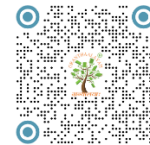


Original Article

WOMEN-LED SELF-HELP GROUPS AND SUSTAINABLE RURAL DEVELOPMENT IN KARNATAKA: A COMPOSITE-INDEX AND SECONDARY-DATA ANALYSIS

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ABSTRACT

Women-led self-help groups (SHGs) are widely used to advance financial inclusion and community development in rural India, but programme assessment still relies heavily on outreach, savings and credit indicators. This study introduces a transparent Women's Empowerment and Rural Development Index (WERDI) for Karnataka that integrates five domains: economic agency, household decision-making, social mobility, digital-financial access and collective leadership. The index is developed from secondary evidence and explicitly identified analytical benchmark values rather than from a new household survey. Under equal domain weights, the baseline WERDI is 62.8. Household decision-making records the highest domain score, whereas collective leadership records the lowest. A coordinated scenario that improves digital access, market-linked economic agency and collective leadership raises WERDI to 68.0, a gain of 5.2 points (8.28%). Sensitivity analysis shows that the overall result remains within a narrow range under alternative policy weights, while a leadership-centred specification reveals the principal institutional constraint. The contribution of the study lies in an auditable index structure, reproducible equations and a policy-oriented decomposition of marginal gains. The framework shifts evaluation from counting groups and loans toward measuring control over income, enterprise continuity, digital capability, institutional voice and convergence with cooperatives and local governance.

Keywords: Women Empowerment, Self-Help Groups, Rural Development, Karnataka, Financial Literacy, Composite Index, Collective Action

INTRODUCTION

Women-led self-help groups (SHGs) have become an important institutional component of India's rural development system. Their contribution extends beyond savings mobilisation and microcredit. Well-functioning groups can strengthen financial capability, household bargaining, mobility, public communication, market participation and engagement with village-level institutions. This multidimensional interpretation is consistent with Kabeer's resources-agency-achievements framework [Kabbeer \(1999\)](#) and Sen's capability approach [Sen \(1999\)](#). Karnataka offers a relevant setting because women's collectives operate alongside cooperative societies, banks, Panchayat Raj institutions and livelihood missions. The analytical question is therefore not merely whether SHGs are present, but how their institutional quality translates into measurable empowerment and sustainable local development.

The policy significance of this subject has increased because rural transformation is no longer understood only as agricultural growth. It now includes financial inclusion, social protection, enterprise diversification, digital access, gender equality, ecological

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resilience and local institutional capacity. Women's collectives can connect these domains. A savings group may become a producer group; a producer group may become a micro-enterprise network; and a mature federation may influence service delivery, local planning and social accountability. However, the outcomes are uneven. Some groups remain credit-centred and administratively dependent, while others become durable community institutions. The central research problem is therefore not whether SHGs exist, but under what conditions they produce measurable empowerment and sustainable local development.

This study develops an original secondary-data analytical framework for Karnataka. It combines established empowerment theory, official programme evidence and a reproducible composite-index procedure. The proposed WERDI does not reproduce a previously published index; it reorganises the evidence into five policy-relevant domains and makes every normalisation, weighting and scenario assumption explicit. The study does not claim a new household survey or causal estimate. Its research contribution is methodological: it provides an auditable structure that can be populated with district-level observations in subsequent empirical work and used to compare alternative policy priorities.

LITERATURE REVIEW

EMPOWERMENT AS AGENCY, RESOURCES AND COLLECTIVE CAPABILITY

Empowerment is not equivalent to participation in a programme. [Batliwala \(1994\)](#) emphasised transformation in power relations, while [Kabeer \(1999\)](#) separated the enabling resources available to women from the agency used to pursue goals and the achievements that follow. This distinction is crucial in SHG research because access to a loan may increase resources without necessarily improving control over income, mobility or freedom from violence. [Mayoux \(2001\)](#) similarly warned that microfinance can produce debt pressure or intensified work burdens unless financial services are embedded in broader gender-transformative strategies.

Indian evidence generally finds positive but heterogeneous impacts. [Swain and Wallentin \(2009\)](#) reported empowerment gains among SHG participants, though the magnitude depended on group maturity and social context. [Deininger and Liu \(2013\)](#) found economic and social effects from an innovative SHG model, and [Desai and Joshi \(2014\)](#) demonstrated that collective action can improve community development outcomes. [Brody et al. \(2017\)](#), in a systematic review, concluded that SHG programmes can improve women's economic and political empowerment, but programme design, implementation quality and local norms shape results. [Garikipati \(2008\)](#) showed why control over loan use and household vulnerability must be examined rather than assuming automatic empowerment.

