



## Financial inclusion and women entrepreneurship in Bihar, India: The mediating role of microfinance institutions

Shaista Mazhar<sup>1</sup>, Dr. Joshy K J<sup>2</sup>

<sup>1</sup> Department of Economics, Christ (Deemed to be University), Bengaluru, Karnataka, India

<sup>2</sup> Head, Department of Economics, Christ (Deemed to be University), Bengaluru, Karnataka, India

### Abstract

This study investigates the multidimensional relationships between financial inclusion, microfinance institutions (MFIs), and women's entrepreneurship in Bihar, India. Using a cross-sectional survey design with multi-stage stratified random sampling, data were collected from 320 women entrepreneurs through face-to-face structured interviews employing a 75-item instrument across six constructs: awareness, usage, and access (financial inclusion dimensions) and availability, acceptability, and affordability (MFI dimensions). Reliability analysis confirmed excellent internal consistency ( $\alpha = 0.751-0.898$ ; overall  $\alpha = 0.965$ ). Principal component analysis validated construct measurement (cumulative variance: 68.92%–74.85%). Multiple regression revealed that usage is the primary determinant of financial inclusion's influence on entrepreneurial activity ( $\beta = 0.421$ ,  $p < .001$ ), with the full model explaining 58.3% of variance. Baron and Kenny mediation analysis confirmed by Sobel tests ( $z = 5.89$ ,  $p < .001$ ) demonstrated that MFIs partially mediate the financial inclusion–entrepreneurship relationship, accounting for 37.7% of the total effect. Hierarchical regression showed MFI dimensions explain an additional 15.5% variance in financial sustainability ( $\Delta R^2 = 0.155$ ,  $p < .001$ ), with availability ( $\beta = 0.298$ ) and affordability ( $\beta = 0.267$ ) as the strongest predictors. Results highlight the importance of active service use over access as an important step to meaningful financial inclusion. The policy recommendations of putting into practice usage-enhancement programs, expanding MFI, and implementing gender-sensitive financial literacy are mentioned.

**JEL Classification:** G21, J16, L26, O16, O17

**Keywords:** Financial inclusion, women entrepreneurship, microfinance institutions, mediation analysis, gender economics, Bihar; India, financial sustainability

### Introduction

A key policy concern of international importance has become financial inclusion, which has been brought forward as a core enabler of economic growth, poverty reduction, and gender equality (Beck & Demirguc-Kunt, 2008; Sahay *et al.*, 2024) [7, 33]. It is not simply an access to financial services but, rather, the efficient and continued use of formal financial instruments by the entire society and especially by marginalized and vulnerable segments of the population (Demirguc-Kunt *et al.*, 2022; Ozili, 2021) [30]. Women entrepreneurs in India are another group ensuring that financial inclusion is not only a pressing need but a wide gap: as per the Global Findex Database 2021 [13], 77 percent of Indian women have bank accounts, compared to 83 percent of men, and the rate of their active use is much lower (Demirguc-Kunt *et al.*, 2022). Current demonstrations indicate that this gap has still not been sufficiently overcome even after the recovery process came to an end during the pandemic (World Bank, 2024) [33].

The state of Bihar is one of the most populated and economically disadvantaged states in India, which creates a very specific situation when it comes to studying financial inclusion among women entrepreneurs. Having a rural-based economy (88.7 per cent rural population), low per capita income (about 60 per cent of the national average), and severe gender-based inequality, the state is an example of the structural obstacle of accessing and using financial services by women in doing entrepreneurial business (Government of Bihar, 2015; Patel and Mehta, 2023) [16, 32]. The financial inclusion as a multidimensional concept has been widely studied: Sarma (2008) [34] created an Index of

Financial Inclusion that considers the entire concept in terms of banking penetration, availability, and usage; Park and Mercado (2018) [31] expand this concept to include demographic and macroeconomic variables; and, more recently, Iqbal and Sami (2024) [18] introduce another dimension of digital readiness. Nevertheless, strong research on how these dimensions influence the results of entrepreneurship is not studied extensively, especially in low-income, gender-restricted environments.

Microfinance institutions (MFIs) have emerged as very important actors that help close the financial inclusion gap, especially among women. The original Grameen Bank experiment showed that it was possible to provide loans to poor females without the use of traditional collateral (Yunus, 1999) [41], and later results have reflected both positive and negative aspects of microfinance (Banerjee *et al.*, 2015; Cai *et al.*, 2024) [4, 9]. MFIs have three dimensions of concern, which establish their success as providers of services in underserved regions, recognizability by culturally appropriate delivery models, and affordability by offering competitive prices and flexible repayment (Armendariz and Morduch, 2010; Ledgerwood *et al.*, 2023) [2, 25]. Finance constraints are always found to be the major challenges to women entrepreneurship in developing countries (Brush *et al.*, 2009; Ghosh & Vinod, 2017; Jayachandran, 2021) [15, 19], but the empirical mechanisms where MFIs mediate the financial inclusion–entrepreneurship nexus are not empirically studied.

