INITIATIVE ON
Digital Innovation

TECHNICAL REPORT

# The Digital Landscape in Eastern India

*Findings from the Digital Needs Assessment Surveys from Bihar and Odisha, India*

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## Abstract

This report examines the digital landscape in the Eastern Indian states of Bihar and Odisha, focusing on disparities in digital access, literacy, and technology utilization. Using gender-disaggregated data from 1,034 households, the findings reveal significant gender, social, and regional inequities. Women, especially from marginalized communities, face reduced access to digital devices, limited operational skills, and low internet usage for agricultural needs. Key barriers include high device costs, limited digital literacy, and inadequate local-language content. Despite challenges, a strong demand for digital skills training emerges, particularly among women and younger populations. The current utilization of mobile internet primarily revolves around communication and entertainment, with minimal use for agriculture-related activities. The report underscores the necessity for tailored digital literacy programs, localized content, and affordable technology to bridge these divides. Addressing these gaps can enhance the adoption of digital tools, fostering inclusive growth and improved agricultural outcomes in the region.

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# The Digital Landscape in Eastern India

## Introduction

The last decade has witnessed significant advancements in integrating digital technologies, tools, and services within agriculture, markets, and climate change. As these technologies evolve, their relevance to food, land, and water systems research has become increasingly apparent. Mobile phones and digital technologies have the potential to significantly improve agricultural productivity for smallholder farmers in developing countries, as evident in increased yields and increased adoption of recommended inputs (Silvestri et al. 2021; Fabregas, Kremer, and Schilbach 2019). They argue that even basic phones and inexpensive text or voice messages can change farmer behavior. Despite these promising developments, a concerning trend emerges: the design and deployment of digital interventions often bypass proper end-user consultations. Common pitfalls that constrain the use of digital extension tools are lack of awareness, inaccessible devices and infrastructure, digital illiteracy, language barriers, and lack of relevance to farmers' needs (Coggins et al. 2022). These pitfalls contribute to lower adoption of digital extension tools among women, less educated, and poor farmers (Coggins et al. 2022). Customizing information and allowing farmers to share their feedback can significantly unlock the benefits of digital agriculture. When digital systems are customized to match individual farmers' characteristics and offer chances for feedback and interaction, these can get better over time and provide more helpful support to farmers (Fabregas, Kremer, and Schilbach 2019).

In most low- and middle-income countries (LMICs), these digital revolutions overlook vital agricultural stakeholders, especially women and marginalized communities. This omission manifests as a digital gender divide, further exacerbated by socio-economic disparities. For example, ownership and use of digital technologies increase women's labor force participation rate, consumption, and income levels and improve occupational choice (Sekabira and Qaim 2017; Abate et al. 2023; Suri and Jack 2016; Amber and Chichaibelu 2023). Emphasizing the transformation potential of digital tools in reshaping food, land, and water systems, it is imperative to strategize for more inclusive digital landscapes. Using data from 12 Latin American and 13 African countries and controlling for education, employment, and income, which determines women's access and use of digital technologies, women emerged as more active users of digital technology (Porciello et al. 2022; Hilbert, 2011). This challenges the notion of a gender digital divide and suggests that digital technologies could be an opportunity to address gender inequalities and biases.

The CGIAR Initiative on Digital Innovation (DI) endeavors to tap into the promise of digital technologies, anchoring them as key decision-support tools across various systems. However, disparities in digital accessibility and benefits persist, influenced by diverse end-user factors like age, gender, educational background, and infrastructure availability. Recent observations have flagged an alarming trend where digital service uptake is predominantly among males or those in economically advantaged positions, widening gender and socio-economic divides.

Addressing these challenges, this report aligns with CGIAR's DI Initiative, aiming to describe the digital ecosystem landscape within Bihar and Odisha, India. This effort includes a detailed analysis of end-user profiles and an assessment of training requirements.

### *Objectives and Research Questions*

The project is structured around a dual-axis objective: first, to construct a database of the digital ecosystem, and second, to conceptualize specialized capacity-building modules for a heterogeneous user base of digital innovations in the target areas. More specifically, the objectives are:

1. To explore the digital services available, including the service providers, their scope of work, type of services, and their clientele group in food, land, and water systems in the Bihar and Odisha States of India.
2. To document the profile of the existing digital landscape, including the diversity of end users, the service reach, and the socio-economic and demographic make-up of the digital service users in the region's agricultural, water management, and climate services.
3. Assess the needs and capacity of the diverse end-users (including women, men, youth, the poor, the uneducated, etc.) to use the digital services available in the region.

This report partially addresses the project's overarching objectives by evaluating the characteristics of sample households in Eastern India. It encompasses a gender-disaggregated analysis of information access methods, mobile device ownership and usage, mobile internet accessibility, and other factors, including the utilization of digital technology and its barriers. Additionally, it examines aspects of social inclusion, digital literacy, training, and information needs. This comprehensive assessment provides insights crucial for policymakers and practitioners to understand the digital landscape in this region.

## Sampling and Data Collection

The research employed a gender-disaggregated household survey in 2022 to understand gender-specific disparities in access to and control over digital services within households in the Indian states of Bihar and Odisha. Recognizing that women and men from the same household might possess varying digital knowledge and skills, individual perspectives were captured by interviewing both primary male and female members, typically the household heads and their primary counterparts (spouses). We refer to them as the male primary members (MPM) and the female primary members (FPM) of the household. The survey encompassed 1,034 households (500 from Odisha and 534 from Bihar), translating to 2,068 individuals. Four districts from each state were chosen, and from each district, 125 households were selected via stratified random sampling. This approach aimed to ensure diverse representation, focusing on youth and marginalized communities, ensuring that 15-20% of respondents were under 30 years of age and another 15-20% represented marginal castes and tribal communities. Given the sociocultural contexts of Bihar and Odisha, special attention was given to the scheduled caste (SC) group in Bihar and the scheduled tribe (ST) group in Odisha. The research team reviewed the district-wise population data in both states and ranked them based on the caste groups. From the rank, the top six districts were selected. Finally, four were used to develop a sampling frame based on local circumstances, such as the complexity involved in access, proximity, and general digital infrastructure available in the districts.

# Socio-Economic Disparities in Bihar and Odisha: Description of the sample

In Bihar and Odisha, caste and socio-economic elements are critical in determining resource ownership and access. This section systematically examines these relationships, focusing on the pronounced gender disparities in these regions.

## *Caste Distribution*

In Bihar, the demographic landscape of our sample is predominantly characterized by Other Socially Marginalized Castes (OSMC), constituting 59% of the population, followed by the Scheduled Castes (SC) at 39% (Figure 1). In contrast, Odisha has a more balanced caste distribution. The non-marginalized castes (NMC) represent 22% of the sampled population, while the OSMC accounts for 38%. Both the SC and Scheduled Tribes (ST) hold an equal share of 20% each (Figure 1). It is noteworthy that the marginalized caste groups, namely SC and ST, collectively make up approximately 40% of the population in both states, which implies that any developmental or policy interventions should consider the unique challenges faced by these disadvantaged groups.

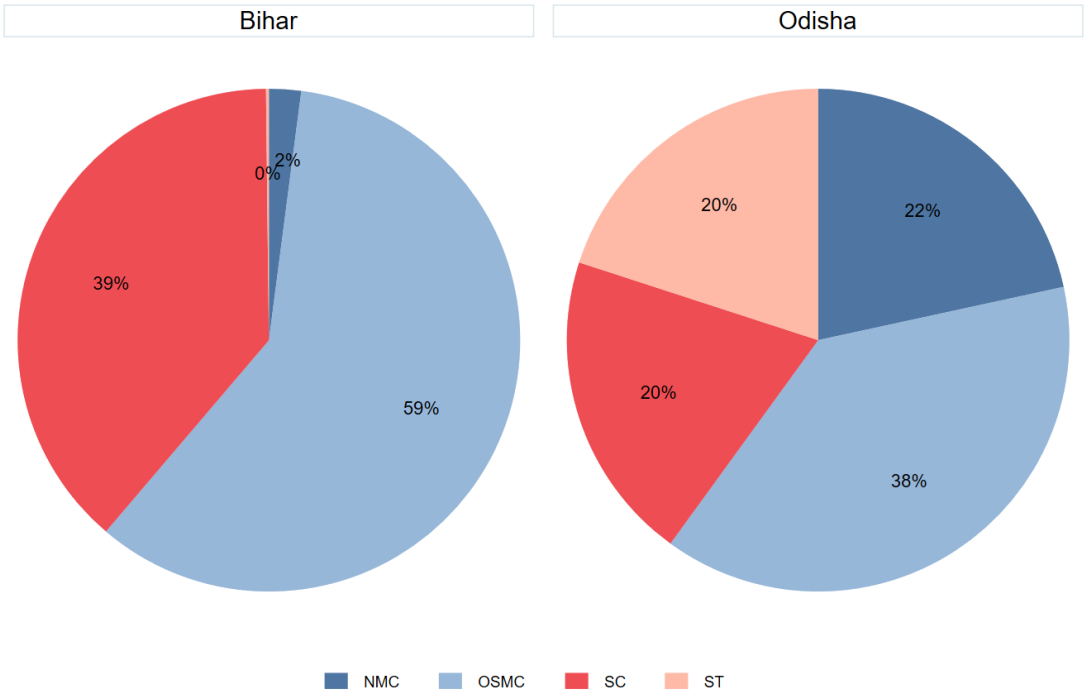


**Figure 1.** Caste distribution by states.

## *Educational Disparities*

A stark gender disparity in education is evident in Bihar. Only 48% of women respondents or FPM of the sample households possess literacy skills, in stark contrast to the 82% of men respondents or MPM of the sample households. Furthermore, the average years of education for women stands at 5 years, significantly lower than the 8 years for men (Table 1). In Odisha, although the gender gap is smaller than in Bihar, it still exists, with women consistently falling behind their male counterparts. The pronounced educational gap between men and women, especially in Bihar, indicates systemic gender biases in access to education. This disparity can

have long-term implications, limiting opportunities for women in various sectors, including employment and socio-political participation.

