

ROLE OF INTERNET AND SELF-HELP GROUPS IN RURAL TRANSFORMATION

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ABSTRACT:

This study focuses on internet connectivity and the contribution of Self-Help Groups (SHGs) in the overall rural transformation process in India, especially on household economic well-being, basic amenities, infrastructure and social protection aspects. The approach was quantitative cross-sectional, and the empirical analysis was carried out with the tools of the so-called survey-weighted descriptive statistics, group comparisons and multivariate regression models. Broadband access was treated as the main and primary digital indicator, and rural transformation was measured by the usual monthly consumer expenditure, in addition to a composite Rural Transformation Index which included non-digital indicators including protection against health risks, drinking water, sanitation, hygiene, electricity, road connectivity, and rural consumer spending. The results indicate that broadband users' consumer expenditures were significantly higher, and their socioeconomic situation significantly better than broadband non-users. These associations were independent of household characteristics and regional effects. The results also show that digitalisation in rural areas is mainly achieved through mobile devices; mobile-phone ownership is much higher than tablet, laptop and computer ownership. The study also places SHGs among the important financial inclusion, women empowerment, collective decision-making and rural development institutional mechanisms. The results, however, as the participation in SHG was not directly measured in the empirical data, offer mainly direct evidence for the dimension of rural transformation related to the internet. Digital inclusion and community-based institutions are complementary pillars of inclusive and sustainable rural development, concluded the study.

KEYWORDS: Rural transformation; Internet access; Broadband connectivity; Self-Help Groups; Digital inclusion; Financial inclusion; Rural households; India

INTRODUCTION

The role of digital connectivity and financial inclusion, as well as collective institutions and access to basic socioeconomic opportunities, is becoming a crucial component in rural transformation. The growing network of the internet in India has brought in new opportunities for communication, market access, information, digital payment, public service access, education and livelihood diversification. But not all social and geographic groups have been equally affected by the spread of the Internet. The lack of convergence in internet access and use between rural and urban areas is a testament to the continued strong connection between internet connectivity and regional development, household resources, gender and social position (Arora & Sapre, 2026; Laskar, 2023). Despite the potential for ICTs to improve learning outcomes in rural areas, existing barriers such as affordability, infrastructure, digital literacy, access to devices, and perceived usefulness remain a challenge (Asrani, 2022). Such inequalities are particularly pertinent since digital exclusion can exacerbate rather than just mirror socioeconomic disadvantage.

Rural digitalization has an especially noteworthy gender aspect. Available evidence from India indicates that gendered use of the internet is linked to income, level of education, household factors and overall gender inequalities (Chandra et al., 2024). Access to digital technologies is also unequal among rural and tribal communities, where education and lack of infrastructure further marginalized already marginalised communities (Nayak & Alam, 2022). Recent studies also show that the rural–urban disparity in women's Internet access is still large, thus reinforcing the importance of addressing digital connectivity as part of a broader process of inclusive rural development and not just as a technological output (Roy et al., 2026). Despite all of this, mobile phones are a significant means for rural women to communicate, access information and engage in economic and social activities (Paul & Dutta, 2023). Digital public services can also open opportunities, but they can also require some assistance, skills, and institutional support to be effective (Soni & Mitchell, 2022).

Another key nexus that can drive rural transformation is financial inclusion. Formal accounts, digital payments, credit and financial services can support households' resilience and better participation in the formal economy (Demirgüç-Kunt et al., 2022). Financial inclusion is related to gender, socio-economic factors and institutional access in rural India, which indicates that inequalities in financial participation remain closely associated with

socio-economic inequalities in development (Kaur & Kapuria, 2020). Recent studies also show that there remain disparities in the financial inclusion of women in rural India and the need to remove structural constraints to participation (Joshi & Kamila, 2026). Financial inclusion is also reflected in women entrepreneurs, especially when they can avail financial services and participate in markets together with productive activities in the rural context (Kumarasamy et al., 2023).

In this context, SHGs are seen as important grassroots institutions that link the concepts of financial inclusion, social participation, collective action and women's empowerment. The role of SHGs in supporting savings, access to credit facilities, entrepreneurship, decision-making, and community participation can help enhance multidimensional rural development. Based on available evidence, it can be concluded that the presence of SHGs is a good indicator of socioeconomic progress and development among rural women towards SDGs (Basak & Chowdhury, 2024). A systematic review also shows that SHG membership has positive influences on the economic, social, and psychological aspects of women's empowerment, but the results differ by participation type and context (Mahato et al., 2023). They can thus help fill the gap of digital connectivity, helping to enable tangible socio-economic benefits for rural households based on their access to information and financial services.