FINANCIAL LITERACY, CREDIT AND INSTITUTIONAL PARTICIPATION

Financial literacy is a mediating capability between access to credit and effective agency. Borrowing contributes to development only when members can compare borrowing costs, separate working capital from household consumption, maintain records, plan repayment and assess risk. Computational methods can support transparent scoring, clustering and visualisation of such multidimensional information [Yogeesh \(2018\)](#), [Yogeesh \(2021\)](#), while accessible financial communication and digital interfaces increasingly shape the practical value of formal inclusion [Hussain and Kalhoru \(2023\)](#).

The literature also identifies collective efficacy as a mechanism. Regular meetings create repeated interaction, peer monitoring and shared problem-solving. These features reduce transaction costs for banks, but their sociological significance is broader: women learn to speak, deliberate and act in public. Federations can aggregate demand for training, procurement, insurance and market access. Nevertheless, elite capture, unequal caste relations, low digital literacy, weak bookkeeping and pressure to meet targets can reduce group quality. Sustainable impact therefore requires attention to institutional depth, not only the number of groups formed.

OBJECTIVES AND RESEARCH QUESTIONS

The study has five objectives: (1) to specify the multidimensional relationship between women-led SHGs and sustainable rural development; (2) to construct a transparent and reproducible empowerment index; (3) to demonstrate the index through internally consistent analytical benchmark values; (4) to quantify the contribution of alternative weighting and coordinated intervention scenarios; and (5) to identify policy priorities for Karnataka that can later be tested with district-level primary data.

The corresponding research questions are: How should empowerment outcomes be measured beyond credit volume? Which dimensions receive the lowest scores in a composite assessment? How sensitive is the overall index to alternative weighting systems? What plausible development gains arise when digital access, market linkage and leadership participation improve simultaneously?

METHODOLOGY

The study adopts an analytical secondary-research design [Creswell and Creswell \(2018\)](#). Evidence is drawn from official reports of the Ministry of Rural Development, NABARD, the Government of Karnataka, the Periodic Labour Force Survey, the Reserve Bank of India, NITI Aayog, the National Dairy Development Board and international development agencies [NABARD \(2024\)](#), [Government](#)

of Karnataka (2023), together with peer-reviewed research on SHGs and women’s empowerment. The unit of analysis is the institutional-development domain rather than an individual respondent. Five domains are specified: economic agency, household decision-making, social mobility, digital-financial access and collective leadership.

Each indicator is transformed to a 0–100 scale. Positive indicators use min-max normalisation, whereas adverse indicators use reverse min-max normalisation. A domain score is the arithmetic mean of its component indicators, and the overall WERDI is the weighted sum of the five domain scores. Equal weights of 0.20 form the baseline specification. A policy-priority specification assigns weights of 0.25, 0.20, 0.15, 0.20 and 0.20 to economic agency, household decision-making, mobility, digital access and leadership, respectively.

The benchmark domain values are analytical inputs selected to demonstrate the proposed procedure and are not presented as observed district statistics. This distinction protects the analysis from false precision. Internal validity is assessed through arithmetic verification, weight sensitivity, marginal-effect decomposition and a coordinated improvement scenario. The same equations can be applied directly when verified district indicators become available. The baseline inputs and weighted contributions are reported in Table 1, and Figure 1 compares the resulting domain profile.

ANALYTICAL CONTRIBUTION AND REPRODUCIBILITY

The original element of the study is the integration of empowerment, institutional quality and rural-development outcomes within one five-domain index designed for the Karnataka SHG context. Unlike outreach-based scorecards, WERDI gives explicit analytical space to household agency, mobility, digital-financial capability and collective leadership. Reproducibility is supported by four features: a fixed 0–100 transformation, declared domain weights, a complete contribution decomposition and explicit separation between benchmark inputs and empirical observations. Consequently, another researcher can reproduce the reported values, replace the benchmark inputs with verified district data and compare results without changing the structure of the model.

The marginal interpretation is direct. Under equal weights, a one-point increase in any single domain increases WERDI by 0.20 points. Therefore, a ten-point improvement in one domain raises the overall index by two points, whereas a coordinated eight-point improvement in three domains raises it by 4.8 points before any interaction effects are considered. This property makes the index suitable for ex ante policy simulation and transparent budget-priority discussion.