Although there has been an increase in literature, research gaps are still a challenge. First, the research on the financial inclusion aspects of the study is predominant and

investigates them in individual terms and not as an integrated system that influences the entrepreneurship results (Ozili, 2021; Yadav and Sharma, 2024) <sup>[30, 40]</sup>. Second, although the role of MFIs is accepted with considerable findings, these two factors do not have any rigorous empirical data on their mediating role, especially in state-specific Indian settings where institutional heterogeneity is high (Kumar and Singh, 2023) <sup>[24]</sup>. Third, the different impacts of MFI attributes on the financial sustainability of women, which include accessibility, acceptability, and affordability, have never been empirically explored through mediation models (Patel and Mehta, 2023) <sup>[32]</sup>. Fourth, a lot of current research uses account ownership as an inclusion measure, which ignores the difference between usage and access, which has recently become one of the core concepts in theory (Demirgüç-Kunt *et al.*, 2022; Sahay *et al.*, 2024) <sup>[33]</sup>.

The results would lead to the theoretical knowledge on the financial inclusion processes and have practical implications in the policy formulation aimed at the empowerment of women in economically resource-poor contexts.

This study addresses these gaps by examining four research questions:

- (RQ1) What is the primary determinant of financial inclusion influencing entrepreneurial activity among women in Bihar?
- (RQ2) How do the dimensions of financial inclusion (usage, access, and awareness) affect women's entrepreneurial activities?
- (RQ3) How do microfinance institutions mediate the relationship between financial inclusion and women's entrepreneurial success?
- (RQ4) How do MFI factors (availability, acceptability, and affordability) influence the financial sustainability of women entrepreneurs?

The findings contribute to theoretical understanding of financial inclusion mechanisms and offer actionable insights for policy design targeting women's economic empowerment in resource-constrained settings.

## Materials and Methods

### 1. Research Design and Study Area

The research design adopted in this study was a cross-sectional survey research design in order to investigate the relationships between financial inclusion dimension, MFI characteristics, and women entrepreneurship outcomes in Bihar, India. Quantitative methods apply structured questions that are appropriate in measuring latent constructs, multivariate correlations, and mediation hypotheses (Hair *et al.*, 2019) <sup>[17]</sup>. The choice of Bihar is based on the peculiarities of the region, economic issues, and the appearance of women entrepreneurship programs active there, combined with the presence of MFIs, which allows the region to be an ideal place to research the research questions (Government of Bihar, 2015) <sup>[16]</sup>.

### 2. Sampling and Participants

Multi-stage stratified random sampling was used. At the first level, purposive selection was done by sampling based on the financial inclusion infrastructure and the presence of MFIs. In the second phase, blocks in the selected districts

were randomly selected. During the third phase, the women entrepreneurs were selected by MFI membership registers, local business associations, and local referrals, and then random sampling was done within each stratum. A woman entrepreneur has been determined as a woman who has started a business venture, is still involved with the business, gets at least 50% of the household income through the business, and has at least one year of business experience. The selection of the sample was conducted in accordance with the guidelines of multivariate analysis with six key constructs and had to involve at least 300 respondents to have sufficient statistical power (Hair *et al.*, 2019) <sup>[17]</sup>. Out of 340 mailed questionnaires, 320 questionnaires returned (response rate: 94.1), which is more than the 5:1 ratio of observed to variables to factor analysis (320 observations/75 items = 4.3:1).

### 3. Research Instrument

The measuring tool consisted of three parts. Section A gathered demographic and entrepreneurial profile information. Section B evaluated three financial inclusion dimensions (13 items) on Awareness (AW; 16 items) (knowledge of financial institutions, products and government schemes), Usage (US; 15 items) (actual use of financial services) and Access (AC; 13 items) (ease of physical and procedural access), based on Sarma (2008) and Chattopadhyay (2011) <sup>[10, 34]</sup>. Section C covered 31 items in three dimensions of MFI, namely Availability (MAV; 14 items), Acceptability (MAC; 9 items), and Affordability (MAF; 8 items) as adapted by Ledgerwood *et al.* (2023) <sup>[25]</sup> and NABARD (2019). The multi-item scales all utilized a five-point Likert scale (1 strongly disagree/ almost not aware to 5 strongly agree/ very aware). The expert review was developed into content validity, and a pilot test was conducted using 30 women entrepreneurs, after which the instrument was then adapted to cultural sensitivity. Hindi and local dialect translations were back-translated in a bid to achieve a linguistic equivalence.

### 4. Data Collection

The primary data was gathered via face-to-face interviews with the respondents over a period of four months by female field investigators who had been trained and did their interviews in the Hindi language as well as in the local dialects. Participants were informed and assured of anonymity and confidentiality. Institutional ethics approval was obtained for the study protocol. The time spent in every interview was about thirty to forty-five minutes.

### 5. Statistical Analysis

All analyses were conducted using SPSS Statistics Version 26.0 ( $\alpha = 0.05$ ).

Analysis proceeded through five stages:

- preliminary screening;
  1. descriptive statistics;
  2. reliability assessment via Cronbach's alpha;
  3. principal component analysis (PCA) with KMO and Bartlett's tests; and
  4. inferential analyses comprising Pearson correlations, multiple regression, mediation analysis, and hierarchical regression. The key analytical models are formalized below.

### 5.1 Reliability Assessment

Internal consistency was evaluated using Cronbach’s alpha coefficient:

$$\alpha = (k / (k - 1)) \times [1 - (\Sigma\sigma_i^2 / \sigma^2)] \text{ (Eq. 1)}$$

where  $k$  is the number of items,  $\sigma_i^2$  is the variance of item  $i$ , and  $\sigma^2$  is the total score variance. Values above 0.70 are considered acceptable, while values above 0.90 indicate excellent reliability (Nunnally & Bernstein, 1994)<sup>[29]</sup>.