Meanwhile, the growing spread of information and communication technologies can create new instances of socio-economic stratification where access, skills, and usage are inequitable (Singh & Mohanty, 2025). This poses an important research question: does rural transformation take place based on the connectivity rates alone or does it rely on whether digital access matches the progress in material wellbeing, amenities, infrastructure, financial security, and social inclusion? The synergy of the Internet and the participation of collective groups in an SHG is therefore significant to understand how technological and institutional arrangements can interact to influence rural development.

This study therefore discusses how access to the internet and SHGs can contribute to rural transformation in terms of economic well-being and multidimensional household development in a particular manner. This holistic framework offers greater depth to the understanding of rural transformation.

Objectives:

- To gauge the level of internet connectivity and ownership of digital resources among rural households.
- To analyse the relationship between Internet use and household economic situation.
- To assess the link between internet connection and multidimensional rural change indicators.
- To place the role of SHG in the overall context of financial inclusion, financial empowerment and rural socio-economic development.

2. METHODOLOGY

2.1 Research Design and Data Source

The study was of quantitative, cross-sectional categorization and was done on secondary data at the household level from the National Sample Survey Office (NSSO), Ministry of Statistics and Programme Implementation (MoSPI), Government of India for the 79th NSS round (2022-23) as part of the Comprehensive Annual Modular Survey (CAMS). The household microdata that are attached comprise 302,086 observations and 85 variables related to the household, basic amenities, digital assets, broadband connectivity, health protection, consumption expenditure, geographical identifiers, and information about the design of the survey. The data were limited to the rural sector, and the analytical sample consisted of 173,096 rural households. This is a nationally representative survey that offers a suitable empirical underpinning to explore the link between digital connectivity and rural socio-economic transformation (National Sample Survey Office, 2024).

2.2 Measurement of Internet Access and Digitalization

The main explanatory variable was household Internet access, which was captured by BL42I2, asking whether the household has Internet access in their own home. Household digitalisation was measured by owning a mobile phone or mobile phone (smartphone) (BL42I1II), desktop computer (BL42I1III), laptop (BL42I1IV), and tablet or palmtop (BL42I1V). These indicators reflect connectivity and access to digital technologies and are specifically documented in the CAMS household schedule. For descriptive and supplementary analyses, ICT-device ownership was retained as the exposure variable, but for broadband access, the main exposure variable retained was broadband access.

2.3 Measurement of Rural Transformation

Rural transformation was defined as a multidimensional process that includes economic, household amenities, infrastructure, hygiene and social protection. Information on expenditure on purchased goods and services, home-produced consumption, clothing and footwear, and household durables was used as supplemental data to the principal indicator of household economic well-being, which was Usual Monthly Consumer Expenditure (UMCE) (BL6I6). A Rural Transformation Index (RTI) was created using non-digital indicators for drinking water adequacy (BL41I6), latrine access (BL41I10), handwashing facilities (BL41I12), household lighting or electricity conditions (BL41I14), all-weather road connectivity (BL41I17), and health-financing or insurance coverage (BL43I11–BL43I18). The chosen indicators were recorded by official MoSPI categories to ensure that

a higher value always reflected favourable conditions, and were then added together into a standardized indicator, from 0 to 100. Internet access and ownership of digital devices were intentionally not included in the RTI because these were both part of the main explanatory variable.

2.4 Covariates and Geographic Controls

Multivariate models included household and geographical features that may affect the likelihood of having internet access and rural development outcomes. Household size (BL41I1), religion (BL41I2), social group (BL41I3), state (ST), NSS region (NSS), and survey sub-round (SR) were principal controls. Systematic differences in infrastructure, socioeconomic development, public-service provision and regional policy environments were considered by the inclusion of state fixed effects. The benefit of this specification is that it minimizes observable confounding and maintains the focus of analysis at the household level.

