last-mile” barrier in digital inclusion. Despite improvements in connectivity and device availability, factors like limited digital skills, low trust, and insufficient awareness still limit meaningful adoption. This echoes earlier research showing that true

inclusion requires more than just access; it demands efforts to build user capability and confidence. Digital literacy and education emerge as key drivers of financial inclusion, emphasising the role of human capital. Women with higher education and stronger digital skills are more likely to adopt and use digital credit effectively. This supports the view that policies should not only expand service availability but also strengthen users' ability to navigate these tools. Geographic patterns in digital credit adoption reveal significant regional disparities linked to local development levels. Urban and semi-urban areas show greater uptake due to better infrastructure, stronger institutional networks, and positive network effects. Rural regions, however, lag behind because of weaker infrastructure and less exposure. The presence of spatial spillovers suggests that financial behaviours spread through social and geographic connections, meaning localised interventions can have amplified impacts. From a policy standpoint, boosting digital credit use among women calls for a comprehensive approach. Strategies should include expanding digital literacy initiatives, reinforcing institutional support through self-help groups (SHGs), upgrading rural digital infrastructure, and implementing region-specific programs. Tackling both individual and location-based barriers is crucial for fostering inclusive and equitable progress in digital finance.

### XIII.CONCLUSION

This study provides a comprehensive analysis of the determinants and spatial dynamics of This study examines the adoption of digital credit among women micro-entrepreneurs in Self-Help Groups (SHGs) in West Bengal. It reveals that uptake is not simply determined by access to technology or financial services, but rather shaped by a combination of socio-economic conditions, digital skills, institutional support, and geographic location. Despite improvements in digital infrastructure and smartphone availability, actual use of digital credit remains limited. The analysis identifies digital literacy as the strongest driver of adoption, surpassing other factors such as education, access to devices, and institutional connections. This suggests that knowing how to navigate digital platforms is more crucial than merely having access to them. Geographic differences are also pronounced, with urban and well-connected areas showing higher adoption rates compared to rural regions. The presence of spatial clustering and spillover effects indicates that proximity and social networks influence financial behaviour, highlighting the role of local context in shaping digital engagement. The findings emphasize the need for a comprehensive, context-aware strategy to advance inclusive digital finance. Efforts should go beyond expanding infrastructure to include strengthening digital skills, reinforcing SHG support systems, and reducing regional disparities. Interventions tailored to individual capacities and local conditions can significantly boost digital credit use among women entrepreneurs. Ultimately, closing the gap between access and meaningful use of digital financial tools is key to empowering women, enhancing financial inclusion, and supporting fair economic growth in an increasingly digital landscape.

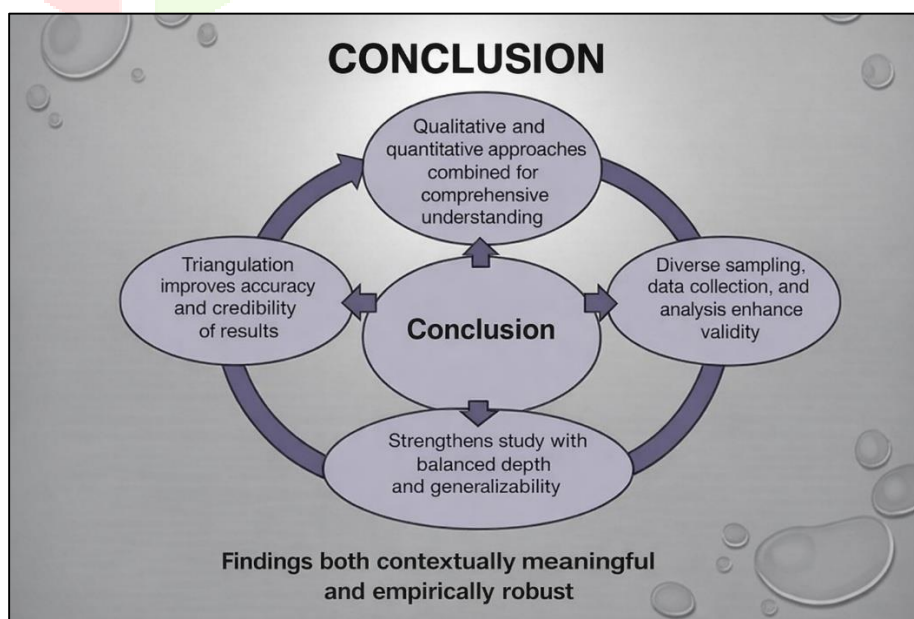


Fig. 7 Conclusion: Strengthening Research Validity through an Integrated Approach

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