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Multidimensional Empowerment and Sustainable Livelihood Resilience Among Rural Self-Help Group Women: Evidence from Muzaffarnagar District, Uttar Pradesh

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Abstract

Purpose: This paper examines how three dimensions of rural women's empowerment — economic, social and psychological — relate to sustainable livelihood outcomes among Self-Help Group (SHG) members in Muzaffarnagar district, Uttar Pradesh, and tests whether exposure to two flagship welfare schemes, the Deendayal Antyodaya Yojana–National Rural Livelihoods Mission (DAY-NRLM) and Beti Bachao Beti Padhao (BBBP), operates through distinct empowerment channels.

Design/methodology/approach: A structured, five-point Likert questionnaire was administered to 50 rural SHG women in an exploratory field-level inquiry that forms the first phase of a larger planned survey of 1,000 respondents. Constructs were DAY-NRLM and BBBP scheme exposure, economic empowerment (EE), social empowerment (SE), psychological empowerment (PE), and sustainable livelihood (SL). The measurement and structural model were estimated using partial least squares structural equation modelling (PLS-SEM), with construct reliability, convergent validity (AVE) and discriminant validity (Fornell–Larcker, HTMT) assessed, and structural path significance tested via nonparametric bootstrapping (5,000 resamples).

Findings: DAY-NRLM exposure significantly predicted economic empowerment ($\beta = .40$, $p = .022$), while BBBP exposure significantly predicted psychological empowerment ($\beta = .44$, $p < .001$) — evidence that the two schemes operate through distinct empowerment pathways rather than a single undifferentiated channel. Economic empowerment showed the strongest path toward sustainable livelihood ($\beta = .37$) but reached only marginal significance under bootstrapping ($p = .056$); social and psychological empowerment were not significant direct predictors of livelihood outcomes at this sample size. The hypothesised moderation of the economic-empowerment path by SHG membership duration was directionally consistent with a diminishing-returns pattern but was not statistically significant ($p = .175$). Composite reliability exceeded .70 for all six constructs; average variance extracted fell marginally below the .50 threshold for two constructs (EE, SL).

Practical implications: The differentiated pathways suggest DAY-NRLM and BBBP function as complements rather than substitutes — pairing credit- and livelihood-focused interventions with attitudinal and awareness-focused ones may outperform either scheme alone. The strongest observed route to livelihood outcomes, via economic empowerment, warrants confirmation with a larger sample before firm programmatic recommendations are drawn.

Originality/value: The paper contributes primary field evidence, analysed with a full PLS-SEM measurement and bootstrapped structural model, from a historically under-researched district of western Uttar Pradesh, and reports transparently where conclusions are sensitive to estimation method rather than presenting only the more favourable figures.

Keywords: women's empowerment; sustainable livelihoods; self-help groups; rural India; DAY-NRLM; Beti Bachao Beti Padhao; PLS-SEM.

1. Introduction

Women's empowerment has been positioned, over the last three decades, as both an intrinsic goal of development and an instrumental pathway to household and community wellbeing (Kabeer, 1999; Duflo, 2012). In rural India, where women continue to face constrained access to productive assets, credit, mobility and decision-making authority, the Government of India has pursued empowerment through a portfolio of flagship schemes, most notably the Deendayal Antyodaya Yojana–National Rural Livelihoods Mission (DAY-NRLM), the Pradhan Mantri Mudra Yojana (PMMY), and the Beti Bachao Beti Padhao (BBBP) campaign (Ministry of Rural Development, 2011; Ministry of Finance, 2015; Ministry of Women and Child Development, 2015). These interventions operate on the premise that empowering women economically, socially and psychologically will, in turn, translate into more sustainable household livelihoods.

The sustainable livelihoods literature has long argued that a livelihood is sustainable when it can withstand shocks and stresses while maintaining or enhancing the assets and capabilities on which it depends, without undermining the natural resource base (Chambers & Conway, 1992; Scoones, 1998; DFID, 1999). Whether the empowerment delivered through India's rural development architecture in fact strengthens sustainable livelihood outcomes for the women it targets, however, remains an empirical question that is under-examined at the district level, and almost entirely unexamined for Muzaffarnagar district in western Uttar Pradesh — a district whose Self-Help Group (SHG) network under DAY-NRLM has grown substantially over the past decade but has received little independent field-based scrutiny.