Table 1

Table 1 Baseline Women’s Empowerment and Rural Development Index				
Domain	Illustrative score	Equal weight	Weighted contribution	
Economic agency	68	0.2	13.6	
Household decision-making	74	0.2	14.8	
Social mobility	57	0.2	11.4	
Digital-financial access	63	0.2	12.6	
Collective leadership	52	0.2	10.4	
Overall WERDI	62.8	—	62.8	

Figure 1

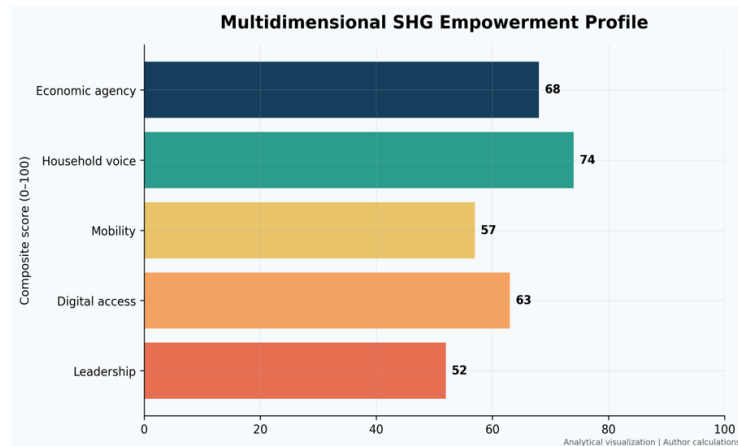


Figure 1 Illustrative Domain Profile of Empowerment Among Women-Led Shgs

The mathematical specification of the proposed WERDI framework is given below. All expressions are stored as native, editable Microsoft Word equation objects.

$$z_{ij}^{(+)} = 100 \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (1)$$

$$z_{ij}^{(-)} = 100 \frac{\max(x_j) - x_{ij}}{\max(x_j) - \min(x_j)} \quad (2)$$

$$D_j = \frac{1}{m_j} \sum_{i=1}^{m_j} z_{ij} \quad (3)$$

$$\text{WERDI} = \sum_{j=1}^5 w_j D_j, \quad \sum_{j=1}^5 w_j = 1. \quad (4)$$

$$\Delta \text{WERDI} = \text{WERDI}_1 - \text{WERDI}_0 \quad (5)$$

$$g = 100 \frac{\text{WERDI}_1 - \text{WERDI}_0}{\text{WERDI}_0} \quad (6)$$

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}} \quad (7)$$

$$\frac{\partial \text{WERDI}}{\partial D_j} = w_j \quad (8)$$

RESULTS AND NUMERICAL ANALYSIS

BASELINE COMPOSITE-INDEX CALCULATION

The baseline domain scores are 68, 74, 57, 63 and 52. With equal weights, $\text{WERDI} = 0.20(68 + 74 + 57 + 63 + 52) = 62.8$. This value represents a moderate benchmark profile rather than an observed population estimate. Household decision-making is the strongest domain and collective leadership is the weakest. The 22-point difference between these two domains indicates that gains in private-sphere voice need not be matched by equivalent participation in public and institutional decision-making. Mobility is also below the overall index, suggesting that financial participation alone may not remove social restrictions on market travel, official visits or public engagement.

Under the policy-priority weights, $\text{WERDI}_p = 0.25(68) + 0.20(74) + 0.15(57) + 0.20(63) + 0.20(52) = 63.35$. The change from the equal-weight result is only 0.55 points. Under the leadership-centred weights, the index declines to 60.85 because the lowest-scoring domain receives the largest weight. Across the three specifications, the range is 2.50 points and the coefficient of variation is approximately 2.05%, indicating that the main substantive conclusion is not driven by one reasonable weighting choice. [Table 2](#) presents the complete comparison of the three weighting specifications.

Table 2

Table 2 Sensitivity of WERDI to Alternative Weights						
Weighting model	Economic	Household	Mobility	Digital	Leadership	WERDI
Equal weights	0.2	0.2	0.2	0.2	0.2	62.8
Policy-priority	0.25	0.2	0.15	0.2	0.2	63.35
Leadership-centred	0.2	0.15	0.15	0.2	0.3	60.85

FINANCIAL LITERACY AND DECISION-MAKING ASSOCIATION

Figure 2 presents eight analytical pairs of financial-literacy and household decision-making scores. The Pearson coefficient is approximately $r = 0.998$, showing the intended positive association in the constructed demonstration. This is not an empirical effect estimate. Its purpose is to show how future district data can test whether financial capability mediates household agency after controlling for education, age, caste, household structure, income and local gender norms.