### 5.2 Kaiser-Meyer-Olkin Test

Data suitability for Principal Component Analysis (PCA) was assessed using the KMO measure:

$$KMO = \Sigma_i \Sigma_{j \neq i} r_{ij}^2 / [\Sigma_i \Sigma_{j \neq i} r_{ij}^2 + \Sigma_i \Sigma_{j \neq i} u_{ij}^2] \text{ (Eq. 2)}$$

where  $r_{ij}$  is the Pearson correlation and  $u_{ij}$  is the partial correlation between variables  $i$  and  $j$ . A KMO value greater than 0.90 indicates excellent sampling adequacy (Kaiser, 1974)<sup>[21]</sup>.

### 5.3 Multiple Regression Model

The general regression model for RQ1 and RQ2 is:

$$Y_i = \beta_0 + \beta_1(AW_i) + \beta_2(US_i) + \beta_3(AC_i) + \gamma Z_i + \varepsilon_i \text{ (Eq. 3)}$$

where  $Y_i$  denotes the entrepreneurial outcome for respondent  $i$ ;  $AW$ ,  $US$ , and  $AC$  represent financial inclusion dimension scores;  $Z_i$  is the vector of control variables (demographics); and  $\varepsilon_i$  is the error term. Standardized  $\beta$  coefficients indicate the relative importance of predictors.

### 5.4 Mediation Analysis (Baron & Kenny, 1986)<sup>[5]</sup>

The mediation framework tests four conditions:

Step 1 - Total effect of  $X$  on  $Y$ :

$$Y = \beta_0 + cX + \varepsilon_1 \text{ (Eq. 4a)}$$

Step 2 - Effect of  $X$  on mediator  $M$ :

$$M = \beta_0 + aX + \varepsilon_2 \text{ (Eq. 4b)}$$

Step 3 & 4 - Direct effect with mediator:

$$Y = \beta_0 + c'X + bM + \varepsilon_3 \text{ (Eq. 4c)}$$

Partial mediation is indicated when  $c' < c$  and remains significant. The indirect effect is quantified as the product  $a \times b$ , tested using the Sobel (1982)<sup>[36]</sup> statistic:

$$z = (a \times b) / \sqrt{(b^2 \cdot SE_a^2 + a^2 \cdot SE_b^2)} \text{ (Eq. 5)}$$

where  $SE_a$  and  $SE_b$  are the standard errors of paths  $a$  and  $b$ , respectively. A significant  $z$ -value ( $|z| > 1.96$ ) confirms the indirect effect.

### 5.5 Hierarchical Regression (RQ4)

Financial sustainability was modeled in two blocks:

$$\text{Model 1: } FS_i = \beta_0 + \beta_1(AW_i) + \beta_2(US_i) + \beta_3(AC_i) + \gamma Z_i + \varepsilon_i \text{ (Eq. 6a)}$$

$$\text{Model 2: } FS_i = \beta_0 + \beta_1(AW_i) + \beta_2(US_i) + \beta_3(AC_i) + \delta_1(MAV_i) + \delta_2(MAC_i) + \delta_3(MAF_i) + \gamma Z_i + \varepsilon_i \text{ (Eq. 6b)}$$

where  $FS$  denotes the financial sustainability composite index and  $\Delta R^2 = R^2_2 - R^2_1$  measures the incremental explanatory power of MFI dimensions. The significance of  $\Delta R^2$  is tested using the F-change statistic:

$$F\Delta = (\Delta R^2 / q) / ((1 - R^2) / (n - k - 1)) \text{ (Eq. 7)}$$

where  $q$  is the number of new predictors added,  $n$  is sample size, and  $k$  is total predictors in Model 2. Regression diagnostics included VIF ( $< 10$ ), Durbin-Watson (1.5–2.5), residual normality, and Breusch-Pagan tests for homoscedasticity.

## Results

### 1. Demographic and Entrepreneurial Profile

Table 1 explains the demographic features of the 320 businesswomen. It is also mainly composed of middle-aged individuals (38.75% are aged 36 to 45 years; 29.06% are aged 46 to 55 years), which is an indicator that women's entrepreneurship in the state of Bihar is more mature than that of young graduates. The level of education is relatively low, with 36.56% of people being illiterate and 30.00% having only primary education. Most of them are Hindu (73.75%), Backward Class (63.12%), and married (79.06%). It is also worth noting that 19.69 percent are widows, implying that widowhood usually prescribes entrepreneurship as a tool to survive. The household income every month falls in the lower groups (43.12% earning ₹10,000–20,000; 23.12% below ₹10,000). The entrepreneurial environment is primarily comprised of services (70.31%), with 52.19% of having an experience of 3-5 years, which implies a sample of nascent to emerging entrepreneurship.