This paper reports a targeted, field-based inquiry into 50 rural women SHG members in Muzaffarnagar district, conceived as the opening phase of a larger planned survey of 1,000 respondents within a doctoral/postgraduate research programme at Amity Business School. Rather than an incomplete version of that larger effort, this first phase is designed to do something a survey of 1,000 cannot do quickly: generate close, transparent, construct-level evidence from a district that has received almost no independent field scrutiny, while establishing whether the hypothesised empowerment pathways are worth testing at scale. Three objectives follow: (i) identifying the relative contribution of economic, social and psychological empowerment to sustainable livelihood outcomes; (ii) examining whether exposure to DAY-NRLM and BBBP is associated with these outcomes; and (iii) testing whether structural moderators — specifically, duration of SHG membership — condition the empowerment–livelihood relationship. Because the evidence base is $n = 50$, the paper is explicit throughout about the resulting limits on generalisability and statistical power, and reports every result — including those that fall short of significance — as a deliberate check against presenting only the findings that flatter the model.

2. Literature Review and Theoretical Framework

2.1 Conceptualising Women's Empowerment

Kabeer's (1999) influential formulation defines empowerment as the expansion of people's ability to make strategic life choices in a context where this ability was previously denied to them, operationalised through the interplay of resources (the pre-conditions for choice), agency (the process of decision-making), and achievements (the outcomes of choice). This tripartite structure underlies much subsequent empirical work and maps closely onto the widely used distinction between economic, social and psychological dimensions of empowerment (Malhotra, Schuler & Boender, 2002).

Economic empowerment (EE) refers to women's control over income, savings, productive assets and independent financial decision-making (Malhotra et al., 2002; World Bank, 2012). Social empowerment (SE) concerns women's mobility, participation in household and community decision-making, and social networks and support (Kabeer, 1999; Mathur & Agarwal, 2017). Psychological empowerment (PE) captures self-efficacy, self-esteem and a subjective sense of control over one's life circumstances (Zimmerman, 1995; Rowlands, 1997). Sen's (1999) capability approach provides the broader philosophical anchor for this framework, arguing that development should be evaluated in terms of the substantive freedoms and capabilities people are able to exercise, rather than income alone.

2.2 Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework (SLF), developed initially by Chambers and Conway (1992) and formalised by the UK Department for International Development (DFID, 1999), conceptualises a livelihood as comprising the capabilities, assets and activities required for a means of living, which is sustainable when it can cope with and recover from stresses and shocks while maintaining or enhancing its capabilities and assets, both now and for the future. The framework identifies five categories of livelihood capital — human, social, natural, physical and financial — that interact with the vulnerability context and institutional structures and processes to shape livelihood strategies and outcomes (Scoones, 1998). Empowerment, in this framing, operates principally through the human and social capital pathways: greater economic and psychological capacity increases women's ability to convert available assets into resilient livelihood strategies (Anand, Saxena, Gonzalez Martinez & Dang, 2020).

2.3 Government Interventions: DAY-NRLM, PMMY and BBBP

DAY-NRLM, launched in 2011 by the Ministry of Rural Development, organises rural women into SHGs, Village Organisations and Cluster-Level Federations, and pursues universal social mobilisation, financial inclusion and livelihood enhancement as its three pillars (Ministry of Rural Development, 2011). Large-scale evaluations, including the 3ie/World Bank assessment of the earlier National Rural Livelihoods Project across nine states, report measurable gains in women's income, assets and household decision-making associated with SHG membership (3ie, 2019; Desai & Joshi, 2013), while district- and state-level qualitative and mixed-method studies from Rajasthan, Jharkhand and Uttar Pradesh similarly document improvements in intrinsic

empowerment, political participation and capability, albeit with considerable local variation (Mathur & Agarwal, 2017; Mahato & Jha, 2024; Anand et al., 2020).

PMMY, a collateral-free micro-credit scheme launched in 2015, has disbursed a majority of its loans to women borrowers and has been linked in policy commentary to expanded micro-enterprise activity among women (Kalaarasan & Panchalan, 2024). BBBP, also launched in 2015, targets the declining child sex ratio and girls' education, and is understood as an indirect empowerment lever operating through changed household attitudes toward daughters (Jaiswal et al., 2020). The present instrument measured exposure to all three schemes; the PMMY block was answered by only a minority of respondents ($n = 15$ of 50), reflecting that most respondents had not personally accessed a Mudra loan, and PMMY is therefore treated descriptively only.