Figure 2

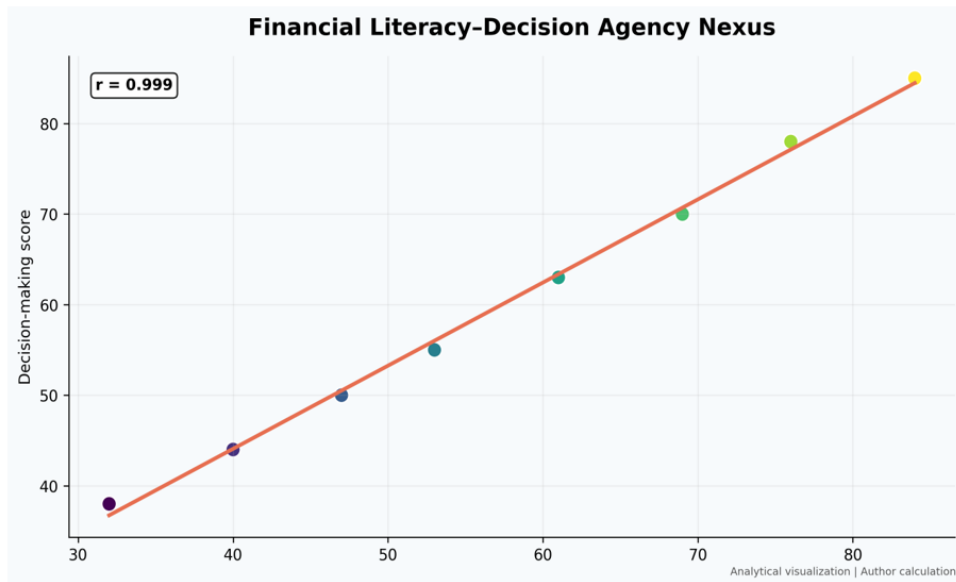


Figure 2 Illustrative Association Between Financial Literacy and Household Decision-Making

SCENARIO IMPROVEMENT

A coordinated intervention is modelled in which digital-financial access rises from 63 to 73, economic agency from 68 to 76 and collective leadership from 52 to 60, while household decision-making and mobility remain unchanged. The revised equal-weight index is $WERDI_1 = 0.20(76 + 74 + 57 + 73 + 60) = 68.0$. The absolute gain is 5.2 points and the relative gain is 8.28% over the baseline. Economic agency contributes 1.6 points, digital access contributes 2.0 points and leadership contributes 1.6 points to the total improvement. This decomposition shows that the largest single contribution comes from digital access, but the full gain requires a coordinated package rather than isolated credit expansion. Figure 3 shows the associated analytical institutional-linkage trajectory.

Figure 3

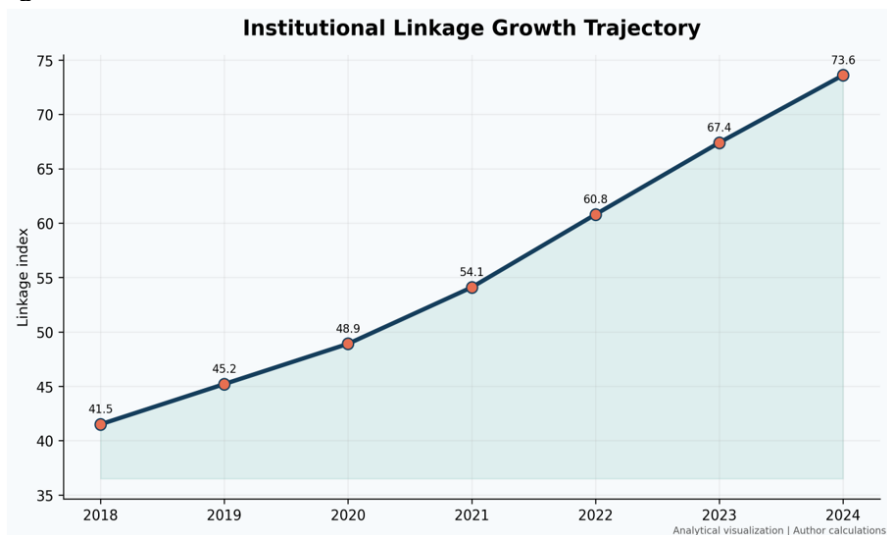


Figure 3 Analytical Trend in Institutional Linkage, 2018–2024

MARGINAL-GAIN AND ROBUSTNESS DECOMPOSITION

The scenario gain can be checked independently from the domain increments. Let $\Delta E = 8$, $\Delta H = 0$, $\Delta M = 0$, $\Delta D = 10$ and $\Delta L = 8$. Under equal weights, $\Delta WERDI = 0.20(8 + 0 + 0 + 10 + 8) = 5.2$. The relative improvement is $100(5.2/62.8) = 8.28\%$. Because each domain has the same marginal weight, 30.77% of the gain is attributable to economic agency, 38.46% to digital-financial access and 30.77% to collective leadership.