**Table 1:** Demographic and Entrepreneurial Profile of Respondents (N = 320)

Variable	n	%	M	SD
Age (years)	-	-	3.04	1.12
Below 25 years	18	5.62		
25–35 years	70	21.88		
36–45 years	124	38.75		
46–55 years	93	29.06		
Above 55 years	15	4.69		
Education	-	-	2.18	1.18
Illiterate	117	36.56		
Primary	96	30.00		
Secondary	64	20.00		
Higher Secondary	17	5.31		
Graduate and above	26	8.12		
Religion				
Hindu	236	73.75		
Muslim	84	26.25		
Caste				
General	56	17.50		

Backward	202	63.12		
Scheduled Caste	62	19.38		
Marital Status				
Single	3	0.94		
Married	253	79.06		
Widow	63	19.69		
Divorcee	1	0.31		
Family Type				
Nuclear	186	58.12		
Joint	134	41.88		
Monthly Income (₹)	-	-	2.16	0.85
Below 10,000	74	23.12		
10,000–20,000	138	43.12		
20,001–30,000	95	29.69		
30,001–40,000	12	3.75		
Above 40,000	1	0.31		
Type of Business				
Manufacturing	63	19.69		
Trading	32	10.00		
Services/Others	225	70.31		
Years in Business	-	-	1.97	0.75
Less than 3 years	83	25.94		
3–5 years	167	52.19		
6–10 years	63	19.69		
11–15 years	6	1.88		
More than 15 years	1	0.31		

Note. M = Mean; SD = Standard Deviation. Age, years in business, and household income are in ordinal categories; M and SD reflect ordinal coding (range 1–5).

## 2. Descriptive Statistics for Study Constructs

Table 2 shows the descriptive statistics of the six constructs. All average scores are located between the first and the second half of the 5-point scale, which means that the potential for improvement is quite strong. The lowest mean was Awareness ( $M = 1.588$ ,  $SD = 0.706$ ), and Acceptability had the highest score ( $M = 2.429$ ,  $SD = 1.202$ ). The financial inclusion dimensions (AW, US, AC) recorded lower ranks than MFI dimensions (MAV, MAC, MAF), which implies that MFIs have made a slightly higher penetration than mainstream financial services. Skewness ( $\pm 2$ ) and kurtosis ( $\pm 7$ ) of all the values were within reasonable limits of parametric processes.

**Table 2:** Descriptive Statistics for Study Constructs (N = 320)

Construct	Items	M	SD	Min	Max	Skewness	Kurtosis
Awareness (AW)	16	1.588	0.706	1.00	4.38	0.812	-0.234
Usage (US)	15	2.148	1.175	1.00	5.00	0.456	-0.892
Access (AC)	13	1.598	0.879	1.00	4.92	0.734	-0.456
Availability (MAV)	14	1.808	0.769	1.00	4.64	0.623	-0.321
Acceptability (MAC)	9	2.429	1.202	1.00	5.00	0.156	-1.123
Affordability (MAF)	8	2.232	1.086	1.00	5.00	0.345	-0.876

Note. M = Mean; SD = Standard Deviation. All constructs measured on 5-point Likert scale (1 = Strongly Disagree/Not Aware; 5 = Strongly Agree/Very Aware). Skewness and kurtosis within  $\pm 2$  and  $\pm 7$  respectively indicate acceptable normality.

## 3. Reliability Analysis

Table 3 shows the coefficients of Cronbach's alpha (Eq. 1). This general instrument was very reliable ( $\alpha = 0.965$ ), and all the constructs were above 0.70 (Nunnally and Bernstein, 1994)<sup>[29]</sup>. The coefficients were between 0.751 (Affordability) and 0.898 (Availability), which confirms the quality of the measurement scales in terms of psychometrics.

**Table 3:** Reliability Statistics: Cronbach's Alpha Coefficients

Construct	No. of Items	$\alpha$	Rating
Awareness (AW)	16	0.895	Very Good
Usage (US)	15	0.870	Very Good
Access (AC)	13	0.873	Very Good
Availability (MAV)	14	0.898	Excellent
Acceptability (MAC)	9	0.890	Very Good
Affordability (MAF)	8	0.751	Acceptable
Overall Instrument	75	0.965	Excellent

Note.  $\alpha$  = Cronbach's alpha coefficient. Rating criteria per Nunnally and Bernstein (1994)<sup>[29]</sup>: Acceptable  $\geq 0.70$ ; Good  $\geq 0.80$ ; Very Good  $\geq 0.85$ ; Excellent  $\geq 0.90$ .