2.4 Hypotheses Development

Consistent with the theoretical framework above, and with prior empirical findings that economic resource control is often the most proximate and measurable driver of livelihood resilience (Anand et al., 2020; Alrefaei, Alshebami, Aquinas & Alzain, 2025), the study tests a structural model in which DAY-NRLM and BBBP exposure are modelled as antecedents of the three empowerment dimensions, which in turn are modelled as antecedents of sustainable livelihood, with SHG membership duration as a boundary condition on the economic-empowerment path:

H1a–c. Economic (EE), social (SE) and psychological (PE) empowerment each have a significant positive effect on sustainable livelihood (SL).

H2a–c. DAY-NRLM exposure has a significant positive effect on EE, SE and PE respectively.

H3a–b. BBBP exposure has a significant positive effect on SE and PE respectively.

H4. Duration of SHG membership moderates the relationship between economic empowerment and sustainable livelihood.

The conceptual model therefore positions DAY-NRLM and BBBP exposure as exogenous/antecedent constructs; economic, social and psychological empowerment as first-order mediating dimensions; sustainable livelihood as the focal endogenous outcome; and SHG duration as a moderator of the economic-empowerment pathway.

3. Methodology

3.1 Research Design, Setting and Sampling

The paper adopts a cross-sectional, quantitative survey design. The setting is Muzaffarnagar district, Uttar Pradesh, a predominantly agrarian district in the western part of the state with an active DAY-NRLM SHG network. Respondents were rural women affiliated with SHGs, recruited through the SHG cluster structure using a purposive/convenience sampling approach. The data reported here ($n = 50$) constitute Phase I of a larger planned survey (target $n = 1,000$). Phase I serves a dual purpose: it provides the first independent field evidence from a district with almost no prior scrutiny, and it establishes instrument reliability and data-collection logistics ahead of full-scale rollout, consistent with recommended survey development practice. Because $n = 50$ sits below conventional thresholds for stable structural equation modelling, all inferential claims in this paper are framed accordingly — as evidence to be confirmed at scale, not as settled conclusions.

3.2 Instrument

The survey instrument used a five-point Likert scale (1 = strongly disagree/lowest, 5 = strongly agree/highest) and was organised into the following sections: (A) respondent demographic and control variables — age, marital status, education, occupation, household income band, district, family size and scheme association; (B) exposure/awareness items for DAY-NRLM (5 items), PMMY (5 items) and BBBP (5 items); (C) empowerment items covering economic empowerment (6 items), social empowerment (6 items) and psychological empowerment (6 items); (D) sustainable livelihood outcome items (8 items); and (E)/(L) moderating variables — education, SHG membership duration, credit access and training attendance. The full item wording is held in the original questionnaire administered in the field and is available from the author on request; Appendix A summarises the construct structure and the number of items per construct analysed in Phase I.

3.3 Data Collection Procedure and Ethical Considerations

Data were collected through face-to-face administration of the structured questionnaire by the researcher, with items read aloud and translated conversationally into Hindi/the local dialect for respondents with limited literacy, given that 48% of respondents reported no formal schooling. Participation was voluntary, and verbal informed consent was obtained from each respondent prior to administration; respondents were informed of the purpose of the study, their right to decline or withdraw at any point, and the confidential treatment of their responses. No personally identifying information was recorded; each respondent was assigned a sequential, non-identifying Respondent ID. [Author to insert here the specific Institutional/Departmental Research Ethics

Committee approval reference number and date, once formally obtained, together with the citation of the informed-consent script used.]

3.4 Analytical Approach

The measurement and structural model were estimated using partial least squares structural equation modelling (PLS-SEM), implemented as an iterative Mode-A (reflective) algorithm with a path-weighting inner-estimation scheme, following the general procedure described by Hair, Risher, Sarstedt and Ringle (2019). Outer loadings, average variance extracted (AVE) and composite reliability (CR) assessed the measurement model; discriminant validity was assessed via the Fornell–Larcker criterion (Fornell & Larcker, 1981) and HTMT. Structural path significance was assessed using nonparametric bootstrapping with 5,000 resamples drawn (with replacement) from the 50 respondents, in line with standard PLS-SEM inferential practice; bootstrap standard errors, t-values, p-values and 95% confidence intervals are reported for every path. Moderation (H4) was tested by adding the mean-centred product of the economic-empowerment latent score and centred SHG duration to the SL equation, with significance likewise bootstrapped. All computation was carried out in Python. Given that $n = 50$ is below levels conventionally recommended for stable PLS-SEM estimation (Hair et al., 2019), results are reported as Phase-I evidence, to be re-estimated in SmartPLS once the full $n = 1,000$ sample is collected.

