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Women and the Web: A Comparative Study of Socio-Cultural and Digital Infrastructural Barriers

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Peer Review Information	Abstract
<i>Submission: 21 April 2025</i> <i>Revision: 20 May 2025</i> <i>Acceptance: 15 August 2025</i> Keywords <i>Digital Divide, Women's Empowerment, Socio-Cultural Barriers, Rural India, Digital Literacy</i>	Despite rapid advancements in digital technology across India, a significant gendered digital divide persists, particularly in rural and semi-urban regions such as Haridwar, Uttarakhand. This research explores the multifaceted barriers hindering women's digital empowerment, drawing on nationally representative datasets (NFHS-5, NSSO, GSMA), district-level statistics, and grounded case studies. The study reveals that women's access to digital resources is shaped not only by infrastructural limitations such as poor internet connectivity, low smartphone penetration, and inadequate public digital facilities but also by entrenched socio-cultural norms including patriarchal restrictions, educational disparities, and safety concerns. Quantitative findings show stark gaps: in rural Uttarakhand, only 30.1% of women aged 15–49 use the internet, compared to 55.4% of men, with merely 44.8% of Haridwar's rural women owning a mobile phone. Educational background strongly correlates with digital access: women with higher secondary education are three times more likely to use the internet than those with no formal education. Case studies from Haridwar villages further highlight real-life stories of women constrained by gender roles and limited digital exposure. The paper underscores the urgent need for gender-sensitive policy interventions, localized digital literacy programs, improved infrastructure, and community-based awareness campaigns. Addressing these barriers is essential for enabling women's participation in education, employment, and governance in the digital era. Ultimately, digital inclusion must go hand-in-hand with social inclusion to achieve equitable development.

INTRODUCTION

In the contemporary knowledge-driven world, digital connectivity is not merely a tool; it is a catalyst for economic empowerment, social inclusion, and individual agency. Yet, for millions of

women in semi-urban and rural India, particularly in regions like Uttarakhand, the web remains a distant, often unattainable frontier. Despite national efforts under initiatives like Digital India, a significant gender gap persists in access to digital tools, internet usage, and digital literacy. This research aims to unpack the layered and often overlapping socio-cultural and infrastructural barriers that hinder women's participation in the digital ecosystem.

While mobile phone penetration and internet availability have expanded rapidly across India, their usage among women, especially in non-urban areas, continues to be restricted by factors such as patriarchal norms, lack of education, economic dependency, and time poverty. In many communities, digital technology is still viewed as a male domain, and women's interaction with it is often regulated, supervised, or outright denied by familial and societal structures. Even when devices are present in households, access is frequently monopolized by male members, reinforcing digital exclusion. These restrictions are compounded by infrastructural limitations such as poor internet connectivity, irregular electricity, and limited availability of digital training centers in rural belts.

The study seeks to examine not only the infrastructural deficits but also the deep-rooted socio-cultural ideologies that shape digital behavior. It explores the intersectionality of gender, geography, education, and class to understand how these variables interact to either enable or inhibit digital empowerment.

By identifying and categorizing these barriers into tangible themes, this study contributes to the ongoing discourse on digital inclusion, gender equity, and development policy. The findings aim to inform localized, gender-sensitive digital strategies that move beyond mere device distribution to foster agency, autonomy, and sustainable empowerment for women.

OBJECTIVE OF THE STUDY

1. To identify key socio-cultural barriers that inhibit women's use of digital technology.
2. To analyse infrastructural gaps in digital access in rural and semi-urban areas.
3. To examine the intersection of gender, location, and digital literacy using national and district-level data.
4. To recommend gender-responsive policies for improving women's digital empowerment.

METHODOLOGY

This study adopts a mixed-methods approach relying primarily on secondary data to investigate socio-cultural and infrastructural barriers to women's digital empowerment in semi-urban and rural regions.

Quantitative data was obtained from:

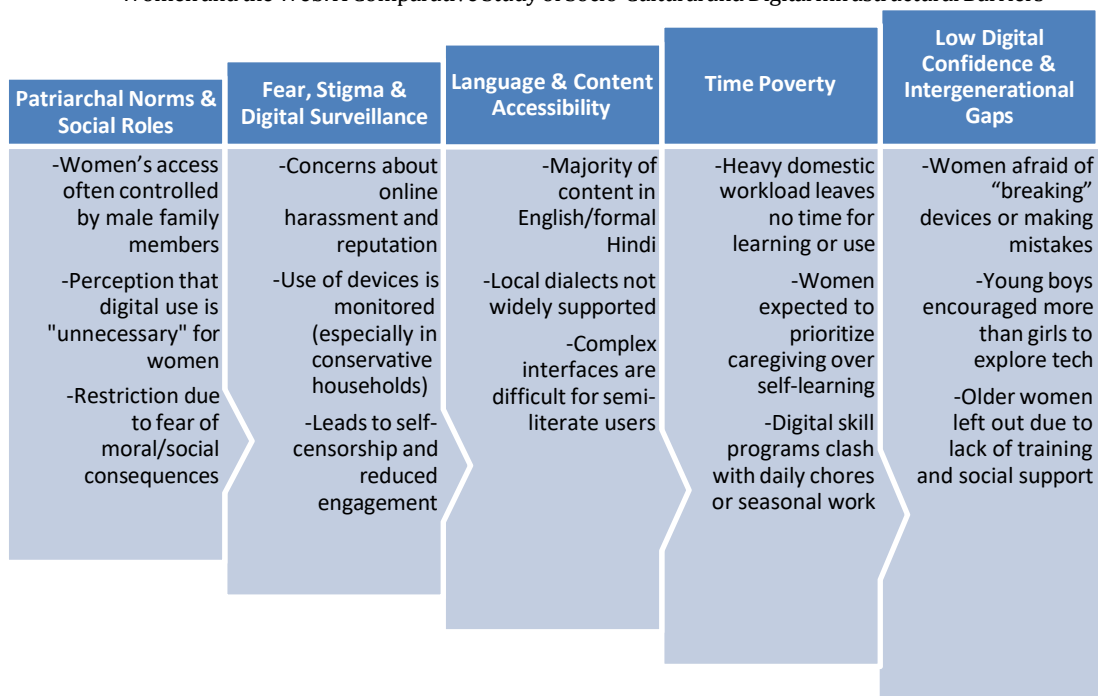
- NFHS-5 (2020–21): For gender-disaggregated data on internet usage, mobile ownership, and education.
- NSSO 75th Round (2017–18): For national estimates on digital literacy and ICT penetration.
- Digital India and PMGDISHA Dashboards: For scheme enrollment, outreach metrics, and policy implementation data.
- District Census Handbook and Haridwar District Statistical Handbook (2021): For region-specific infrastructural statistics and demographic indicators.

Qualitative insights were derived through:

- Case studies documented by NGOs (e.g., Internet Saathi, Digital Empowerment Foundation).
- Development and policy reports highlighting lived experiences, cultural constraints, and best practices.

Socio-Cultural Barriers to Digital Empowerment

Despite the increasing penetration of digital infrastructure in India, the uptake and meaningful use of digital technologies by women especially in semi-urban and rural regions remains critically low. This digital exclusion is not solely due to lack of access or infrastructure, but is deeply rooted in socio-cultural norms and gendered power structures that shape technology adoption. In the Haridwar district of Uttarakhand, as in many parts of India, these social constructs significantly restrict women's digital empowerment. This section explores the key socio-cultural barriers identified through data analysis and case studies.



Source-Gathered from multiple sources through the use of secondary data.

These socio-cultural barriers are deeply interlinked and reinforce one another. Patriarchal norms dictate access, surveillance reinforces distrust, while low literacy and time constraints erode confidence and opportunity. Addressing digital empowerment requires more than infrastructure it demands a cultural shift toward inclusivity, gender sensitivity, and autonomy in digital access and usage.

Infrastructural Barriers to Digital Empowerment of Women in Semi-Urban and Rural Areas