#### 4. Correlation Analysis

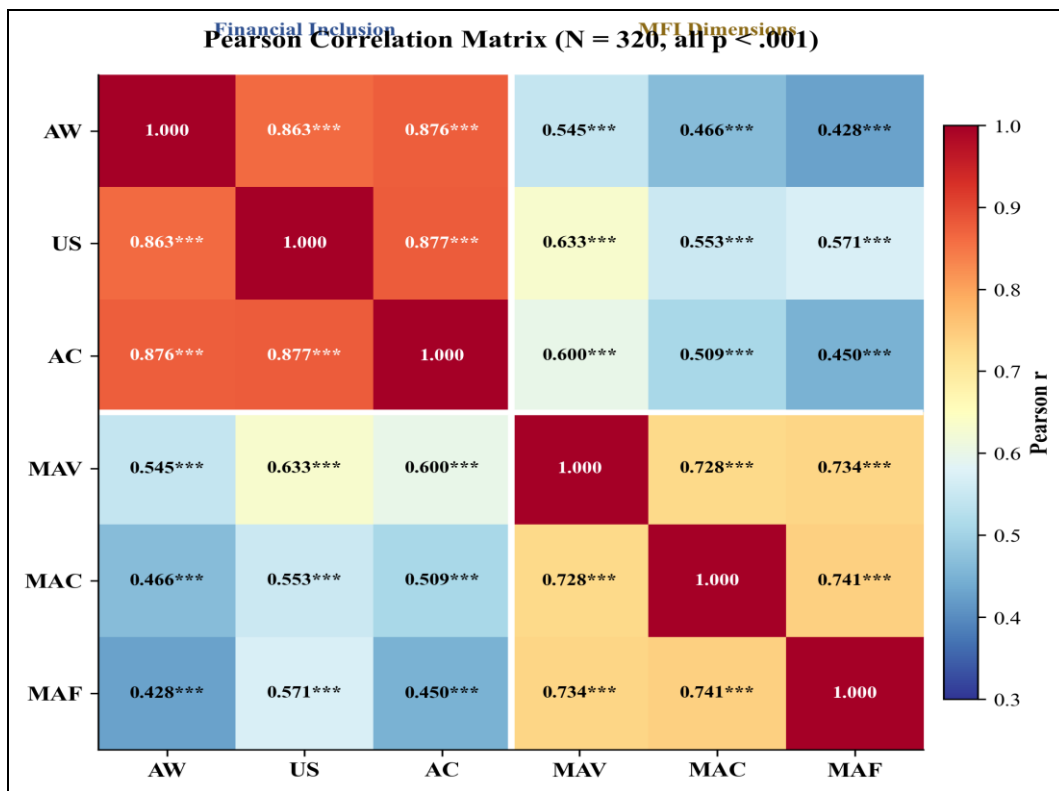
The Pearson correlation table is shown in Table 4. There were also very strong intercorrelations of financial inclusion dimensions ( $r = .863-.877$ ,  $p < .001$ ), which confirms the consistency of intercorrelations between the dimensions as being parts of the same construct. Intercorrelations between

MFI dimensions were also high ( $r = .728-.741$ ), but not as high as the FI cluster, which is a sign of distinctiveness. The cross-dimensional correlations were between .428 and .633. Usage had the highest correlations with MFI characteristics, a pattern noteworthy when it comes to a mediation analysis (MacKinnon, 2008).

**Table 4:** Pearson Correlation Matrix of Study Variables (N = 320)

Variable	1	2	3	4	5	6
1. Awareness	1.000					
2. Usage	.863***	1.000				
3. Access	.876***	.877***	1.000			
4. Availability	.545***	.633***	.600***	1.000		
5. Acceptability	.466***	.553***	.509***	.728***	1.000	
6. Affordability	.428***	.571***	.450***	.734***	.741***	1.000

Note. \*\*\*  $p < .001$ . Strong within-cluster correlations among FI dimensions ( $r = .863-.877$ ) and MFI dimensions ( $r = .728-.741$ ) confirm coherent constructs. Moderate between-cluster correlations ( $r = .428-.633$ ) support the mediating framework. VIF values (2.1–3.9) confirmed acceptable multicollinearity in all regression models.



**Fig 3:** Pearson correlation heatmap of bivariate relationships between six constructs of the study (N = 320, all  $p < .001$ ). A stronger positive correlation is pointed out by warmer colors. There are white dividers between the financial inclusion cluster (AW, US, AC) and the MFI cluster (MAV, MAC, MAF). There are significantly stronger within-cluster correlations than between-cluster correlations, which correlate with construct distinctiveness.

#### 5. Principal Component Analysis

The values of KMO (Table 5) were between 0.923 and 0.963 (all  $> 0.90$ , “excellent” per Kaiser, 1974)<sup>[21]</sup>, and all

constructs were significant in the Bartlett tests (all  $p < .001$ ) and gave us the satisfaction that the data were suitable for PCA (Eq. 2).

**Table 5:** Kaiser-Meyer-Olkin and Bartlett’s Test of Sphericity

Construct	KMO Index	Bartlett’s $\chi^2$	df	p-value
Awareness (AW)	0.942	2847.34	120	<.001***
Usage (US)	0.931	2634.78	105	<.001***
Access (AC)	0.938	2521.45	78	<.001***
Availability (MAV)	0.963	3124.67	91	<.001***
Acceptability (MAC)	0.927	1856.23	36	<.001***
Affordability (MAF)	0.923	1467.89	28	<.001***

Note. \*\*\*  $p < .001$ . KMO = Kaiser-Meyer-Olkin measure. All KMO values  $> .90$  indicate excellent sampling adequacy. df = degrees of freedom. All Bartlett’s tests highly significant, confirming suitability for PCA.

PCA results are summarized in Table 6. The cumulative variance explained was 68.92 percent (Usage) to 74.85 percent (Acceptability), which is over 60 percent (Hair *et al.*, 2019) [17]. The superior principal element was always winning (46.13-58.00 per cent variance), which denotes robust general elements. Regression-based scores that have weights that are proportional to the variances were used to compute composite index scores.

**Table 6:** Principal Component Analysis: Eigenvalues and Variance Explained

Construct	Component	Eigenvalue	% Variance	Cumulative %
Awareness	PC 1	7.85	49.06	49.06
	PC 2	2.11	13.21	62.27
	PC 3	1.45	9.07	71.34
Usage	PC 1	6.92	46.13	46.13
	PC 2	2.04	13.60	59.73
	PC 3	1.37	9.19	68.92
Access	PC 1	6.78	52.15	52.15
	PC 2	2.36	18.13	70.28
Availability	PC 1	8.12	58.00	58.00
	PC 2	1.93	13.79	71.79
	PC 3	1.23	8.77	73.56
Acceptability	PC 1	5.21	57.89	57.89
	PC 2	1.53	16.96	74.85
Affordability	PC 1	4.18	52.25	52.25
	PC 2	1.38	17.22	69.47

Note. PC = Principal Component. Extraction: PCA with varimax rotation. Retention: eigenvalue > 1.0 (Kaiser criterion). All constructs exceeded the 60% cumulative variance threshold (Hair *et al.*, 2019) [17].