### *Economic Engagement*

In terms of non-agricultural income, FPM in Bihar earns significantly less than MPM (Table 1). The gender disparity in non-agricultural income suggests that women have limited access to diverse income-generating opportunities. However, this disparity is less pronounced in Odisha. Notably, most households in these states have access to basic amenities like electricity and banking services. The Labor Force Participation Rate (LFPR, defined as an individual who has worked for at least an hour in the past week in farming, non-farm business, or as an employee/apprentice) further underscores the gender divide. In Bihar, the LFPR for MPM is 98%, significantly higher than the 78% observed for FPM (Table 1). Similarly, in Odisha, the LFPR for MPM is 92% compared to 63% for FPM.

**Table 1.** Respondent characteristics by gender and state.

| | **Bihar** | | **Odisha** | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| Age in years | 37 | 36 | 37 | 41 |
| % of respondents who can read and write | 48 | 82 | 76 | 88 |
| % of respondents who attended school | 99 | 97 | 96 | 99 |
| Years of education | 5 | 8 | 6 | 8 |
| Non-agricultural income (USD/annum) | 1096 | 1346 | 1006 | 985 |
| % of respondents having access to electricity | 99 | 99 | 96 | 96 |
| % of respondents having a bank account (%) | 95 | 97 | 95 | 95 |
| Labor Force Participation Rate (LFPR) (%) | 78 | 98 | 63 | 92 |

### *Agricultural Engagement*

Agricultural activities see a reverse trend in gender engagement. In Bihar, 74% of MPM are engaged in farming-related activities, compared to 94% of FPM. Odisha reflects a similar pattern, with 66% of MPM and 82% of FPM involved in agriculture (Figure 2). However, a concerning observation is the limited marketable surplus, especially in Bihar, where it is a mere 13%, indicating a predominance of subsistence farming (Table 2). Bihar's low marketable surplus indicates economic vulnerabilities for farming households, as they might need more produce to sell and generate income after meeting their needs.

The interesting fact is that the higher LFPR for men compared to women underscores traditional gender roles, where men are often the primary breadwinners. However, women's significant involvement in agricultural activities, especially subsistence farming, indicates their crucial role in sustaining households, even if their efforts do not directly translate into marketable surplus or significant income.

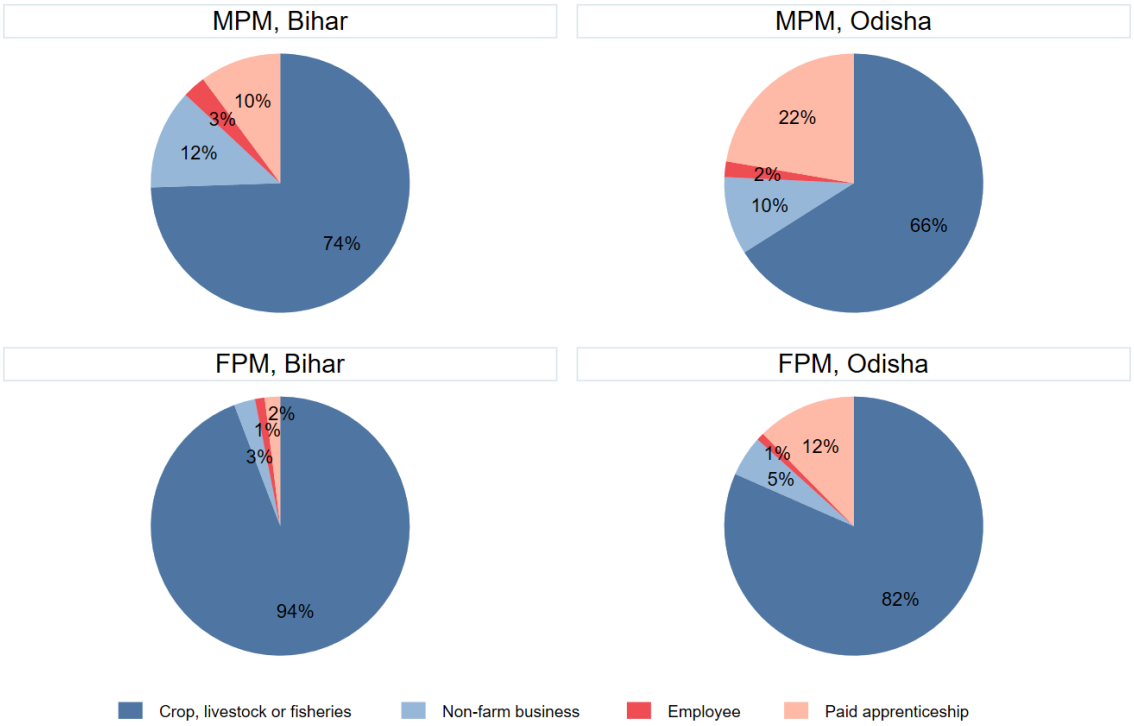


**Figure 2.** Distribution of work activities (over the past 7 days) by gender and state.

The data reveals a significant gender gap, particularly in education and employment. FPMs face substantial obstacles, manifested in their lower educational attainment, reduced earnings from non-agricultural activities, and a higher reliance on subsistence agriculture. These disparities necessitate urgent, targeted interventions to foster equitable socio-economic advancement. The findings emphasize the need for research, policy, and development initiatives to integrally consider caste dynamics, gender roles, and local socio-economic factors. Addressing these identified challenges is imperative not only for achieving gender equality but also for the broader socio-economic progress of these regions.

**Table 2.** Marketable surplus by states.

| | Bihar | Odisha |
|---|---|---|
| Marketable surplus of agriculture, livestock, and fisheries produce | 13% | 55% |

## Digital access, utilization, and needs

This section explores the current state of digital access, utilization, and needs among different demographics in Bihar and Odisha. It highlights the disparities in digital competencies, the barriers to effective internet use, and the specific digital literacy requirements. Understanding these factors can better address the challenges and enhance digital integration in these regions.

### *Use of ICT devices*

Most sample respondents use mobile phones in the states (Figure 3). Additionally, television emerged as a popular device among many respondents, underscoring its potential as an effective medium for information dissemination (Figure 3). Other digital technologies are limited in use. However, the use of mobile phones by the majority indicates a potential platform for widespread information dissemination through voice-based services or SMS,

which is even effective in areas with limited internet access or digital literacy (Fabregas, Kremer, and Schilbach 2019; Silvestri et al. 2021).