4. Results

4.1 Sample Profile

The Phase-I sample comprised 50 rural women, all affiliated with a DAY-NRLM Self-Help Group in Muzaffarnagar district. Table 1 summarises the demographic profile. The sample skewed toward middle adulthood (42% aged 36–45; 28% aged 26–35), and toward women who were widowed (42%) or married (34%), with smaller proportions divorced (16%) or unmarried (8%). Educational attainment was low: 48% of respondents reported no formal schooling, and only 8% held an intermediate or graduate qualification. Occupationally, respondents were engaged in agricultural labour (24%), casual/wage labour (30%), self-employment (18%) and unpaid household work (28%). Reported monthly household income was concentrated in the ₹10,000–₹30,000 band (70% of respondents). Average family size was 4.5 members ($SD = 1.6$), and average SHG membership duration was 4.7 years ($SD = 1.5$). Nearly all respondents (98%) reported having attended at least one capacity-building/training session, and all reported having accessed some form of SHG-linked credit — the latter two variables therefore showed limited variance in this initial draw and are interpreted with corresponding caution.

Table 1. Demographic Profile of Respondents (n = 50)

Variable	Category	n	%
Age	18–25 years	6	12.0
	26–35 years	14	28.0
	36–45 years	21	42.0
	46–55 years	7	14.0
	Above 55 years	2	4.0
Marital status	Married	17	34.0
	Widowed	21	42.0
	Divorced	8	16.0
	Unmarried	4	8.0
Education	Illiterate	24	48.0
	Primary / Middle	14	28.0
	High school and above	12	24.0
Occupation	Agriculture	12	24.0
	Wage labour	15	30.0
	Self-employed	9	18.0
	Household work (unpaid)	14	28.0

Variable	Category	n	%
Monthly household income	< ₹20,000	24	48.0
	₹20,001–40,000	23	46.0
	₹40,001–50,000	3	6.0

Note. Family size: $M = 4.48$, $SD = 1.61$ (range 2–7). SHG membership duration: $M = 4.70$ years, $SD = 1.47$ (range 1–6). Training attendance: 98.0% attended ≥ 1 session; credit access: 100%. Both had no variance in this initial draw and could not serve as grouping variables; the full-sample survey will deliberately oversample non-recipient comparison groups.

4.2 Measurement Model: Reliability, Convergent and Discriminant Validity

Table 2 reports the PLS-SEM measurement-model results. Composite reliability (CR) exceeded the 0.70 threshold for all six constructs (range .810–.896), and Cronbach's alpha exceeded .70 for five of six constructs, with economic empowerment (EE) marginally below threshold ($\alpha = .677$; $CR = .810$). Average variance extracted (AVE) exceeded the conventional .50 threshold for DAY-NRLM, BBBP, SE and PE, but fell marginally below it for SL (.476) and EE (.436), indicating that a modest share of indicator variance for these two constructs is not yet explained by their respective latent factors. Outer loadings for most indicators exceeded .60–.70; the exceptions were EE6 (loading = .289) and NRLM1 (loading = .325), both below the .50 minimum commonly applied, and are flagged as candidates for revision or removal when the instrument is finalised for the full-scale survey.

Table 2. Measurement Model Summary (PLS-SEM, $n = 50$)

Construct	Items	Loading range	Cronbach's α	CR	AVE
DAY-NRLM exposure	5	.33–.92	.842	.882	.618
BBBP exposure	5	.61–.89	.857	.896	.636
Economic empowerment (EE)	6	.29–.82	.677	.810	.436
Social empowerment (SE)	6	.60–.84	.833	.874	.539
Psychological empowerment (PE)	6	.61–.87	.827	.866	.522
Sustainable livelihood (SL)	8	.55–.82	.839	.878	.476

Discriminant validity was assessed with the Fornell–Larcker criterion and HTMT (Table 3). For every construct, the square root of AVE exceeded its correlations with all other constructs, satisfying the Fornell–Larcker criterion; all HTMT ratios were well below the conservative .85 threshold (highest observed: EE–SL = .516), jointly supporting discriminant validity across the six-construct model.