2.5 Data Preparation and Survey Weighting

Before estimating, the microdata was analyzed for missing data, coding problems, structural non-response, and extreme values. Only rural households were included, and categorical responses were recoded according to the official CAMS classification system. Structurally inapplicable observations did not constitute true missing observations and were not treated as zero. For regression analysis, consumer expenditure was analyzed for skewness and transformed to its natural log. To correct for differential sampling and to increase the representativeness of the population, the household survey multiplier (MULT) was used for descriptive and multivariate analyses. The complex survey structure was addressed by including sampling identifiers (first-stage unit (FSU) and stratification variables).

2.6 Statistical Analysis

The empirical analysis was carried out in successive steps. First, survey-weighted descriptive statistics were estimated to describe broadband penetration, ownership of ICT devices, household expenditure, and key indicators of rural transformation. First, survey-weighted descriptive statistics were estimated to describe broadband penetration, ownership of ICT devices, household expenditure, and major indicators of rural transformation. Secondly, various bivariate comparisons were made to determine differences in economic wellbeing, sanitation, hygiene, infrastructure and health protection between households with and without broadband. Third, multivariate regression models were estimated to assess if broadband access continued to be associated with these outcomes after controlling for household and regional factors. Log transformation of UMCE and continuous RTI were analyzed by ordinary least-squares regression, and logistic regression was used for individual binary transformation outcomes. Standard errors were clustered at the sampling-unit level, and results were presented in the form of coefficients or odds ratios, 95% confidence intervals, and p-values with a statistical significance criterion of $p < 0.05$.

Model specifications varied, starting with an unadjusted association between broadband access and the outcome, then adjustment for household variables, and lastly state and survey controls. For the purpose of robustness checks, sensitivity analyses have been conducted of alternative digital indicators and individual components of the RTI. Since the CAMS data were cross-sectional and observational, the magnitudes of the estimated coefficients were interpreted as conditional associations, not causal effects.

2.7 Treatment of the Self-Help Group Dimension

One of the important limitations of the empirical design is that there is no direct measure of Self-Help Group (SHG) membership, participation in the SHG or savings from the SHG, on the attached CAMS household data set, and there is no SHG-linked borrowing measure. As a result, the current household-level analysis provides empirical evidence for the Internet–rural transformation aspect of the study but cannot estimate the effect of SHG participation or an interaction between Internet and SHG participation. In the general research question “Role of Internet and Self-Help Groups in Rural Transformation”, the SHG dimension should be analyzed with a secondary data set that includes a direct individual/household-level indicator of SHG. At the interpretation phase, results obtained from the Internet and SHG analysis should be synthesized and not directly merged data from independent surveys conducted on unrelated households. This separation guarantees construct validity and prevents an SHG effect being assigned to variables which are not part of the CAMS data.

2.8 Ethical Considerations

The study was based on anonymized secondary survey microdata only, with no direct contact, intervention or recruitment of human participants. No personal details were used in the analysis, and all data have been presented statistically and aggregately, so that the confidentiality of the data is maintained. Data were used only for academic research and managed under the conditions for data-access and usage defined by MoSPI. As a result, the study did not result in the collection of additional personal or sensitive information beyond that included in the anonymised secondary data set.

3. RESULTS

3.1 Rural Household and Digital Access Profile

The final analytical sample included 173,096 households in the rural population of the CAMS household dataset. Table 1 shows that 71.31% of the rural households had access to broadband Internet and 94.15% had a mobile phone or smartphone, significantly higher. Ownership of desktop computers (0.70%) and laptops (3.25%) was still low, however, compared to tablets or palmtops (0.53%). The household share of at least one desktop, laptop or tablet was around 4.17% while the TV ownership was 59.80%. Weighted mean household size was 4.35 persons and mean usual monthly consumer expenditure (UMCE) was ₹10,944.34. Of the 1,000 rural households surveyed, more than seven in ten had broadband at home, but 28.69% of rural households had no broadband at home, as shown in Figure 1.