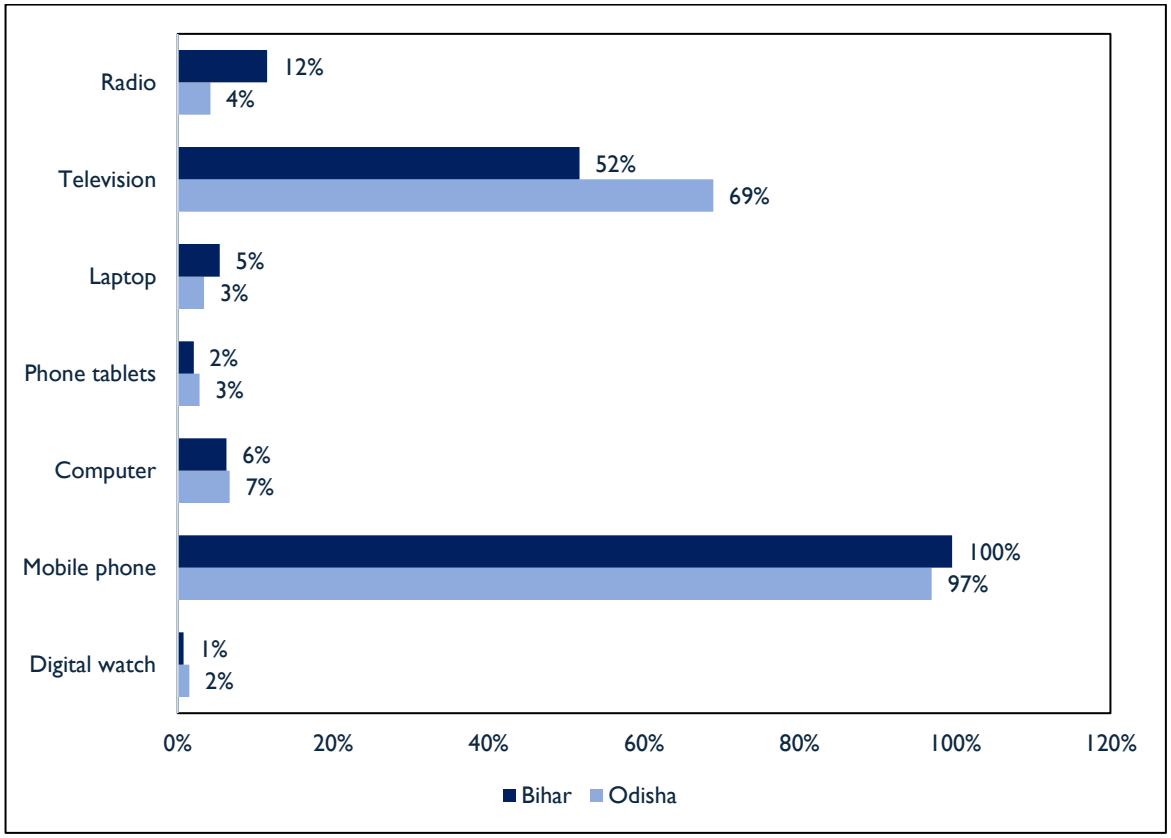


**Figure 3** Use of ICT devices by gender and state

### *Methods of information access*

In the context of the evolving digital landscape, it is crucial to understand how information is accessed, as this knowledge is vital for effective communication strategies. This section explores the distinct sources of information access (Figure 4).

Both FPM and MPM exhibit similarities in their primary information access methods, with 77% of the households in Odisha and 62% in Bihar relying on friends, neighbors, and family. However, their secondary methods differ. In Odisha, people turn to television, the internet, and mobile-based platforms like social media and SMS. In contrast, Bihar households prefer traditional methods such as visits to retailers and community group interactions. This highlights the need for information dissemination strategies to leverage these trusted networks, especially for new concepts or practices. The divergence in methods, with Odisha favoring digital means (like social media and SMS) and Bihar traditional ones, underscores the digital divide and regional variations in technology adoption. Therefore, a one-size-fits-all approach to information dissemination is ineffective; strategies should be tailored to each state's unique technological landscape.

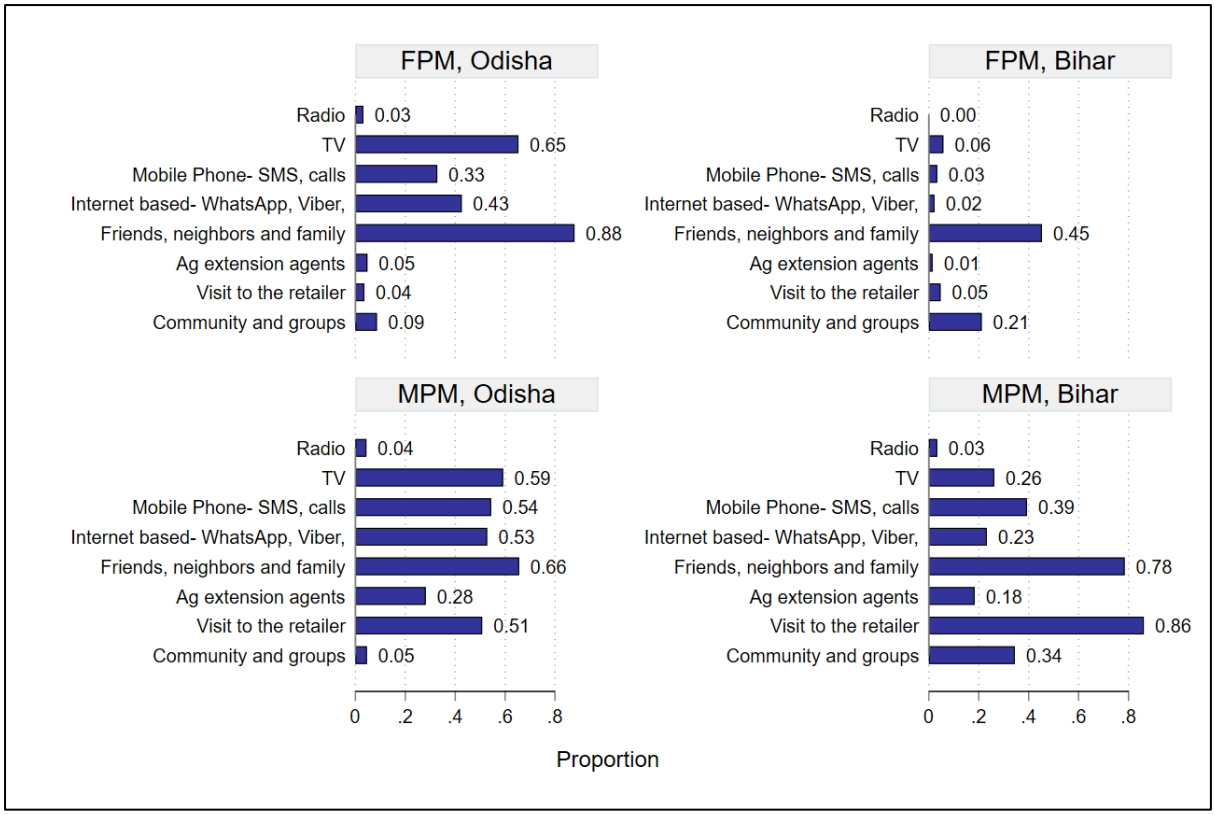


**Figure 4** Methods of information access by gender and states

## *Utilization of ICT devices*

Mobile devices are frequently utilized for making audio calls and sending SMS, a trend particularly common among MPM users (Figure 5). Beyond these essential functions, these devices' next most popular uses include engaging with social media platforms and conducting video calls. This emphasizes the capability of mobile devices to enhance both traditional communication methods and modern digital interactions, positioning them as valuable tools in ICT innovations.


**Figure 5** Utilization of ICT devices for different purposes

## Mobile Technology and Internet Usage

The proliferation of mobile technology and the internet has transformed communication landscapes globally, also observed in India. From 2005 to 2020, India experienced a significant increase in mobile phone subscriptions, rising from 8 to 83 per 100 people.[1], alongside an increase in internet usage from 2% to 43% of the population[2]. This section examines the disparities in mobile phone ownership, internet access, and digital literacy between FPM and MPM in Bihar and Odisha.

[1] https://ourworldindata.org/grapher/mobile-cellular-subscriptions-per-100-people?tab=chart&time=earliest..2021&country=~IND

[2] https://ourworldindata.org/grapher/share-of-individuals-using-the-internet?country=~IND#sources-and-processing

### *Mobile Device Ownership*

A significant gender, social, and regional disparity is evident in mobile phone ownership. In Bihar, only 38% of FPM own a mobile device, compared to 89% of MPM. Similarly, in Odisha, 41% of FPM own a mobile device, in contrast to 83% of MPM (Figure 6). There is a significant difference between mobile ownership by different caste groups in Odisha, with the non-marginalized caste (NMC) group owning the highest (72%) compared to marginalized communities. However, there was no statistical difference between the caste groups in Bihar. This disparity underscores potential barriers women and marginalized communities face in accessing digital communication tools.