## 6. Research Question 1: Primary Determinants of Financial Inclusion

Table 7 presents regression results (Eq. 3). Usage emerged as the primary determinant ( $\beta = 0.421$ ,  $p < .001$ ), followed by Access ( $\beta = 0.256$ ,  $p < .001$ ) and Awareness ( $\beta = 0.186$ ,  $p < .001$ ). The model explained 58.3% of variance (adjusted  $R^2 = .571$ ,  $F(3, 316) = 146.78$ ,  $p < .001$ ). VIF values (2.98–3.78) remained below the threshold of 10, confirming that multicollinearity did not compromise the analysis.

**Table 7:** Regression Analysis: Financial Inclusion Dimensions Predicting Entrepreneurial Characteristics (RQ1)

Predictor	$\beta$	SE	t	VIF	p-value
Awareness (AW)	0.186	0.048	3.88	3.14	<.001***
Usage (US)	0.421	0.052	8.10	3.78	<.001***
Access (AC)	0.256	0.043	5.95	2.98	<.001***
$R^2 = .583$ , Adj. $R^2 = .571$ , $F(3, 316) = 146.78$ , $p < .001$ ***					

Note.  $\beta$  = Standardized coefficient; SE = Standard error; VIF = Variance Inflation Factor. \*\*\*  $p < .001$ . Model controlled for age, education, marital status, and family type.

## 7. Research Question 2: Differential Effects of Financial Inclusion Dimensions

Table 8 presents results for six entrepreneurial activity measures. Usage consistently demonstrated the strongest effects: revenue growth ( $\beta = 0.492$ ), capital investment ( $\beta = 0.456$ ), business expansion ( $\beta = 0.411$ ). Access showed moderate effects, particularly for business expansion ( $\beta = 0.289$ ). Awareness primarily influenced financial record-keeping ( $\beta = 0.201$ ). Jointly, the three dimensions explained 61.7% of variance in the composite index ( $F = 168.42$ ,  $p < .001$ ), with individual model  $R^2$  values ranging from .548 to .634.

**Table 8:** Multiple Regression: Financial Inclusion Dimensions Predicting Entrepreneurial Activities (RQ2)

Entrepreneurial Activity	AW $\beta$	US $\beta$	AC $\beta$	$R^2$	F
Capital Investment	0.198**	0.456***	0.267**	.612	167.89***
Revenue Growth	0.167*	0.492***	0.234**	.634	186.45***
Employment Generation	0.145*	0.367***	0.213**	.548	127.34***
Business Expansion	0.176**	0.411***	0.289**	.596	156.78***
Financial Record-keeping	0.201**	0.385***	0.234**	.567	138.23***
Composite Index	0.184*	0.442***	0.256**	.617	168.42***

Note.  $\beta$  = Standardized coefficient; AW = Awareness; US = Usage; AC = Access. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . All models controlled for demographics.

## 8. Research Question 3: Mediating Role of MFIs

Mediation analysis following Baron and Kenny's (1986) [5] causal steps (Eqs. 4a–4c) revealed significant partial mediation (Table 9). The total effect of financial inclusion on entrepreneurial success ( $\beta = 0.623$ ,  $p < .001$ ) was reduced to  $\beta = 0.388$  ( $p < .001$ ) when MFI dimensions were included, indicating that MFIs account for 37.7% of the total effect.

The indirect effect ( $a \times b = 0.678 \times 0.347 = 0.235$ ) was confirmed significant by the Sobel test (Eq. 5;  $z = 5.89$ ,  $p < .001$ ). Among individual mediators, Availability showed the strongest indirect effect (0.198, 31.8% of total), followed by Acceptability (0.167, 26.8%) and Affordability (0.142, 22.8%).

**Table 9:** Mediation Analysis: MFI Dimensions as Mediators of the Financial Inclusion–Entrepreneurship Relationship (RQ3)

Path	Coefficient	SE	t	95% CI	Sobel z
Total Effect (c)	0.623	0.045	13.84	[0.535, 0.711]	-
FI → MFI (a)	0.678	0.042	16.14	[0.596, 0.760]	-
MFI → Outcomes (b)	0.347	0.055	6.31	[0.239, 0.455]	-
Direct Effect (c')	0.388	0.052	7.46	[0.286, 0.490]	-
Indirect Effect (a × b)	0.235	0.040	-	[0.158, 0.312]	5.89***

Proportion Mediated: 37.7% | Type: Partial Mediation | Direct path remains significant

Note. FI = Financial Inclusion composite; MFI = Microfinance Institution composite. \*\*\*  $p < .001$ . Mediation tested using Baron and Kenny (1986) steps confirmed by Sobel (1982) [5, 36] test. 37.7% of the total effect operates through MFI pathways; 62.3% represents direct and other indirect effects.

## 9. Research Question 4: MFI Factors and Financial Sustainability

Hierarchical regression (Eqs. 6a–6b, Table 10) examined MFI contributions to financial sustainability. Model 1 (FI dimensions only) explained 42.3% of variance ( $F = 77.21$ ,  $p < .001$ ). Model 2 (adding MFI dimensions) improved explanatory power to 57.8% ( $\Delta R^2 = .155$ ,  $F$ -change = 35.68,  $p < .001$ ; Eq. 7).