Table 1. Digital and socioeconomic profile of rural households

Indicator	Unweighted N	Weighted statistic
Rural households	173,096	—
Broadband internet access	126,553	71.31%
Mobile phone/smartphone ownership	163,433	94.15%
Desktop computer ownership	1,361	0.70%
Laptop ownership	5,824	3.25%
Tablet/palmtop ownership	1,038	0.53%
Any desktop/laptop/tablet	7,554	4.17%
Television ownership	103,499	59.80%
Mean household size	4.35	
Mean UMCE (₹/month)	10,944.34	
Median UMCE (₹/month)	9,702.00	

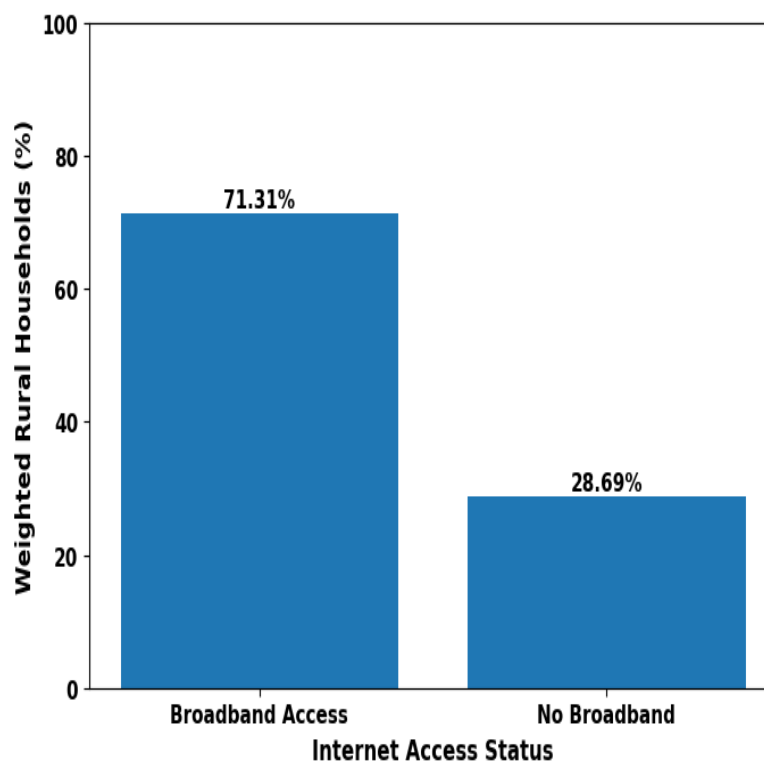


Figure 1. Broadband Internet Access among Rural Households

Overall digital ownership is shown in Figure 2. The penetration of mobile phones was almost universal, whereas the ownership of computers, laptops, and tablets had a very low rate, showing that digitalisation is still mostly mobile-based in rural areas.

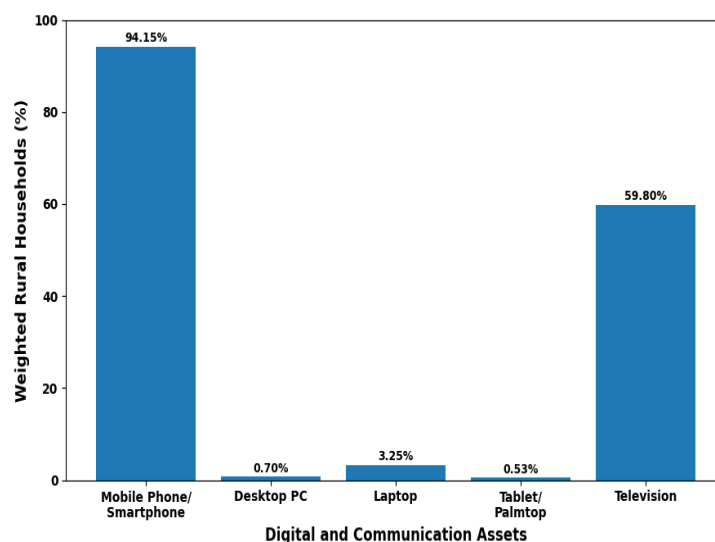


Figure 2. Digital Asset Ownership among Rural Households

3.2 Internet Access and Household Economic Well-being

There were significant broadband differences in household expenditure. Table 2 shows that the weighted mean UMCE for the broadband-connected households was ₹12,428.45, while for the non-broadband-connected households it was ₹7,255.90. Other areas of spending that were reported as higher for connected households included purchased goods and services, home-grown consumption, clothing and footwear, and household durables.