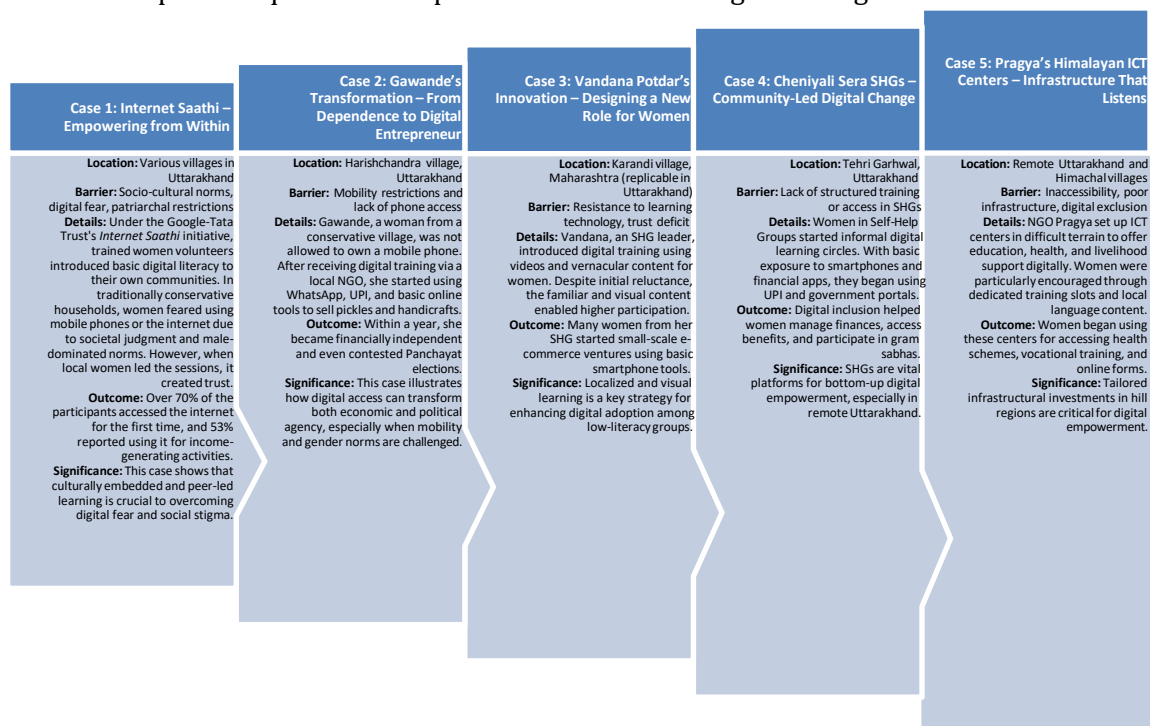
Barrier	Description	Impact on Women
1. Weak Internet Connectivity	Poor network coverage and low bandwidth in remote villages	Limited or interrupted access to online content, classes, services, or jobs
2. Inadequate Access to Devices	Low smartphone penetration; women often rely on shared or old devices	Reduces independence, digital fluency, and confidence
3. Power Supply Issues	Frequent outages, voltage fluctuations, and limited backup power	Disrupts continuity in learning, work, or accessing e-governance services
4. Male-Dominated Access Points	CSCs and internet cafés are often socially uncomfortable for women	Restricts safe access to public digital infrastructure
5. Distance from Digital Centers	Digital training centers often located far from villages	Unsafe or unfeasible travel; household duties limit participation
6. Poor ICT Infrastructure in Schools	Lack of computer labs, internet, or trained teachers in rural schools	Girls miss early digital exposure and skill development
7. Lack of Technical Support	Absence of repair shops or technicians in rural blocks	Devices remain broken or unused for long durations
8. Language and Interface Gaps	Most apps and portals are in English or poorly translated Hindi	Difficult to navigate digital services like banking, healthcare, government portals

Source- Collected from various sources using secondary data.

This table demonstrates that even when physical infrastructure (e.g., electrification) seems adequate, real- world usage is hindered by factors like low literacy, shared device usage, patriarchal control, and poor local support ecosystems. For women, especially in rural Uttarakhand, these infrastructural deficits converge to reinforce exclusion rather than inclusion. The lack of accessible and inclusive digital ecosystems continues to marginalize women and prevents meaningful digital participation.

Case Snapshots: Lived Experiences of Digital Barriers and Breakthroughs

To complement the quantitative evidence presented earlier, the following real-world case narratives illustrate the socio-cultural and infrastructural barriers to digital empowerment faced by women in rural and semi-urban India, especially in regions similar to Haridwar, Uttarakhand. These stories provide qualitative depth to the understanding of the digital divide.



Source- Gathered from multiple sources through the use of secondary data.

The case studies highlight how deeply rooted socio-cultural norms and infrastructural gaps hinder women's digital empowerment in rural and semi-urban India. Challenges such as limited phone ownership, patriarchal restrictions, low digital literacy, and poor internet access are common threads across these examples.

At the same time, the cases also show how localized efforts like community digital centers, peer training, and women-led initiatives can effectively bridge these gaps. Programs like Internet Saathi and mobile ICT hubs demonstrate that when digital access is made culturally relevant and community-driven, real change is possible.

These stories reinforce that digital empowerment is not just about access to devices or the internet it requires addressing social norms, building confidence, and creating supportive ecosystems. The case snapshots bring the data to life and support the argument that inclusive digital policies must go beyond infrastructure to tackle social barriers as well.