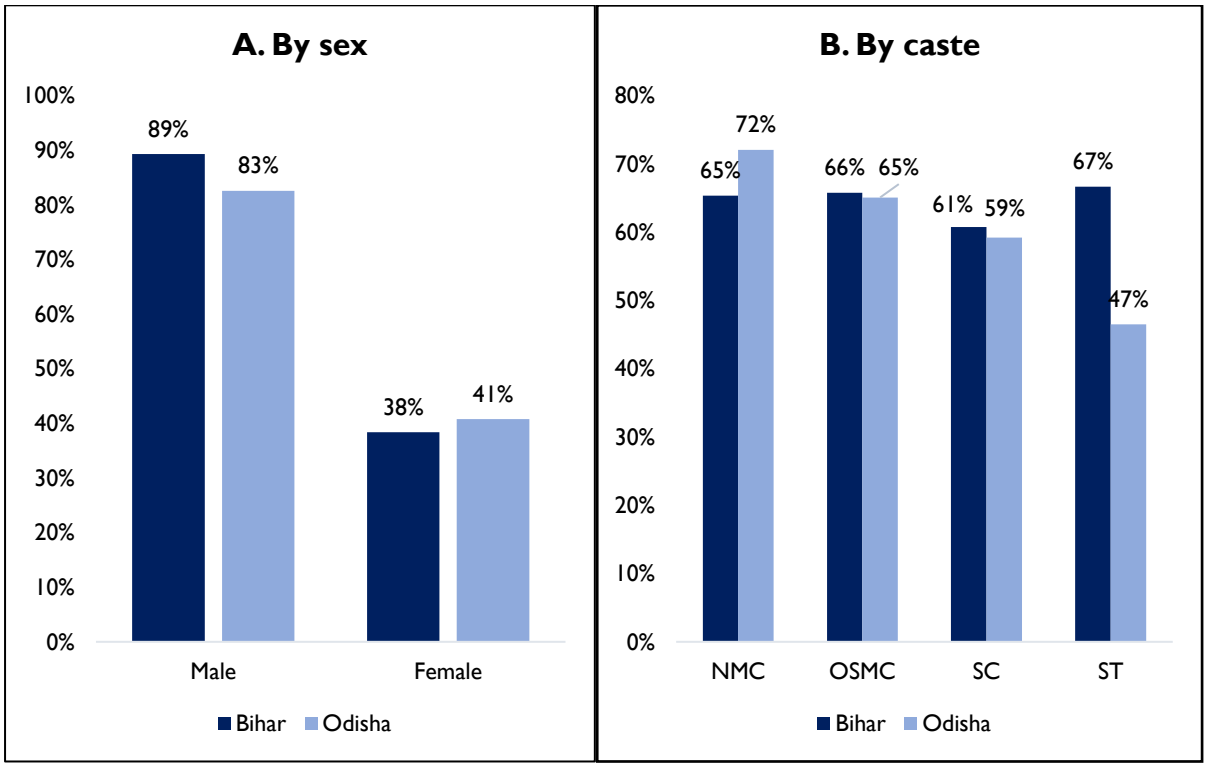


**Figure 6** Mobile device ownership by gender, caste groups, and states.
*Note*: NMC – non-marginalized castes, OSMC – other socially marginalized castes, SC – scheduled castes, and ST – scheduled tribes.

### *Type of Mobile Phones Owned*

The gender and social divide extends to the type of mobile phones owned. Among mobile device owners, only 37% of FPM in Bihar and 47% in Odisha possess smartphones. In contrast, 59% of MPM in Bihar and 58% in Odisha own smartphones, indicating a gender-based technological divide (Figure 7). Similarly, smartphone ownership is significantly less among marginalized communities. Women and marginalized communities have substantially higher basic phones while owning significantly fewer smartphones. This affects the quality of access and the range of services and information that can be accessed, given that smartphones offer a broader array of functionalities than basic phones.

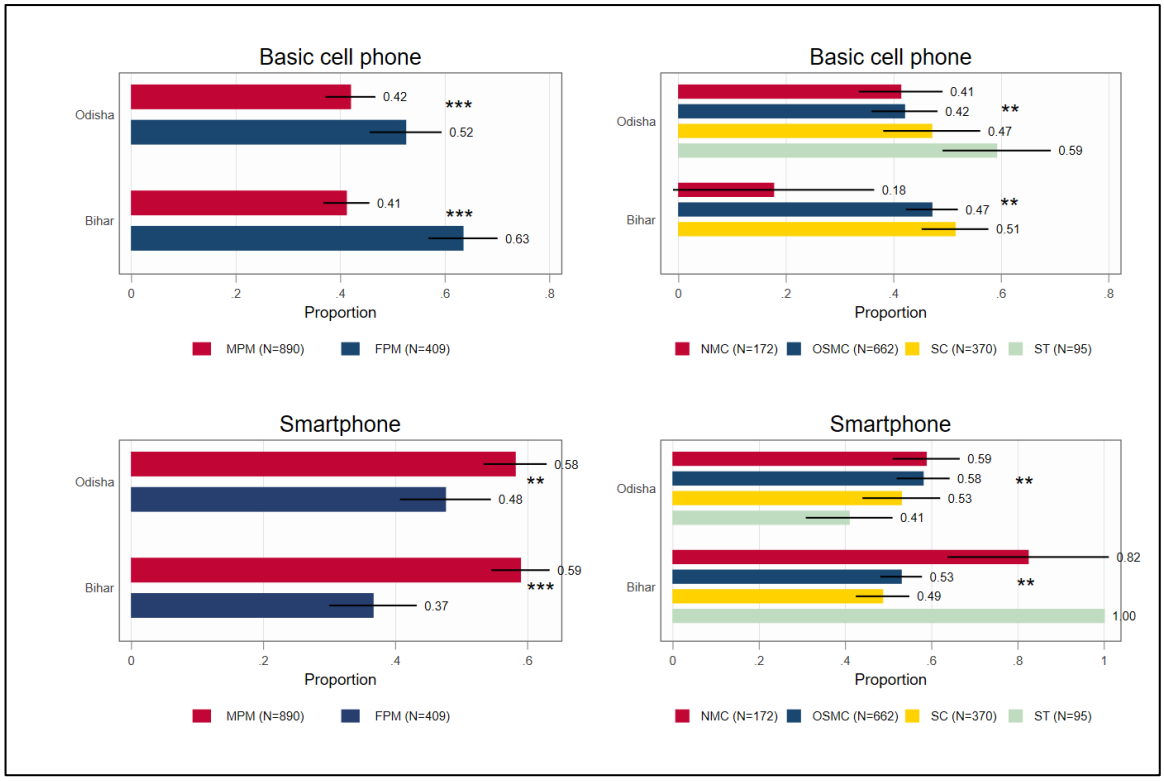


**Figure 7** Type of mobile/cell phone owned by gender, caste groups, and states

*Notes*: ** and *** indicate statistical significance at 5% and 1% level. t-test and Kruskal-Wallis test are used to test differences by sex and caste groups, respectively. NMC – non-marginalized castes, OSMC – other socially marginalized castes, SC – scheduled castes, and ST – scheduled tribes.

## *Accessibility of Mobile Phones and the internet*

While over 90% of households, excluding FPM in Bihar, have full-time access to mobile phones, only 49% of FPM in Bihar enjoy such access (Table 3). Furthermore, among those without full-time access, a mere 22% of FPM in Bihar can access mobile phones when needed (Table 3). Limited access can hinder timely communication, access to vital information, and utilization of digital services. This disparity in mobile phone access, particularly among FPM in Bihar, aligns with findings from Kansiime et al. (2019), who observed similar challenges in mobile agri-advisory services, underlining the need for improved accessibility and design to ensure effective communication and information dissemination.

**Table 3.** Access to mobile devices and the internet by gender and state.

| | **Bihar** | | **Odisha** | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| Full-time access to mobile phones (%) | 49 | 93 | 92 | 92 |
| Always have access to mobile phone when required (%) | 22 | 45 | 12 | 0 |
| Consistent internet access (%) | 89 | 85 | 84 | 81 |
| Poor cellular connectivity (%) | 63 | 12 | 62 | 21 |
| Poor internet connectivity (%) | 2 | 1 | 20 | 18 |
| % respondents who are not comfortable in using digital devices | 48 | 13 | 43 | 25 |
| Use cell phones/computers for e-learning comfortably or with help (%) | 8 | 32 | 1 | 3 |

### *Quality of Connectivity*

Most smartphone owners regularly use the internet, with 87% in Bihar and 82% in Odisha reporting consistent usage (Table 3). However, 62-63% of female primary members (FPM) in both states reported poor cellular connectivity, compared to 12% of male primary members (MPM) in Bihar and 21% in Odisha. This significant difference in connectivity issues between genders is unusual. Additionally, 1-2% of households in Bihar and 18-20% in Odisha expressed dissatisfaction with internet connectivity. This disparity may be due to women primarily using devices at home, where connectivity issues are more prevalent.

### *Digital Literacy and Operational Skills*

Operational skills with digital devices show significant disparities (Table 3). In Bihar, 48% of FPM reported discomfort using digital tools, compared to 43% in Odisha. In contrast, 87% of MPM in Bihar and 75% in Odisha felt comfortable with these devices. Regarding e-learning or tutorial videos, only 8% of FPM in Bihar and 1% in Odisha felt comfortable using mobile phones or computers independently or with assistance, compared to 32% and 3% of MPM, respectively. This widespread discomfort with digital platforms for e-learning highlights a gap in digital literacy.

A focused examination of digital competencies in Bihar and Odisha revealed significant gender disparities (Figure 8). In Bihar, only 10% of female primary members (FPM) could proficiently perform tasks like downloading applications, app registrations, online payments, online searches, using applications in daily life, and discerning quality content online, compared to 44% of male primary members (MPM). In Odisha, 16% of FPM were proficient in these tasks, compared to 37% of MPM. The gap between FPM and MPM was evident in both states, particularly in functions like downloading apps and making online payments, with FPM lagging behind MPM in these digital skills.