Table 2. Household expenditure according to broadband internet access

Expenditure component	No broadband mean (₹)	Broadband mean (₹)
Purchased goods/services, monthly	5,413.37	9,301.19
Home-grown consumption, monthly	846.91	1,278.18
Wages in kind/gifts, monthly	373.97	438.60
Clothing/footwear, annual	5,450.13	10,036.36
Household durables, annual	2,597.22	7,633.11
Usual monthly consumer expenditure	7,255.90	12,428.45

The difference between the levels of expenditure is clearly illustrated in Figure 3, where the monthly consumer expenditure for the broadband-connected households is much higher than for non-connected households.

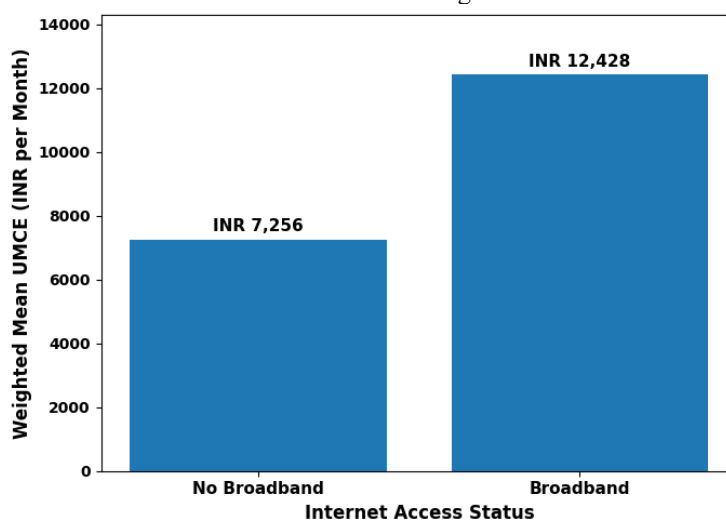


Figure 3. Household Consumption Expenditure by Broadband Internet Access

3.3 Internet Access and Rural Transformation Indicators

The variations were also noticeable in the socio-economic and non-monetary aspects of rural change. Broadband-connected households always had better outcomes than households not connected to broadband, as shown in Table 3. The biggest differences were in terms of latrine access and handwashing facilities. 92.15% of connected households had access to latrines, 79.84% of non-connected households had access to latrines,

89.01% of connected households had access to a handwashing facility with soap or detergent, and 76.56% of non-connected households had access to a handwashing facility with soap or detergent.

Table 3. Rural transformation indicators according to broadband internet access

Indicator	No broadband (%)	Broadband (%)	Difference (percentage points)
Sufficient drinking water throughout year	91.93	92.30	+0.37
Access to a latrine	79.84	92.15	+12.31
Handwashing with water and soap/detergent	76.56	89.01	+12.45
Electricity as primary lighting source	98.74	99.82	+1.09
All-weather road within 2 km	93.54	94.70	+1.16
Health financing/insurance coverage	54.96	61.88	+6.92

Households with broadband connection were also 6.92 percentage points more likely to have health-financing or insurance coverage. The differences in drinking water and electricity access, as well as road connectivity, were relatively small, as access to these services was already widespread across the groups. Consistently better transformation indicators are observed for connected households as summarized in Figure 4.