Data Highlights (from Secondary Sources)

Table 1: Gender-wise Internet Usage in India (% of individuals aged 15–49)

Region	Women (%)	Men (%)	Gender Gap (%)
All-India Average	33.3	57.1	23.8
Rural India	24.6	48.7	24.1
Urban India	51.8	73.5	21.7
Uttarakhand	39.2	63.9	24.7
Rural Uttarakhand	30.1	55.4	25.3
Urban Uttarakhand	58.5	79.7	21.2

Source: NFHS-5 (2020-21)

The data shows a consistent gender gap in internet usage, with women significantly behind men across India. The gap is wider in rural areas, especially in rural Uttarakhand, where only 30.1% of women use the internet. Despite higher access in urban areas, gender disparities persist, highlighting the need for targeted digital empowerment policies for women.

Table 2: Mobile Phone Ownership Among Women (15–49 years)

Location	Own Mobile Phone (%)	Do Not Own (%)
Rural India	46.6	53.4
Urban India	69.0	31.0
Rural Uttarakhand	51.2	48.8
Haridwar (Est.)	44.8	55.2

Source: NFHS-5 (2020-21)

The data reveals that mobile phone ownership among women is considerably lower in rural areas, with less than half of rural women in India and Haridwar owning a mobile. Urban women fare better, but significant gaps remain. This lack of personal device ownership directly limits women's access to digital resources and independence in connectivity, especially in regions like Haridwar.

Table 3: Digital Literacy in Rural Households

Parameter	% Households
Households with internet access	14.9%
Households with computer access	4.4%
Households with at least one member digitally literate	16.5%

Source: NSSO 75th Round (2017-18), Unit-level estimates

Note: Data refers to rural India. In backward regions like Haridwar, values tend to fall below these national averages.

Digital penetration in rural India remains alarmingly low, with only 14.9% households having internet access and a mere 4.4% having computer access. Just 16.5% of rural households have a digitally literate member. In underdeveloped districts like Haridwar, these figures are likely even lower, underscoring severe infrastructural and educational gaps that hinder digital empowerment

Table 4: Key Infrastructure Gaps in Semi-Urban & Rural Uttarakhand

Parameter	Rural Haridwar	Urban Haridwar
Electrified households	89.4%	99.2%
Consistent internet access	~22%	~60%
Smartphone penetration	~35%	~71%
Public Wi-Fi/Digital centers	Rare	Moderate
Distance to nearest cyber cafe or CSC	>5 km avg.	1–2 km

Sources: District Census Handbook, Digital India Reports

The data highlights significant infrastructural disparities between rural and urban Haridwar. While urban areas enjoy higher internet access (60%) and smartphone usage (71%), rural regions lag with just 22% internet access and limited digital infrastructure. The scarcity of public digital centers and long distances to access points further restrict rural residents, especially women, from engaging with digital platforms.

Table 5: Awareness of Government Digital Schemes Among Women

Scheme Name	Awareness (%)	Actual Enrollment (%)
PMGDISHA (Digital Literacy)	26% (rural women)	6–10%
Jan Dhan-Aadhaar-Mobile (JAM)	55%	40%
Digital India Portal Use	15%	<5%

Sources: NITI Aayog reports, PMGDISHA dashboard (2023 data)

The data reveals a significant gap between awareness and actual participation in government digital schemes among women. While 55% of women are aware of JAM, only 40% are enrolled. More critically, only 6–10% of rural women enrolled in PMGDISHA despite 26% awareness, and Digital India portal usage remains below 5%, indicating barriers beyond awareness such as access, skill gaps, or socio-cultural constraints.

Table 6: Device Sharing Patterns Among Women in Rural Areas

Device Access Type	Rural Women (%)
Own personal phone	38%
Shared within household	44%
No access at all	18%

Source: GSMA Mobile Gender Gap Report (2020), India subset

The table shows that only 38% of rural women own a personal phone, while a larger share (44%) must share devices within the household, often limiting privacy, time, and freedom of use. Additionally, 18% of rural women have no access to a mobile device at all, highlighting a critical barrier to consistent and autonomous digital engagement.

Table 7: Educational Background vs. Digital Access (Women aged 15–49)

Education Level	Mobile Ownership (%)	Internet Use (%)
No formal education	24.1	6.8
Primary school	38.6	14.9
Secondary school	62.3	34.7
Higher secondary & above	78.4	58.1

Source: NFHS-5, NSSO 75th Round

Education plays a pivotal role in digital empowerment. Women with no formal education show extremely low levels of mobile ownership (24.1%) and internet use (6.8%). These figures improve significantly as education levels rise reaching 78.4% mobile ownership and 58.1% internet usage among women with higher secondary education or above. This highlights how educational attainment directly influences digital access and underlines the need for integrated education-digital literacy strategies.