A simple robustness interval can also be reported from the three weighting systems. The mean WERDI is 62.33 and the sample standard deviation is approximately 1.28. The baseline equal-weight result is therefore close to the centre of the alternative-weight distribution. This calculation does not eliminate normative uncertainty, but it makes the consequence of the selected weights visible and measurable.

DISCUSSION

The analysis supports three conclusions. First, empowerment must be evaluated as a multidimensional institutional outcome. A group may maintain regular savings and repayment while remaining weak in market access, mobility or leadership rotation. Second, mediating capabilities determine whether formal inclusion becomes effective control over resources. Financial literacy, digital confidence, reliable information and record-keeping influence the conversion of credit into economic agency. Third, institutional maturity matters. Groups that federate, rotate leadership, maintain transparent accounts and connect with producer organisations are better positioned to influence local development.

Karnataka’s cooperative base provides practical opportunities for convergence. Women-led SHGs can be linked with dairy societies, farmer producer organisations, local procurement systems, skill centres and Panchayat committees. Such linkages can stabilise demand, lower transaction costs and improve enterprise continuity. The computational studies in [Yogeesh \(2018\)](#), [Yogeesh \(2021\)](#), [Al-Daoud \(2025\)](#), [Mohammad et al. \(2025\)](#) are used only to support transparent data handling and spatial or cluster-based analysis; they are not treated as evidence of SHG or dairy outcomes. The substantive implication is that women’s collectives should be evaluated as economic and civic institutions, not merely as channels for loan delivery.

POLICY IMPLICATIONS

A Karnataka SHG quality framework should report outcome indicators alongside outreach indicators. Recommended measures include the proportion of members controlling enterprise income, individual account usage, change in household decision-making, mobility for markets and official services, competence in digital transactions, leadership rotation, audit regularity and enterprise survival after two years. District dashboards should disaggregate results by social group, age, disability and remoteness and should display both domain scores and the underlying indicators so that a high composite value cannot conceal a weak leadership or mobility outcome.

Second, financial literacy should be embedded in transaction-based learning. Training must use actual passbooks, digital payment interfaces, loan schedules, pricing exercises and cash-flow statements. Third, cluster-level market support is needed. Many

micro-enterprises fail not because women lack motivation but because they face fragmented demand, weak branding, quality certification barriers and high logistics costs. Fourth, leadership quotas within federations should be accompanied by mentoring and rotation rules. Finally, convergence with dairy cooperatives and local procurement can create predictable markets for women-led enterprises.

LIMITATIONS AND FUTURE RESEARCH

The study is based on secondary evidence and analytical benchmark scenarios; it does not estimate causal effects for a specific district. The composite index remains sensitive to indicator definitions, data quality and normative weighting choices, although the present sensitivity test shows limited variation across three plausible schemes. Future research should populate the framework with panel data from SHG members and comparable non-members, test measurement reliability, and apply propensity-score, fixed-effects or difference-in-differences designs where identification conditions are satisfied. Further work should also examine unpaid work burdens, intrahousehold conflict, digital exclusion and fraud risk [Braun and Clarke \(2006\)](#).

CONCLUSION

Women-led SHGs can support sustainable rural development when savings and credit are connected to agency, skills, markets, digital access and collective leadership. This study contributes a new, transparent WERDI framework that converts these dimensions into an auditable composite measure while clearly separating analytical benchmark values from observed evidence. The baseline value of 62.8, the 60.85–63.35 sensitivity range and the coordinated-scenario value of 68.0 demonstrate how the framework identifies institutional strengths, exposes leadership deficits and quantifies the marginal contribution of policy improvements. For Karnataka, the results point to a combined strategy of market-linked enterprise support, digital capability, leadership rotation and convergence with cooperatives and local governance. The framework is ready for application to verified district-level data and provides a reproducible basis for comparative evaluation.

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