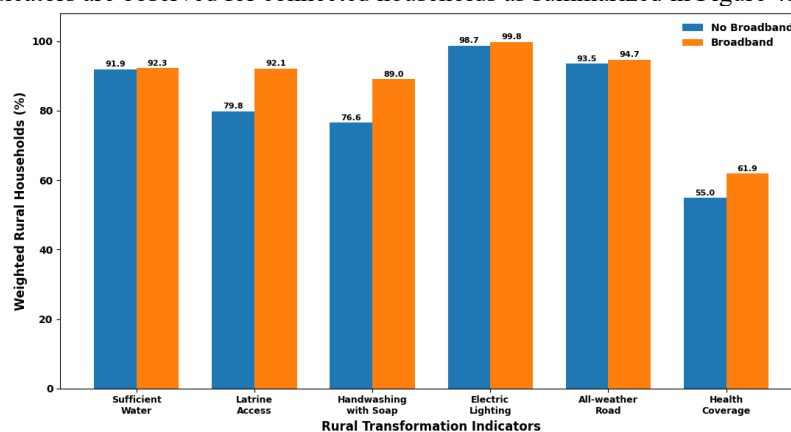


Figure 4. Rural Transformation Indicators by Broadband Internet Access

3.4 Multivariate Association between Internet Access and Household Expenditure

The weighted regression estimates shown in Table 4 also show that the positive relationship between broadband access and household expenditure remained after controlling for household and geographical characteristics. In the unadjusted model, the coefficient for broadband access was equal to 0.584 ($p < 0.001$), which represented an increase of around 79.34% in UMCE. The difference drops to 45.27% after controlling for household size, religion and social group. Broadband access was still associated with UMCE in the fully adjusted model and including state and survey sub-round effects ($\beta = 0.327$, 95% CI: 0.316–0.338, $p < 0.001$). Conditional on the covariates included in the model, the exponentiated coefficient represents about 38.67 per cent increase in UMCE in the broadband-connected households. The unadjusted model had an R^2 of 0.211, while the fully adjusted model had an R^2 of 0.512, showing an improvement in model explanatory power.

Table 4. Weighted regression estimates for broadband access and household consumer expenditure

Model	Broadband β	Robust SE	95% CI	Estimated difference UMCE	R^2
Model 1: Unadjusted	0.584***	0.007	0.570–0.598	79.34%	0.211
Model 2: Household controls	0.373***	0.006	0.361–0.386	45.27%	0.443
Model 3: Fully adjusted	0.327*	0.006	0.316–0.338	38.67%	0.512

Note: (N=173,096). Dependent variable = ln (UMCE). Model 2 adjusts for household size, religion, and social group; Model 3 additionally includes state and survey sub-round effects. ***($p < 0.001$).

3.5 Broadband Access and the Rural Transformation Index

Six non-digital indicators were used to create a composite Rural Transformation Index (RTI): drinking-water adequacy, latrine access, handwashing facilities, electric lighting, all-weather road connectivity, and health-financing or insurance coverage. The weighted mean RTI was 88.31 for households with broadband access,

while it was 82.60 for households without broadband access. In the unadjusted model, broadband access was also linked to a 5.71-point higher RTI as presented in Table 5. The association was still significant following regional and household characteristic adjustments. In the fully adjusted model, broadband access was statistically significantly associated with an increase in RTI of ~4.94 points (95% CI: 4.615–5.270, $p < 0.001$).

Table 5. Weighted regression estimates for broadband access and Rural Transformation Index

Model	Broadband coefficient	Robust SE	95% CI	R ²
Model 1: Unadjusted	5.715***	0.198	5.327–6.102	0.034
Model 2: Household controls	5.923***	0.199	5.532–6.314	0.050
Model 3: Fully adjusted	4.942*	0.167	4.615–5.270	0.185

Note: (N=173,096). RTI ranges from 0 to 100. Model 2 adjusts for household characteristics, while Model 3 additionally incorporates regional controls. ***($p < 0.001$).

3.6 Summary of Results

Taking a holistic view, those households in rural areas with broadband access had higher consumer expenditures, as well as more favourable socioeconomic, infrastructural, sanitation and social-protection indicators than broadband-inexposed households. Household and regional characteristics were included in the statistical adjustment, which did not affect the significance of the associations. Based on the findings, it can be concluded that there is a strong connection between digital connectivity and rural transformation. The results however, are only for the Internet aspect of the overall study and do not provide a direct measure of participation in Self-Help Groups and therefore cannot be used to directly compare the SHG aspect of the study.

4. DISCUSSION

The results highlight the positive relationship between broadband connectivity in households and various aspects of rural change. Broadband access was reported by 71.31% of the rural households, and 94.15% of the rural population has mobile phones, which shows that digitalization in rural areas is mainly mobile digitalization. This is like the information that, even with the rapid digital growth, there is still significant information and communication technology (ICT) disparity between rural India (Arora & Sapre, 2026). The comparative low rates of computer ownership, computer ownership in the classroom, laptop ownership and teacher ownership of tablets also indicate that simply being connected is not the same as having access to sophisticated digital resources. Earlier, Chandra et al. (2024) found similar socioeconomic differences in digital use among Indian women, and these disparities have been found to be related to various household characteristics and wealth. As a result, it is important to consider the observed broadband penetration in the context of ongoing disparities in the extent and quality of digital inclusion.