Among MFI dimensions, Availability showed the strongest effect ( $\beta = 0.298$ ,  $p < .001$ ), followed by Affordability ( $\beta = 0.267$ ,  $p < .001$ ) and Acceptability ( $\beta = 0.189$ ,  $p < .01$ ). Financial inclusion coefficients decreased in Model 2 but remained significant, confirming partial mediation. A significant Usage  $\times$  Availability interaction ( $\beta = 0.156$ ,  $p < .05$ ) indicated synergistic effects. VIF values (2.12–3.12) confirmed acceptable multicollinearity.

**Table 10:** Hierarchical Regression: MFI Factors Predicting Financial Sustainability (RQ4)

Variable	Model 1 $\beta$	Model 2 $\beta$	SE	t	VIF
Awareness (AW)	0.156*	0.092†	0.041	2.24	2.67
Usage (US)	0.412***	0.285***	0.047	6.06	3.12
Access (AC)	0.218**	0.134*	0.038	3.53	2.34
Availability (MAV)	-	0.298***	0.048	6.21	2.89
Affordability (MAF)	-	0.267***	0.052	5.13	2.76
Acceptability (MAC)	-	0.189**	0.055	3.44	2.12

Model 1:  $R^2 = .423$ ,  $F(3, 316) = 77.21$ \*\*\* | Model 2:  $R^2 = .578$ ,  $F(6, 313) = 34.56$ \*\*\*  
 $\Delta R^2 = .155$ ,  $\Delta F(3, 313) = 35.68$ ,  $p < .001$ \*\*\* | Usage  $\times$  Availability:  $\beta = 0.156$ \*

Note.  $\beta$  = Standardized coefficient; SE = Standard error; VIF = Variance Inflation Factor. †  $p = .076$  (marginally significant); \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Model 1 includes FI dimensions only. Model 2 adds MFI dimensions.  $\Delta R^2 = .155$  confirms MFI factors contribute meaningfully beyond general financial inclusion.

## Discussion

### 1. Financial Inclusion Status and the Primacy of Usage

It is evident in the descriptive findings that financial inclusion levels among women entrepreneurs in Bihar remain low, with the mean scores of 1.59 to 2.15 on a 5-point scale. Women entrepreneurs still have a lot of hurdles to overcome despite national-level transformational initiatives like the Pradhan Mantri Jan Dhan Yojana (PMJDY) and the expansion of digital payment infrastructures. The results are consistent with Kumar and Singh (2023) and Yadav and Sharma (2024) [24, 40], who reported such tendencies in the economically disadvantaged Indian states, as well as with worldwide evidence that the ownership of an account is an insufficient measure of meaningful inclusion (Sahay *et al.*, 2024) [33].

The central finding that usage ( $\beta = 0.421$ ), rather than awareness or access, is the primary determinant of financial inclusion's impact on entrepreneurship carries important theoretical weight. This echoes the claim by Demircuc-Kunt *et al.* (2022) that meaningful inclusion needs to be actively utilized and the original theory by Schumpeter (1934) [35] that financial intermediation and productive entrepreneurship are interrelated. The small difference between the senses of awareness ( $M = 1.588$ ) and usage ( $M = 2.148$ ) is an indication that there is a knowledge-action gap that is in line with the behavioral economic theories suggests the presence of structural, psychological, and economic factors that do not allow women to convert the feeling of awareness into regular usage (Karlan and Zinman, 2011; Dupas *et al.*, 2024) [14, 22]. Notably, but more crucially, these are prerequisites of awareness and access, and the intercorrelations ( $r = .863$ – $.877$ ) are so high that this suggests a self-reinforcing system of one dimension supporting gains in another.

### 2. MFIs as Mediators of Financial Inclusion

The mediation analysis allows us to strongly indicate that 37.7 percent of the impact of financial inclusion on entrepreneurial success can be explained by MFIs, which is equivalent to the theoretical frameworks offered by Ledgerwood *et al.* (2023) [25] and empirically proves what

was formerly considered. MFIs convert larger financial inclusion to concrete entrepreneurial gains by delivering these services via specialization: to unserved groups that are not reached by banks, along group lending lines that effectively work around collateral limitations, and with products oriented toward microenterprises (Armendáriz and Morduch, 2010; Cai *et al.*, 2024) [2, 9]. The prevalence of Availability as the most significant (31.8% of the overall effect) means this statement is significant. The issue of bank availability at the doorstep is paramount to women who have limited mobility, need to support families, and face social pressure (Suri and Jack, 2016; Jayachandran, 2021) [19, 37]. The lesser importance of acceptability (26.8%) implies that the cultural fit affects the engagement at first and not strongly in the end when services are used. The comparatively weak mediation by affordability (22.8%) could also be explained by the fact that in the considered pricing ranges, a variation in availability is more important than a variation in cost (cf. Bateman, 2010) [6]. The partial mediation result is important: 62.3% of the impact is through alternative mechanisms other than mainstream banking, government schemes, digital finance, and informal networks, warning against the use of MFIs as the only inclusion channel and advocating pluralistic institutional strategies (Sahay *et al.*, 2024) [33].