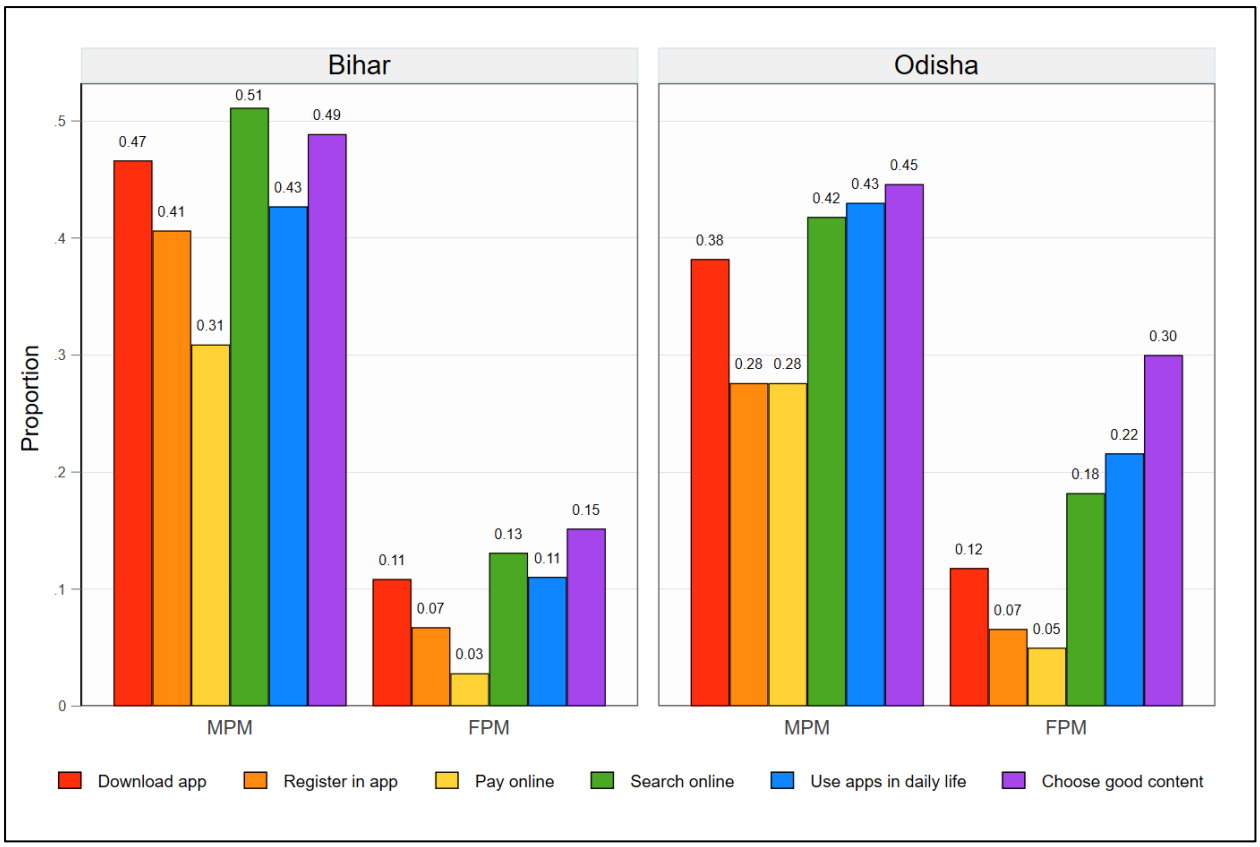


**Figure 8** Internet operational skills by gender and state.

### Digital Privacy Awareness

In Bihar, 82% of male primary members (MPM) are aware of digital privacy, compared to 61% of female primary members (FPM). Additionally, 70% of MPM and 56% of FPM use security measures like passwords or fingerprints. In Odisha, awareness and adoption of security measures are lower, with 54% of MPM and 34% of FPM aware of digital privacy risks and 47% of MPM compared to 19% of FPM using security measures (Figure 9).

### *Training in Digital Platforms*

Poor operating skills and comfort with digital devices may stem from a lack of training. Few households have undergone e-learning training, except for 10% of male primary members (MPM) in Bihar who attended digital finance courses. The limited participation in digital training, especially among female primary members (FPM), highlights the need for targeted digital literacy initiatives.

## Digital Utilization and Barriers

The digital era has ushered in many opportunities and challenges. This section examines the digital use patterns and the barriers faced by MPMs and FPMs in Bihar and Odisha.

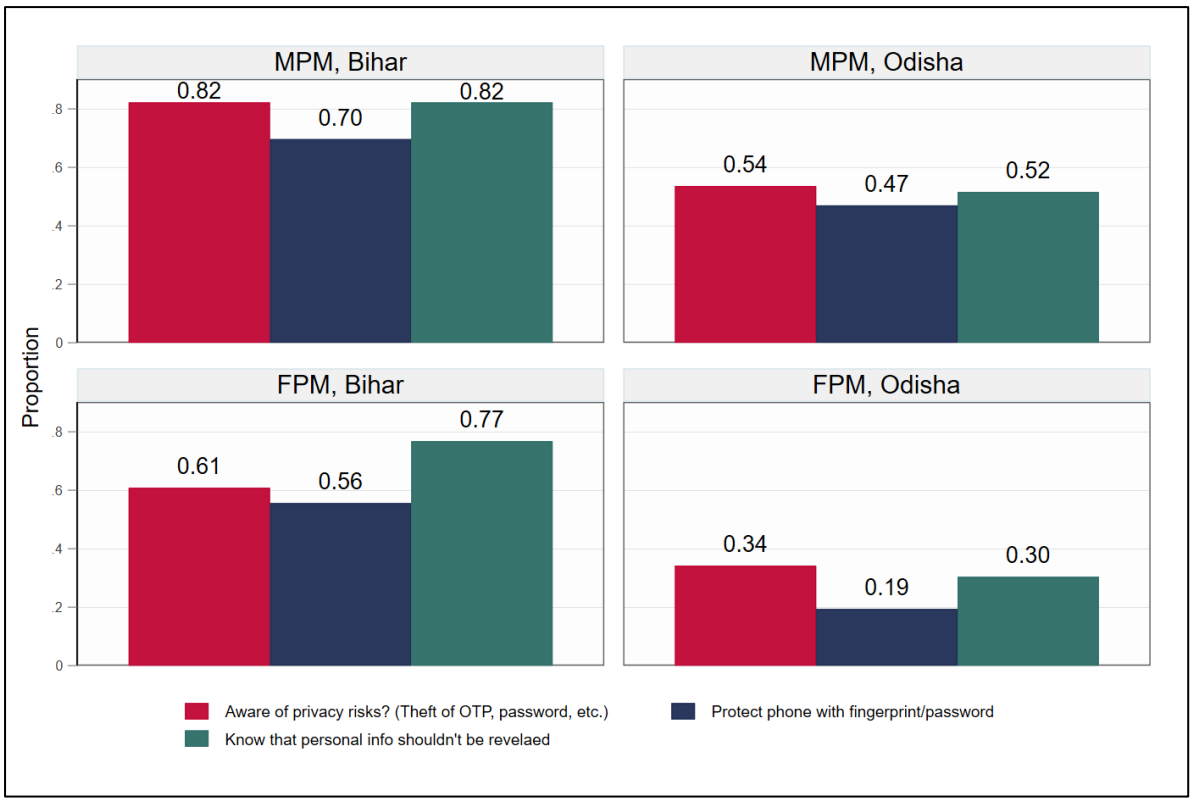


**Figure 9** Digital safety awareness by gender and state.

### *Primary Digital Activities*

In Odisha, both MPM and FPM primarily use the internet for personal communication, social media, and entertainment, as shown in Table 4. Contrastingly, in Bihar, internet usage is more concentrated on personal communication and entertainment, suggesting a limited exploitation of the internet's broader functionalities. This pattern points to a potential underutilization of Bihar's broader internet capabilities.

**Table 4** Reasons for internet use by gender and state

| | Odisha | | Bihar | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| One-to-one communication | 44% | 52% | 21% | 27% |
| Social media | 35% | 46% | 22% | 32% |
| Entertainment | 41% | 49% | 19% | 39% |
| Medical/health information | 5% | 19% | 1% | 4% |
| Information seeking | 42% | 51% | 2% | 9% |
| Education | 10% | 17% | 4% | 13% |
| Shopping | 6% | 20% | 2% | 5% |
| Banking and financial services | 4% | 26% | 1% | 8% |
| Expressing and voicing opinions on issues | 1% | 5% | 1% | 3% |
| Creating and sharing /publishing content | 8% | 16% | 1% | 5% |
| Job search | 2% | 12% | 2% | 6% |
| Supporting own business | 1% | 6% | 0% | 5% |

### *Barriers to Internet Use*

In Bihar, the main barriers to internet use are the high costs of devices and illiteracy. Secondary barriers include needing more digital skills, high internet costs, absence of local language content, and operational challenges with digital devices (Table 5). In Odisha, the primary barriers are the high costs of devices and internet services, lack of access to internet-enabled devices, illiteracy, operational challenges, and a deficit in digital skills (Table 5). These

barriers align with common issues in digital agriculture, such as limited awareness, inaccessible devices, digital illiteracy, language barriers, and misalignment with farmers' needs (Coggins et al., 2022). Addressing these foundational issues is crucial for effective digital integration in these regions.