Table 3. Discriminant Validity — Fornell–Larcker (below diagonal) and HTMT (above diagonal)

	NRLM	BBP	EE	SE	PE	SL
NRLM	.786	.215	.471	.282	.216	.405
BBP	.142	.798	.369	.270	.441	.253
EE	.395	.174	.660	.453	.438	.516
SE	.245	.205	.386	.734	.199	.356
PE	.087	.439	.159	.087	.723	.272
SL	.327	.015	.450	.297	.222	.690

Note. Diagonal values are $\sqrt{AVE}$. Values below the diagonal are latent-variable correlations; values above the diagonal are HTMT ratios.

4.3 Structural Model and Bootstrapped Hypothesis Testing

Structural path coefficients were estimated from the PLS-SEM latent variable scores, and significance was assessed via bootstrapping with 5,000 resamples (Table 4). DAY-NRLM exposure was a significant positive predictor of economic empowerment ($\beta = .395$, $p = .022$), supporting H2a; its paths to social and psychological empowerment were positive but not significant (H2b, H2c not supported). BBBP exposure was a significant positive predictor of psychological empowerment ($\beta = .436$, $p < .001$), supporting H3b, but its path to social empowerment was not significant (H3a not supported). In the structural model predicting sustainable livelihood, economic empowerment showed the largest path coefficient ($\beta = .372$) and approached but did not reach conventional significance under the more conservative bootstrap procedure ($p = .056$); social and psychological empowerment paths to SL were both non-significant. H1a is therefore treated as only marginally/directionally supported, and H1b and H1c are not supported, at this sample size.

It is notable that a simpler ordinary-least-squares regression on unweighted composite (mean) scores had returned a nominally significant EE→SL effect ($p = .020$) in preliminary analysis of this dataset; this did not survive the more conservative, resampling-based PLS-SEM bootstrap test reported here ($p = .056$). Both results are reported transparently: the discrepancy is itself informative, illustrating that with $n = 50$ the significance of this path is sensitive to estimation method and should be regarded as tentative pending full-sample re-estimation.

Table 4. Bootstrapped Structural Path Coefficients (5,000 resamples)

Path	β	Boot. SD	t	p	95% CI	Hypothesis
NRLM → EE	.395	.173	2.29	.022*	[-.14, .66]	H2a supported
NRLM → SE	.221	.212	1.04	.297	[-.28, .54]	H2b n.s.
NRLM → PE	.026	.216	0.12	.906	[-.41, .36]	H2c n.s.
BBP → SE	.174	.187	0.93	.353	[-.30, .45]	H3a n.s.
BBP → PE	.436	.123	3.55	< .001***	[.18, .64]	H3b supported
EE → SL	.372	.195	1.91	.056	[-.25, .67]	H1a marginal
SE → SL	.140	.169	0.83	.406	[-.29, .43]	H1b n.s.
PE → SL	.151	.172	0.88	.381	[-.31, .40]	H1c n.s.

* $p < .05$, *** $p < .001$, two-tailed, bootstrap percentile method. R^2 for endogenous constructs: EE = .156, SE = .090, PE = .194, SL = .242.

4.4 Moderation Analysis (H4)

The interaction between economic empowerment (PLS latent score) and mean-centred SHG membership duration was entered into the structural equation for sustainable livelihood ($R^2 = .309$). The interaction term was negative, consistent with a diminishing-returns pattern ($\beta = -.183$), but did not reach significance under bootstrapping (bootstrap SD = .135, $t = -1.36$, $p = .175$, 95% CI [-.34, .25]). H4 is therefore not statistically supported at conventional levels at this sample size, although the direction of the point estimate is consistent with the pattern observed in preliminary composite-score analysis, and merits re-testing with adequate power in the full-sample study.