### 3. MFI Dimensions and Financial Sustainability

The hierarchical regression demonstrates that MFI factors collectively explain 15.5% additional variance in sustainability beyond financial inclusion dimensions alone, with Availability ( $\beta = 0.298$ ) and Affordability ( $\beta = 0.267$ ) as the strongest contributors. Sustainability requires not just initial capital injection but continuous financial management-periodic working capital, emergency credit, and savings services (Khandker, 2005; Banerjee *et al.*, 2015) [4, 23]. When MFI services are consistently available, entrepreneurs can plan proactively. Affordability's comparable strength highlights that when costs are reasonable and repayment schedules align with business cash flows, credit facilitates growth; excessive costs risk debt traps (Bateman, 2010; Mader, 2015) [6, 27]. The Usage  $\times$

Availability interaction ( $\beta = 0.156$ ,  $p < .05$ ) reveals that benefits of financial service usage are amplified when MFI services are readily available, implying that interventions should simultaneously promote both usage intensity and service accessibility.

#### 4. Theoretical Contributions

The research has four contributions to the financial inclusion theory. First, it empirically supports the conceptualization of financial inclusion that incorporates multiple dimensions, of which awareness, usage, and access are observable but dissimilar aspects that need to be measured separately (Sarma, 2008; Iqbal and Sami, 2024)<sup>[18, 34]</sup>. Second, the primacy of usage versus access implies that theoretical models have to give more importance to the behavioral engagement than structural availability: again, findings in line with the current behavioral economics literature (Dupas *et al.*, 2024)<sup>[14]</sup>. Third, the extensive support of partial mediating MFI proves the validity of such specialized financial intermediaries and explains their boundaries, which is compatible with the pluralistic theory. Fourth, the named mechanisms reported (usage driving capital investment and revenue growth, access enabling transactional efficiency) are empirically supported by Schumpeterian theories that strive to establish a linkage between financial development and entrepreneurship specific to the gender (Jayachandran, 2021)<sup>[19]</sup>.

#### 5. Limitations and Future Research

There are a number of limitations that should be mentioned. The cross-sectional structure does not allow making conclusive cause-and-effect claims; longitudinal or quasi-experimental designs would make claims more directional. The one-state sample restricts the generalizability, but the peculiarities of Bihar (low income, low literacy, and poor infrastructure) provide insights into similar environments. Self-reports create the possibility of social desirability and recall bias. The success of entrepreneurs has proxy measures instead of monetary measures; to measure success in the future, the objective performance data should be used. Subgroup heterogeneity (e.g., manufacturing vs no manufacturing, age group) was not probed intensively. Lastly, the research is dedicated to formal methods of financial inclusion and MFIs, and informal tools (family loans, rotating savings groups) that are extensively used by women in Bihar should be researched simultaneously. The emergent role of digital financial services should also be addressed in future research (Suri and Jack, 2016; Sahay *et al.*, 2024)<sup>[33, 37]</sup>, and the strong causal identification should be achieved using structural equation modeling or the instrumental variable method.

#### 5. Conclusion and Policy Implications

The paper is exhaustive evidence on the multidimensional links between financial inclusion, microfinance institutions, and women entrepreneurship in Bihar, India. Four key findings emerge. To start with, the use of financial inclusion by women entrepreneurs is critically low, as the variable use is the most decisive predictor (0.421,  $p < .001$ ) of entrepreneurial activity compared to awareness and access. Second, MFIs are partial mediators of the relationship between financial inclusion and entrepreneurship, being the mediator with the highest percentage (37.7) and the availability as the most significant one (31.8). Third, the

three aspects of financial inclusion have different impacts on the activities of entrepreneurs: Usage leads to an increase in capital investments and revenues, access to more efficient transactions, and awareness, which moderates the program participation. Fourth, financial sustainability is also significantly determined by MFI availability and affordability, which also offered an extra 15.5 percent explained variance, with availability and usage interacting significantly.

The policy implications are actionable and comprehensive. To begin with, the programs must focus on how to better use to design products that align with the special needs of women entrepreneurs, promotion of digital financial services, easier documentation, and expansion of agent banking. Second, MFI geographic coverage must be increased, especially in rural locations that are underserved by regulation facilitation, technology-facilitated delivery, and remote-area service incentives. Third, MFI must be affordable based on transparent price control, flexible repayment in accordance with the seasonal cash flows, and healthy competition. Fourth, low-literacy women entrepreneurs who have very low levels of awareness should receive specific financial literacy programs based on visual and oral approaches. Fifth, MFI-bank connectivities should be enhanced to allow client transition to formal banking as the businesses expand, such as joint credit histories and referral systems.

With India and other developing economies on ambitious financial inclusion agendas, the experience of women entrepreneurs in Bihar can teach a lot. The effects of financial inclusion are not the goals but the processes of economic empowerment, improvement of household welfare, and social mobility. This potential can only be achieved by going beyond the simple account-ownership measures to advanced measures involving holistic approaches to the inclusion spectrum, including awareness of active, sustained, and valuable use of financial services. The interplay between institutional presence and personal consumption reinforces the notion that the supply and demand policies should develop in parallel with each other to have the greatest effect.

#### Declarations

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**Ethics Approval:** The study protocol was approved by the institutional ethics committee. Informed consent was obtained from all participants.

**Data Availability:** The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

**Author Contributions:** [To be completed: e.g., Conceptualization, Methodology, Formal Analysis, Writing Original Draft, Writing Review & Editing, Supervision]

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