**Table 5** Reasons for not using the Internet

| | Odisha | | Bihar | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| High cost of the device | 40% | 31% | 42% | 24% |
| High internet cost | 38% | 27% | 25% | 11% |
| No device that has internet | 39% | 27% | 14% | 7% |
| No time | 5% | 5% | 7% | 5% |
| Internet drains my battery | 0% | 0% | 0% | 0% |
| Limited/No coverage | 1% | 2% | 1% | |
| Slow internet | 5% | 3% | 1% | |
| No content in my language | 24% | 16% | 26% | 8% |
| No time to learn the internet | 5% | 5% | 20% | 6% |
| Not useful/interesting | 10% | 10% | 13% | 4% |
| Can't read or write | 30% | 24% | 44% | 19% |
| Difficult to use devices | 30% | 21% | 27% | 12% |
| Not confident | 26% | 16% | 10% | 2% |
| Don't have the right skills | 31% | 23% | 29% | 17% |
| Nobody to help me | 3% | 4% | 10% | 2% |
| No family approval | 1% | | 1% | 0% |
| The community does not support | 0% | 0% | 1% | 0% |
| Concern: stranger contact | 0% | | 2% | |
| Concern: harmful content | 3% | 1% | 1% | |
| Concern: private information theft | 2% | 1% | 1% | |

## Digital technology utilization and needs in agriculture

This section examines how digital technology is currently utilized in agriculture and identifies the specific needs of farmers in Bihar and Odisha. It highlights the gaps in digital literacy, access to technology, and the barriers that hinder the effective use of digital tools in farming. By addressing these issues, we can develop targeted strategies to enhance the adoption and impact of digital technologies in the agricultural sector.

### *Information Needs in Agriculture*

Almost 90% of farmers strongly needed information on various farming-related topics. While not statistically significant, there were slight gender-based variations in specific topics of interest, especially in Bihar (Table 6). In Odisha, FPM and MPM shared similar top three information needs: Food and Nutrition, Health and Hygiene, and Plant Nutrition. In Bihar, FPM prioritized Food and Nutrition, Plant Nutrition, and Crop Insurance, while MPM preferred Crop Insurance, Innovative and Sustainable Farming Practices, and Government Schemes and Subsidies.

The high demand for farming-related information highlights a significant knowledge gap in the agricultural sector. Gender-based variations suggest different roles or priorities in farming, necessitating gender-specific information campaigns. Research institutions, governmental bodies, and developmental programs must recognize and address these needs. Effective information dissemination depends on the appropriateness of the chosen channel. For example, using SMS or WhatsApp for climate risk mitigation in Bihar may not be practical due to the state's preference for traditional information access methods. A nuanced approach, considering regional, gender-based, and technological preferences, can significantly enhance the reach and impact of information, especially in critical sectors like agriculture.

**Table 6** Information needs by gender and state.

| | Odisha | | Bihar | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| Soil Health and Land Management | 41% | 46% | 30% | 30% |
| Innovative and sustainable farming tech | 39% | 48% | 33% | 35% |
| Farm machinery and equipment | 33% | 36% | 28% | 30% |
| Improved seeds and seed varieties | 53% | 54% | 35% | 44% |
| Climate risk mitigation and management | 31% | 43% | 34% | 28% |
| Plant Nutrition | 66% | 48% | 31% | 33% |
| Disease and pest management | 61% | 57% | 35% | 42% |
| Weed Control and Management | 55% | 45% | 31% | 35% |
| Water Management and Irrigation | 31% | 40% | 30% | 26% |
| Harvesting and post-harvest technologies | 49% | 37% | 28% | 20% |
| Food and nutrition | 83% | 50% | 24% | 21% |
| Health and hygiene | 82% | 46% | 23% | 25% |
| Storage and Marketing | 38% | 46% | 30% | 22% |
| Crop Insurance | 39% | 48% | 34% | 46% |
| Govt. Agri Schemes and Subsidies | 67% | 56% | 37% | 50% |
| Extension services, agencies, and agents | 34% | 45% | 29% | 25% |
| Agri-service providers | 23% | 31% | 27% | 20% |

### *Internet Usage in Agriculture*

A central observation is the limited mobile internet utilization for accessing agriculture, land, water, and climate-related information by MPM and FPM (Table 7). Notably, in Odisha, households primarily access mobile internet to access information on weather forecasts and flood/drought warnings. This is particularly interesting given Odisha's history of 16 natural disasters, including ten cyclones in the past 11 years[3]. In Bihar, households also use mobile internet to access weather forecasts and receive flood or drought warnings, reflecting the state's vulnerability to natural disasters (National Remote Sensing Centre 2020)In both states, households rarely use the Internet to acquire information on procuring improved seeds, accessing seed subsidies, making online payments, or gaining insights into modern agricultural techniques.

**Table 7** Internet use in agriculture by gender and state

| | Odisha | | Bihar | |
|---|---|---|---|---|
| | **FPM** | **MPM** | **FPM** | **MPM** |
| Buying improved seeds | 0% | 1% | 1% | 5% |
| Other inputs/fertilizer | 0% | 1% | 1% | 4% |
| Track seed prices | 1% | 9% | 1% | 12% |
| Fertilizer/other input price | 3% | 10% | 1% | 9% |
| Track output price | 0% | 6% | 1% | 10% |
| Weather forecast | 42% | 53% | 3% | 29% |
| Flood/drought warning | 43% | 53% | 1% | 19% |
| Climate insurance news | 1% | 2% | 1% | 7% |
| Water users group news | 0% | 1% | 0% | 5% |
| Agri. advisory | 2% | 7% | 1% | 4% |
| New variety info | 1% | 6% | 1% | 5% |
| Logistics post-harvest | 0% | 0% | 0% | 2% |
| Modern techniques/tech | 1% | 6% | 0% | 2% |
| Seed subsidy | 1% | 1% | 0% | 6% |
| Online payments | 1% | 11% | 1% | 16% |

[3] Odisha saw 16 calamities in 11 years, says Sudam Marndi | Bhubaneswar News - Times of India (indiatimes.com)

# Digital Literacy Aspirations

As the digital era unfolds, it brings a wealth of opportunities, emphasizing the criticality of digital literacy. This section explores the tendencies of households in Bihar and Odisha towards developing digital and internet skills, a key factor in harnessing the potential of this digital revolution.

## *Overarching Interest in Digital Skills*

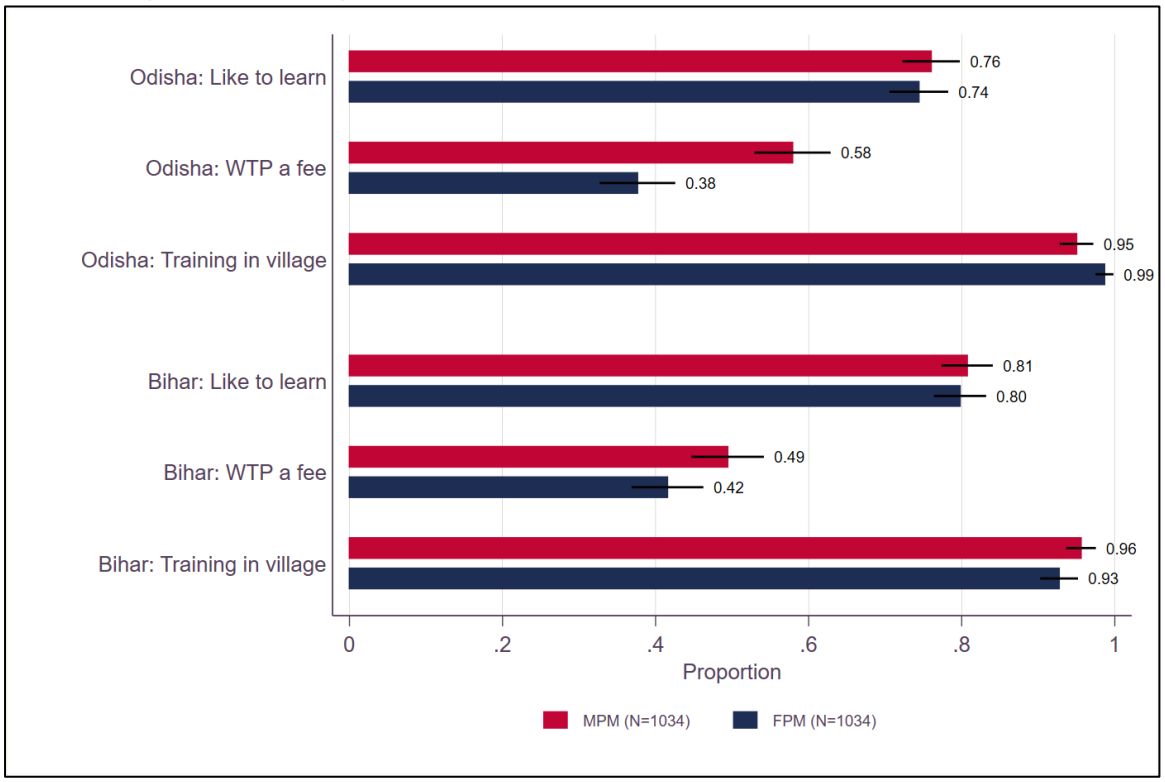


**Figure 10** Appetite for digital skills to learn by gender and state.

A significant majority, exceeding three-quarters of the HHs, are interested in acquiring digital and internet competencies (Figure 10). This enthusiasm is more pronounced in Bihar compared to Odisha. Intriguingly, approximately half of these HHs are willing and prepared to incur a fee for such training (Figure 10). However, a predominant preference emerges for these training sessions to be conducted within the confines of their respective villages, emphasizing the importance of accessibility and convenience. The overwhelming interest in acquiring digital skills among households indicates a strong desire for digital inclusion. This suggests that while there may be barriers to digital access, the fundamental aspiration to be digitally literate exists, and it is robust.