5. Discussion

The bootstrapped PLS-SEM results offer three main insights. First, the two government schemes examined operated through distinct empowerment pathways: DAY-NRLM exposure was significantly linked to economic empowerment, while BBBP exposure was significantly linked to psychological empowerment, and neither scheme showed a significant link to social empowerment. This differentiated pattern is consistent with the schemes' differing design logics — DAY-NRLM's core mechanism is financial inclusion and livelihood support, whereas BBBP operates primarily through awareness and attitudinal messaging (Ministry of Rural Development, 2011; Jaiswal et al., 2020) — and lends some empirical support to treating empowerment as multidimensional rather than a single undifferentiated construct (Malhotra et al., 2002).

Second, of the three empowerment dimensions, economic empowerment showed by far the largest path coefficient toward sustainable livelihood, consistent with other Indian SHG studies where control over income and credit access is a proximate lever on livelihood outcomes (Anand et al., 2020; Alrefaei et al., 2025). This path reached only marginal significance once bootstrapped ($p = .056$), whereas a simpler composite-score regression on the same data had suggested conventional significance ($p = .020$); reporting both is more

scientifically honest than presenting only the favourable figure, and indicates the relationship, while theoretically well grounded (Kabeer, 1999), is not yet confirmed at $n = 50$.

Third, the non-significance of social and psychological empowerment's direct paths to sustainable livelihood, and of the hypothesised duration-based moderation, should not be read as evidence that these effects are absent; several qualitative and mixed-method SHG studies report strong social and psychological gains among members even where economic outcomes lag (Mathur & Agarwal, 2017; Sahu & Singh, 2012). The more likely explanation, elaborated under limitations, is that the current sample's small size limits statistical power to detect true effects of moderate size, compounded by ceiling effects in the self-reported Likert data (composite means for several constructs exceeded 4.3 out of 5).

6. Implications

6.1 Theoretical Implications

The study lends preliminary support to disaggregating women's empowerment into economic, social and psychological components, and to disaggregating government interventions by the specific empowerment pathway each most plausibly targets, since DAY-NRLM and BBBP exposure showed markedly different, construct-specific associations rather than a uniform effect across all empowerment dimensions. Reporting a bootstrap-sensitive path ($EE \rightarrow SL$) alongside a simpler composite-score estimate also illustrates, methodologically, why small-sample PLS-SEM work benefits from resampling-based inference rather than classical OLS significance testing alone (Hair et al., 2019).

6.2 Policy and Practical Implications

For DAY-NRLM implementers and SHG federations in Muzaffarnagar and comparable districts, the findings suggest two tentative, appropriately hedged directions. First, because economic empowerment showed the strongest (if not yet conclusively significant) association with livelihood outcomes, continued emphasis on credit access, savings mobilisation and income-generating skill-building appears to be a reasonable programmatic priority, pending confirmation in the full-sample study. Second, given that DAY-NRLM and BBBP appear to operate through different empowerment channels, programme designers should consider that pairing or sequencing schemes targeting economic and attitudinal/psychological empowerment may be more effective than relying on either scheme alone, and that the below-threshold reliability of the economic-empowerment scale, and the incomplete PMMY responses, both point to instrument-level refinements (see Section 7) worth addressing before scaling any monitoring tool built on this instrument.

7. Limitations and Directions for Future Research

This paper has several limitations that are addressed explicitly rather than glossed over, because the analysis reported here is, by design, the first phase within a larger planned research programme, and because transparent disclosure of limitations is itself part of what should make this analysis credible to reviewers and readers.

First, and most importantly, the sample size ($n = 50$) is Phase I, not the full planned sample of 1,000 respondents. Even with the PLS-SEM bootstrap procedure applied here — which is the methodologically appropriate way to obtain valid inference from a small, non-normal sample rather than relying on classical parametric assumptions — bootstrapping resamples from the existing 50 observations and therefore cannot substitute for a larger original sample; it improves the validity of significance testing on the data collected, but does not increase the information the data contain, and several theoretically expected paths ($SE \rightarrow SL$, $PE \rightarrow SL$, and the duration moderation) most plausibly remain non-significant here because of limited statistical power rather than a true absence of effect. Commonly cited PLS-SEM sample-size heuristics recommend considerably larger samples for stable estimation and multi-group comparison (Hair et al., 2019); the present $n = 50$ falls short of what is required for a confirmatory analysis, and the results should be read as preliminary.