One of the important results was that there was a significant economic disparity between the two household groups: connected and non-connected households. The monthly consumer expenditure of broadband-connected households was in the range of ₹12,428.45 per household, while that of households without broadband was ₹7,255.90 per household. More significantly, broadband was still positively related to the UMCE in the fully adjusted model, where the model suggests a 38.67% increase in the UMCE for everyone per cent increase in the broadband penetration rate. This finding aligns with the hypothesis that digital connectivity is related to wider economic benefits in rural areas. Similarly, access to smartphones has been associated with an increase in well-being among economically marginalized women in India (Parthiban et al., 2022). While digital technologies can help to increase access to information, markets, financial services and government programmes, they can only do so if users can access and engage with digital platforms effectively (Soni & Mitchell, 2022). Mobile technology could play a particularly significant role for rural women in accessing information, making communication easier and more convenient, in livelihood activities and social connectivity (Paul & Dutta, 2023).

The findings also demonstrate that households with broadband connections did better on some non-financial measures of rural change. Differences of 12.31 percentage points were observed in access to latrines, and 12.45 percentage points in handwashing facilities. Households had 6.92 percentage points more health-financing or insurance coverage among those who were connected. Accordingly, the average value of the Rural Transformation Index was 88.31 in households with broadband and 82.60 in those without it, and this difference was still significant after adjustment. These results indicate that digitization is not an independent phenomenon but is part of a larger socioeconomic context in which households are better resourced and enabled to access services.

Collective institutions like Self-Help Groups (SHGs) should be considered in the broader sense of rural transformation. Past studies show that SHGs can play a part in socioeconomic development and fulfilment of Sustainable Development Goals by way of financial involvement, collective organisation and livelihood opportunities (Basak & Chowdhury, 2024). It has also been found that increased public involvement in SHG is linked to increased public decision making and women empowerment (Cheek & Corbett, 2024); collective participation is associated with women empowerment in broader aspects (Ghosh et al., 2024). These mechanisms are important because digital access and community-based institutions could be complementary means for rural people to get information, resources, financial services, and increased socioeconomic agency.

A particularly significant linkage between SHGs and rural transformation is that of financial inclusion. SHG financing can alleviate reliance on expensive informal credit and enhance financial outcomes for rural households (Hoffmann et al., 2021), and better financial access can boost women's involvement in household decision-making (Kochar et al., 2022). It also reveals that SHGs play a significant role in socioeconomic development (Kandpal, 2022), financial inclusion (Roy & Patro, 2025), and economic empowerment of the rural people (Survase & Panda, 2026). Microfinance can also improve women's role within SHGs, and entrepreneurship can be used as another tool to reinforce their economic role (Pandhare et al., 2024). SHG-based interventions can affect household welfare and nutrition, as well as monetary results: This is a reflection of the multidimensionality of collective rural development mechanisms (Kumar et al., 2024).

Nevertheless, the findings should be interpreted cautiously. The cross-sectional design does not allow for making causal inferences, and there may be omitted household characteristics that affect both the likelihood of using broadband and the likelihood of transformation. More importantly, the present empirical analysis designed at the household level does not directly measure the participation in SHG. Thus, the observed estimates should not be regarded as an indication of an SHG effect. Instead, the focus of the SHG literature is on the institutional dimension of the rural transformation. Further studies that would combine measures at the household level of internet connection and SHG participation would allow for the direct estimation of their independent and interactive effects. This would offer better evidence on the effects of digital inclusion and collective financial institutions on more inclusive and sustainable rural transformation.

5. CONCLUSION

The findings of this study show the significance of digital connectivity in the current process of rural transformation. The results show that the rural households with broadband internet services have higher levels of consumer expenditures and better results in the areas of sanitation, hygiene, health protection, infrastructure and other measures of household wellness. However, these relationships remain after controlling for household and regional characteristics, indicating that internet availability is tightly correlated with other socioeconomic benefits in rural regions. The results, meanwhile, show that digitalisation in rural areas is still highly reliant on mobile devices, with significantly fewer computers, laptops and tablets owned. The study also places Self-Help Groups in the broader context of rural change, including their established links with financial inclusion, women's empowerment, collective decision-making, entrepreneurship and household welfare. However, participation in SHGs and its impact on all the strands of rural transformation is not directly captured in the household dataset used in the empirical analysis, and therefore, the results of the present analysis speak only to the internet strand of rural transformation. The study highlights the importance of holistic rural development approaches that incorporate digital inclusion alongside robust financial and social institutions at the community level. Further studies are needed to investigate the household-level synergy between internet access and SHGs and its impact on inclusive and sustainable rural development.

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