## *Gender Dynamics in Learning Preferences*

A deeper dive into gender-specific preferences reveals that 40% of FPM in Bihar and 61% in Odisha are inclined towards hands-on training, focusing on the physical operation of digital devices. In contrast, 56% of MPM prefer learning the practical applications of digital devices in both personal and professional spheres. Furthermore, 40% of MPM in Odisha express a specific interest in online information retrieval techniques (Figure 11). The distinct learning preferences between MPM and FPM highlight the need for gender-sensitive training modules. While women prioritize foundational skills, men appear more interested in advanced, application-based digital skills.

### *Training Frequency Preferences*

Regional variations are evident in the frequency of training. HHs in Bihar prefer weekly training sessions, while their counterparts in Odisha prefer a monthly format (Figure 12). This distinction underscores the importance of tailoring digital literacy programs to regional preferences.

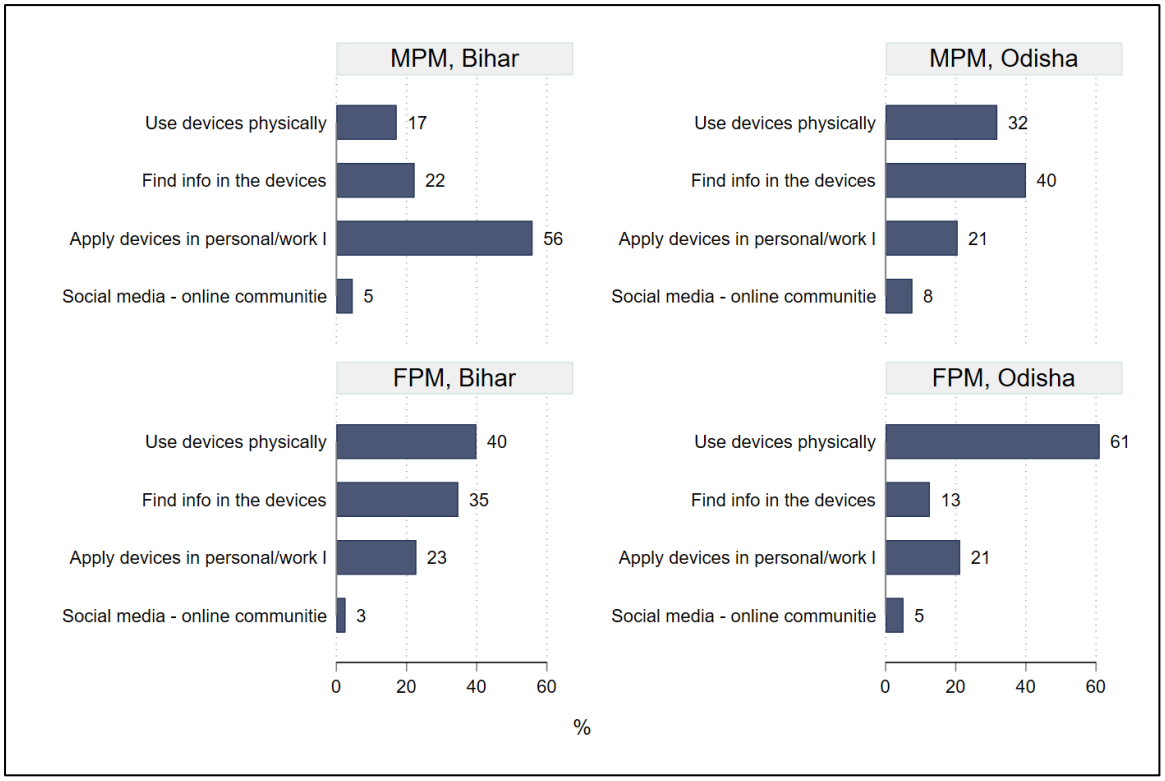


**Figure 11** Appetite for digital skills to learn by gender and state

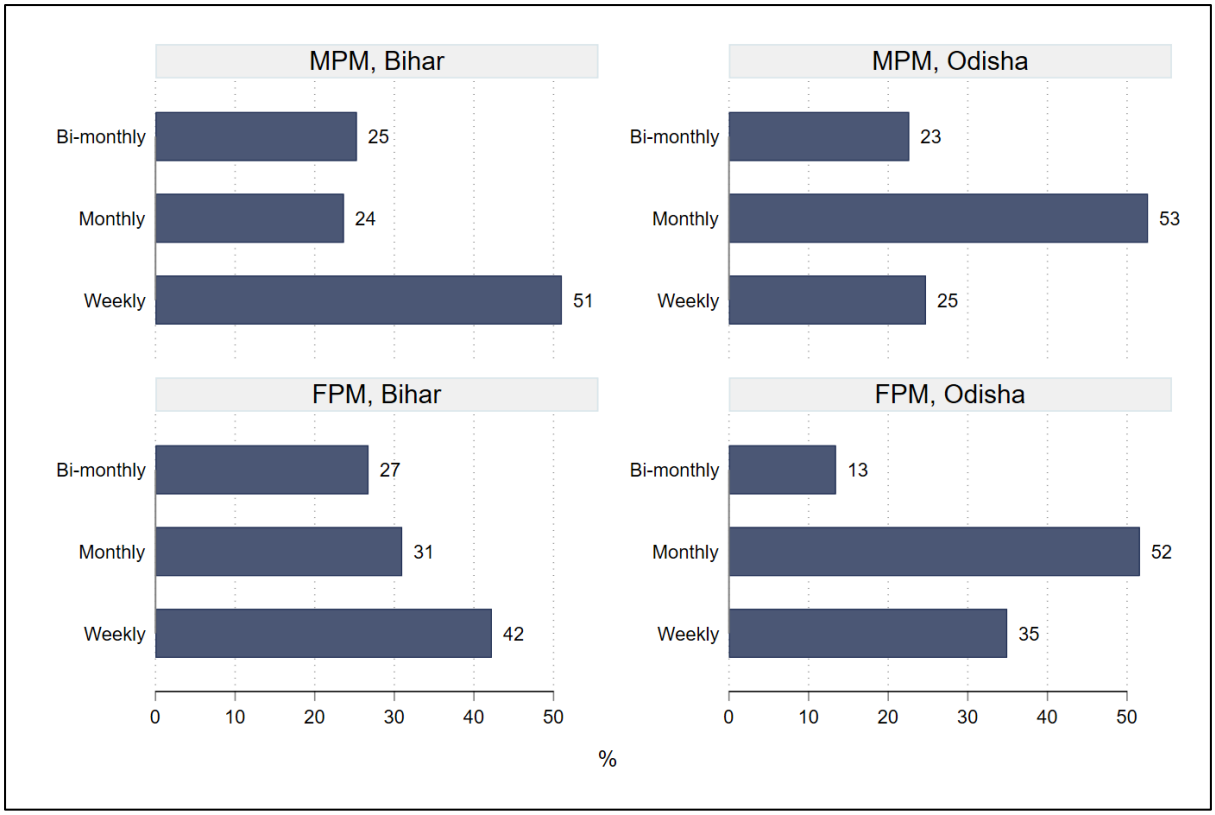


**Figure 12** Frequency of training sessions to be conducted by gender and state.

### *Strategies to Enhance Farmers' Digital Access*

In the context of agriculture's digital transformation, the key to realizing its potential lies in farmers' access to digital services. This section discusses the views and suggestions of MPM and FPM on strategies to enhance farmers' digital access, reflecting on the critical role of technology in modernizing agricultural practices.

#### *Availability and Affordability of Devices and Services*

A recurring theme across all groups was the emphasis on the availability and affordability of digital devices and services. FPM in both states and MPM in Odisha highlighted this as a primary concern, indicating that access to hardware remains a significant barrier.

#### *Affordable Data*

Affordable internet data emerged as a unanimous recommendation from all groups. This is particularly noteworthy given that while India boasts some of the world's lowest internet costs, these rates might still be prohibitive for the rural populace, emphasizing the need for further cost reductions. This has broader implications for telecom policies and highlights the importance of ensuring digital inclusivity reaches the grassroots level.

#### *Demand Creation through Awareness Training*

FPM in Odisha and MPM in Bihar underscored the importance of generating demand for digital services through targeted awareness training. This suggests that while digital services might be available, farmers' understanding of their potential benefits needs to be enhanced. This underscores the need for comprehensive educational campaigns to bridge this gap.

### *Skill Development and Training*

FPM in Bihar specifically highlighted the need for training on accessing information from the internet and apps. This points to a potential skills gap that, if addressed, could significantly enhance the utility of digital services for farmers.