FINDINGS AND INTERPRETATION

The analysis reveals that women in rural and semi-urban Haridwar face layered digital barriers, shaped by both socio-cultural constraints and infrastructural limitations.

- Gender disparity is a recurring theme across data tables. As per NFHS-5 (Table 1), the internet usage gap between men and women is as high as 25.3% in rural Uttarakhand. This digital divide is worsened by low mobile ownership (Table 2) and high device sharing (Table 6), which significantly limits women's autonomy and privacy online.
- Education strongly correlates with digital access. As shown in Table 7, internet use rises from just 6.8% among uneducated women to 58.1% among highly educated ones, confirming that digital literacy efforts must be paired with broader educational support.
- From the infrastructure perspective, rural Haridwar lags in key metrics like internet access, smartphone penetration, and public digital centers (Table 4). Only 22% of rural homes have regular internet access, and many women must travel over 5 km for digital services.
- Despite schemes like PMGDISHA and Digital India, awareness and enrollment remain low (Table 5), especially among rural women. This shows a gap between policy design and on-ground implementation.
- Case studies further illustrate these challenges. For example, Neelam shares a phone with three others, and Farida dropped out of a digital course due to mobility and family restrictions. These lived realities validate the quantitative trends.

In essence, digital empowerment is hindered by both hardware (infrastructure, devices) and software (social norms, education). Bridging this divide will require integrated policy action, grassroots training, and gender-sensitive infrastructure planning.

RECOMMENDATIONS

Based on the comprehensive analysis of quantitative data and real-life case studies from semi-urban and rural Haridwar, the following recommendations are proposed to address the multifaceted digital barriers faced by women:

1. Improve Infrastructure in Rural & Semi-Urban Areas

- Expand broadband connectivity and improve mobile network coverage, especially in interior villages.
- Establish more Common Service Centres (CSCs), public Wi-Fi hubs, and digital resource

centres within accessible distances.

- Ensure regular electricity supply in rural homes, as digital access is contingent upon basic infrastructure.

2. Promote Affordable Digital Devices

- Introduce subsidized smartphone schemes targeted at women from low-income households.
- Provide refurbished devices through local NGOs or digital banks under CSR initiatives.
- Encourage community digital libraries or device-lending kiosks in villages.

3. Gender-Sensitive Digital Literacy Programs

- Expand programs like PMGDISHA with doorstep delivery of training and female trainers to boost participation.
- Include basic internet safety, e-banking, and digital health literacy in curriculum.
- Design time-flexible modules for homemakers and working women.

4. Strengthen Awareness and Outreach

- Use local influencers, ASHA workers, self-help groups (SHGs), and anganwadi centres to spread awareness of digital schemes.
- Launch targeted campaigns in regional languages through TV, radio, and mobile vans.

5. Address Socio-Cultural Norms and Safety Concerns

- Conduct community sensitization workshops to challenge digital gender stereotypes.
- Promote safe digital environments with emphasis on cyber hygiene, privacy, and responsible usage.
- Involve male family members in awareness drives to build a more enabling home environment.

6. Integrate Digital Access with Livelihood Programs

- Link women's skill development, entrepreneurship training, and SHG operations with digital platforms.
- Provide market linkages through e-commerce platforms, digital payments, and online marketing tools.

7. Monitoring and Evaluation

- Implement district-level audits of digital inclusion with a gender lens.
- Collect gender-disaggregated data regularly to track progress and recalibrate programs accordingly.

CONCLUSION

1. The digital divide in India, particularly among women in rural and semi-urban regions like Haridwar, is not merely a technological gap but a deeply rooted socio-cultural and infrastructural challenge. Despite national efforts such as Digital India and PMGDISHA, the penetration of digital access among women remains limited due to a combination of low device ownership, inadequate internet infrastructure, gendered norms, and restricted mobility.
2. The analysis of data from NFHS-5, NSSO, and GSMA, along with real-life case snapshots, reveals a consistent pattern: women with lower education, limited income, and residing in rural areas face the greatest barriers to digital empowerment. Moreover, cultural restrictions, safety concerns, and a lack of targeted awareness programs further restrict their participation in the digital ecosystem.
3. However, the research also highlights that these barriers are not insurmountable. With focused interventions improving infrastructure, designing inclusive policies, promoting affordable digital tools, and engaging communities significant progress can be made. When women are empowered digitally, the benefits ripple across education, health, livelihoods, and overall socio-economic development.
4. Bridging the gendered digital divide, therefore, is not just a matter of equity but a crucial step toward inclusive and sustainable development. The path ahead requires coordinated efforts from government bodies, civil society, educators, and local communities to ensure that no woman is left offline in the digital age.

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