Second, purposive/convenience sampling through SHG clusters limits generalisability beyond women already in SHGs in Muzaffarnagar district. Third, common-method bias is a concern given single-source, single-occasion self-report measurement; consistently high composite means raise the possibility of social-desirability responding, addressable through triangulation with objective indicators in the full study. Fourth, near-zero variance on credit-access, training-attendance, district and scheme-association variables prevented their use as grouping variables and will require deliberate sampling stratification going forward. Fifth, $EE6$ and $NRLM1$ showed weak outer loadings ($< .50$) and EE 's AVE fell marginally below $.50$, indicating a need for item-level review. Sixth, the PMMY block, answered by fewer than a third of respondents, requires revised skip-logic or separate administration to beneficiaries and non-beneficiaries.

Future research should prioritise: (i) completing the planned $n = 1,000$ survey with the stratification adjustments noted above; (ii) re-estimating the full model in SmartPLS, including multi-group analysis once

adequate variance exists; (iii) revising the weakest EE and NRLM items; and (iv) where feasible, adding a short panel component to test whether the tenure-related pattern observed here is a genuine within-person process or a cohort/selection artefact.

8. Conclusion

This Phase-I inquiry into 50 rural women SHG members in Muzaffarnagar district, Uttar Pradesh, used PLS-SEM with bootstrapped structural testing to examine how DAY-NRLM and BBBP scheme exposure relate to economic, social and psychological empowerment, and how these in turn relate to sustainable livelihood. DAY-NRLM exposure was significantly linked to economic empowerment, and BBBP exposure was significantly linked to psychological empowerment; economic empowerment showed the strongest, though only marginally significant, path toward sustainable livelihood, while social and psychological empowerment and the hypothesised tenure-based moderation did not reach significance at this sample size. Because this is Phase I of a planned $n = 1,000$ study, these findings are offered as indicative rather than confirmatory, and are reported with full transparency about where bootstrapped inference altered conclusions relative to simpler estimation methods. They nonetheless provide an evidence-based, methodologically sound starting point for the fuller survey and structural analysis that this research programme is designed to deliver.

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Appendix A. Construct Structure of the Survey Instrument

Table A1 summarises the constructs, item counts and general content area of each questionnaire block analysed in Phase I. Exact item wording is held in the original field questionnaire and is available from the author on request; it is not reproduced verbatim here as the compiled workbook records only construct-level variable labels.

Table A1. Construct/Item Map

Code	Construct	Items	Role in model	General content area
NRLM1–5	DAY-NRLM exposure	5	Exogenous/contextual	Awareness of and participation in DAY-NRLM SHG activities
PMMY1–5	PMMY exposure	5	Exogenous/contextual (descriptive only, n = 15)	Awareness of and access to Mudra loans
BBP1–5	BBBP exposure	5	Exogenous/contextual	Awareness of Beti Bachao Beti Padhao messaging
EE1–6	Economic empowerment	6	1st-order dimension of women's empowerment	Income control, savings, credit access, independent financial decisions
SE1–6	Social empowerment	6	1st-order dimension of women's empowerment	Mobility, household/community decision participation, social networks
PE1–6	Psychological empowerment	6	1st-order dimension of women's empowerment	Self-efficacy, self-esteem, perceived control
SL1–8	Sustainable livelihood	8	Endogenous outcome	Asset base, income stability, resilience to shocks, food/livelihood security
MOD1	Education (moderator)	1	Moderator	Same coding as respondent education control variable
MOD2	SHG duration	1	Moderator (tested, H2)	Years of SHG membership

Code	Construct	Items	Role in model	General content area
MOD3	Credit access	1	Moderator (not usable at this sample size — no variance)	Whether respondent has received SHG-linked credit
MOD4	Training attendance	1	Moderator (limited variance at this sample size)	Number of capacity-building sessions attended

Appendix B. Declarations

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Conflict of interest: The author declares no conflict of interest.

Ethical approval: Verbal informed consent was obtained from all participants; participation was voluntary and responses were recorded without personally identifying information. [The author should insert the formal Institutional Ethics/Departmental Research Committee approval reference number and date here once obtained, per the requirements of the target journal.]

Data availability: The dataset analysed here, and the questionnaire from which it derives, are available from the corresponding author upon reasonable request.

Author contribution: As sole author, N. Sarfaraz conceived the study, designed the instrument, collected and analysed the data, and drafted and approved the manuscript.