### *Suggestions to improve existing digital service*

Respondents from both states provided valuable suggestions for enhancing the existing digital services (Figure 13). A significant majority (~95%) emphasized the need for comprehensive training programs to improve skills and awareness related to device usage and internet navigation. They highlighted that such training would empower users to utilize digital technologies more effectively. Additionally, respondents pointed out the importance of ensuring affordable and reliable network connections to facilitate seamless access to digital services. By addressing these key areas—training and network quality—digital services can be significantly improved, making them more accessible and efficient for all users.

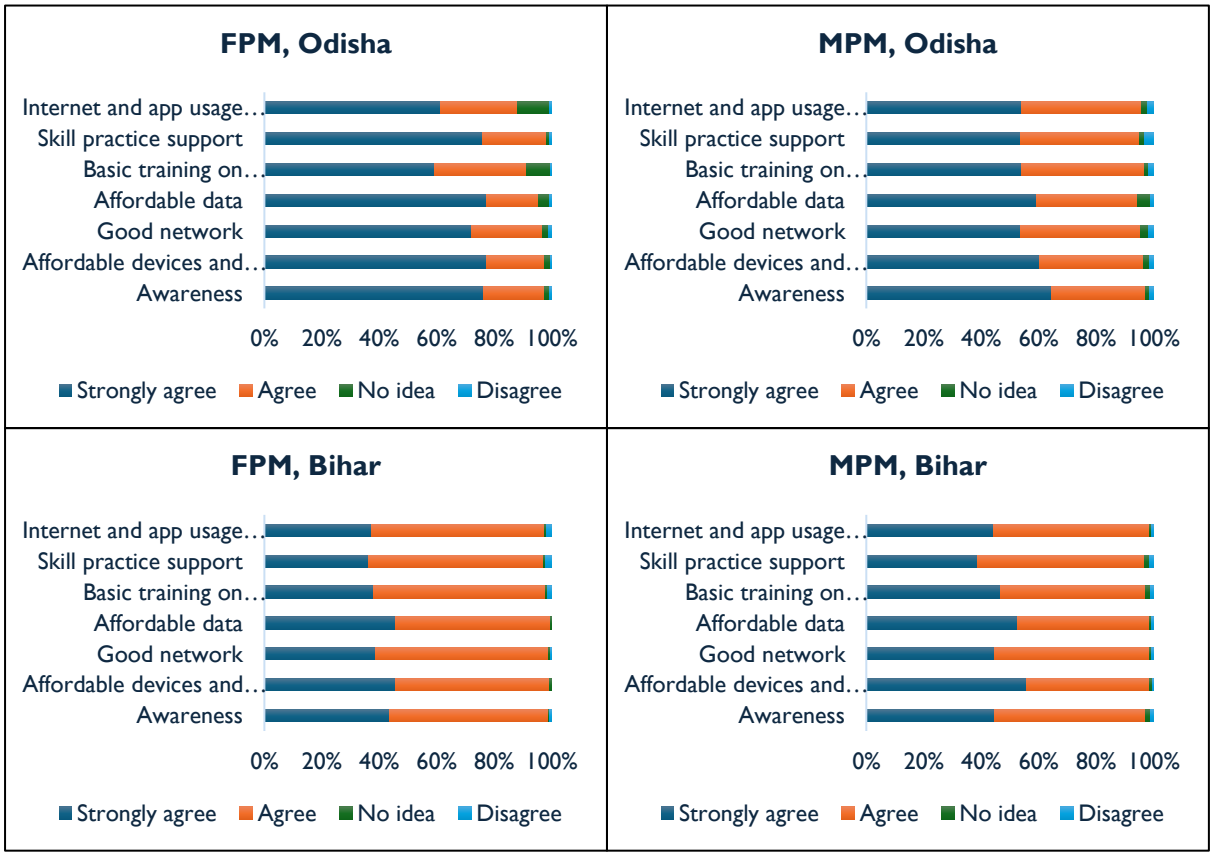


**Figure 13.** Suggestions to improve access to digital services by gender and state.

## Conclusions

The report, based on gender-disaggregated data from 1,034 households in Bihar and Odisha, India, highlights significant gender, social, and regional disparities in digital access. Women's lower participation in education and the labor market, with a focus on subsistence agriculture, reflects broader inequalities. A pronounced digital divide exists, with disparities in mobile device ownership and usage skills, such as navigating smartphone applications and performing online transactions.

The findings stress the urgent need to address these gaps in mobile phone ownership, digital access, literacy, and skills. Most households use mobile internet primarily for communication and entertainment, with limited utilization for farming-related information. Barriers such as cost, access, digital skills, language, and literacy hinder broader internet use. The lack of local language content further limits digital engagement, underscoring the need for localized and culturally relevant digital resources.

In the agricultural sector, digital tools remain underutilized, likely due to unawareness, insufficient relevant content, or skepticism about digital agricultural information. This reveals a critical need for reevaluating digital strategies in agriculture, shifting from mere digitization to comprehensive solutions that address these barriers. Emphasizing localized content, targeted digital literacy programs, and awareness campaigns can significantly improve digital adoption and inclusiveness.

Despite the challenges, households are strongly interested in enhancing their digital skills. Researchers and policymakers should prioritize foundational digital literacy initiatives before launching broader digital campaigns, particularly in agriculture. Strengthening digital skills can pave the way for more effective and equitable technology adoption.

The dual approach of making digital tools and services more affordable while enhancing digital literacy is essential. While India is known for rapid mobile penetration and affordable internet, rural populations still face cost-related barriers. Addressing these challenges is crucial to ensuring that the benefits of the digital revolution are equitably distributed, enabling all societal groups to harness the opportunities offered by mobile technology and the internet.

# References


Abate, Gashaw T., Kibrom A. Abay, Jordan Chamberlin, Yumna Kassim, David J. Spielman, and Martin Paul Jr Tabe-Ojong. 2023. "Digital Tools and Agricultural Market Transformation in Africa: Why Are They Not at Scale yet, and What Will It Take to Get There?" *Food Policy* 116 (April): 102439. https://doi.org/10.1016/j.foodpol.2023.102439.

Amber, Hina, and Bezawit Beyene Chichaibelu. 2023. "Narrowing the Gender Digital Divide in Pakistan: Mobile Phone Ownership and Female Labor Force Participation." *Review of Development Economics* 27 (3): 1354–82. https://doi.org/10.1111/rode.12994.

Coggins, Sam, Mariette McCampbell, Akriti Sharma, Rama Sharma, Stephan M. Haefele, Emma Karki, Jack Hetherington, Jeremy Smith, and Brendan Brown. 2022. "How Have Smallholder Farmers Used Digital Extension Tools? Developer and User Voices from Sub-Saharan Africa, South Asia and Southeast Asia." *Global Food Security* 32 (March): 100577. https://doi.org/10.1016/j.gfs.2021.100577.

Fabregas, Raissa, Michael Kremer, and Frank Schilbach. 2019. "Realizing the Potential of Digital Development: The Case of Agricultural Advice." *Science* 366 (6471). https://doi.org/10.1126/science.aay3038.

Hilbert, Martin. 2011. "Digital Gender Divide or Technologically Empowered Women in Developing Countries? A Typical Case of Lies, Damned Lies, and Statistics." *Women's Studies International Forum* 34 (6): 479–89. https://doi.org/10.1016/j.wsif.2011.07.001.

Kansiime, Monica K., Abdillahi Alawy, Catherine Allen, Manish Subharwal, Arun Jadhav, and Martin Parr. 2019. "Effectiveness of Mobile Agri-Advisory Service Extension Model: Evidence from Direct2Farm Program in India." *World Development Perspectives* 13 (March): 25–33. https://doi.org/10.1016/j.wdp.2019.02.007.

National Remote Sensing Centre. 2020. "Flood Hazard Atlas - Bihar: A Geospatial Approach." Hyderabad. https://bhuvan.nrsc.gov.in/pdf/Flood-Hazard-Atlas-Bihar.pdf.

Porciello, Jaron, Sam Coggins, Edward Mabaya, and Gabriella Otunba-Payne. 2022. "Digital Agriculture Services in Low- and Middle-Income Countries: A Systematic Scoping Review." *Global Food Security* 34 (September): 100640. https://doi.org/10.1016/j.gfs.2022.100640.

Sekabira, Haruna, and Matin Qaim. 2017. "Can Mobile Phones Improve Gender Equality and Nutrition? Panel Data Evidence from Farm Households in Uganda." *Food Policy* 73 (December): 95–103. https://doi.org/10.1016/j.foodpol.2017.10.004.

Silvestri, Silvia, Musebe Richard, Baars Edward, Ganatra Dharmesh, and Romney Dannie. 2021. "Going Digital in Agriculture: How Radio and SMS Can Scale-up Smallholder Participation in Legume-Based Sustainable Agricultural Intensification Practices and Technologies in Tanzania." *International Journal of Agricultural Sustainability* 19 (5–6): 583–94. https://doi.org/10.1080/14735903.2020.1750796.

Suri, Tavneet, and William Jack. 2016. "The Long-Run Poverty and Gender Impacts of Mobile Money." *Science* 354 (6317): 1288–92. https://doi.org/10.1126/science.aah5309.