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ORIGINAL RESEARCH

Evaluation of India's Unified Payments Interface (UPI) through a gender lens: the case study of Digital Budget Rani

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Abstract
Unified Payments Interface (UPI) is India's homegrown digital payment technology that has revolutionized the digital payment landscape. However, gender and income gaps persist in user access. This paper presents an analysis of a digital financial inclusion project designed to encourage the adoption of UPI among women from informal sectors and low-income households. The initiative provides a unique case of an IVR payment system as well as smartphone applications. Through the triangulation of qualitative and quantitative data collected for programme implementation this paper examines how the design and delivery of UPI and the digital public infrastructure enables or constrains women's uptake of digital financial services. Three trajectories of women's uptake and relationship with UPI are identified. Users represent younger women with higher education levels and technology access. Non-users are divided into those excluded by structural and social barriers and those who reject UPI based on financial control strategies and distrust. Community mobilisers are shown as a means to overcome some of these barriers. IVR represents how human-centred design can overcome access barriers as long as the technology is reliable and reflects users' technology access. Findings are limited to women's onboarding process rather than reflecting their continual user journey.

Keywords Unified Payments Interface; Digital financial inclusion; Technology design; Gender-digital divide; Access; Trust and fear

1 Introduction

The World Bank has shown that the penetration of financial services is directly linked to GDP growth and is vital in achieving the equitable growth required to achieve all 17 Sustainable Development Goals [1, 2]. The rapid development of technology has provided the means to deliver financial services to low-income and unbanked populations. Mobile banking and digital financial services have been shown to make financial services cheaper and more accessible for low-income communities, but gender gaps persist [3]. Strategies to provide financial services and credit to women have historically focused on microfinance and group loans so women can increase their independence, grow their businesses and reduce poverty. Mobile phones and other digital financial services are seen as a way to meet the unmet promise of these efforts [3, 4]. But the challenge remains as women use digital finance at lower-rates than men. Women are often left behind in terms of technological access and use which has serious socioeconomic implications for financial inclusion initiatives that focus on digitalization.

This paper provides an analysis of mixed-data sources from the implementation of a financial inclusion programme in India that targeted women from low-income households. Digital Budget Rani (2022–2025) was an awardee of the USAID and Reliance Foundation WomenConnect Challenge, that trained 40,552 women across rural and urban districts in Telangana and Andhra Pradesh in India's iconic digital payment platform, Unified Payments Interface (UPI). Through the analysis of quantitative MIS data and a baseline-endline survey triangulated with qualitative data collected through field visits and TOT workshop training

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reviews, this paper poses the question: *How does the design and delivery of UPI systems within India's Digital Public Infrastructure (DPI) enable or constrain women's uptake of digital financial services*? This paper presents a unique case of an Interactive Voice Response (IVR) payment system as well as typical smartphone applications. Current literature focuses on smartphone applications and USSD platforms.

1.1 Context

Since 2008, India has witnessed exponential growth in financial inclusion by driving bank account ownership among first time users [5]. India focused on digitalisation as a central driving mechanism through the development of its Digital Public Infrastructure known as the India Stack. Bank account access stands at 89% with minimal gender divide as a result of policies that leveraged the India Stack [6]. This, combined with increased mobile phone access presents a cohort that is access ready for mobile phone based digital financial services. In 2016, India's Unified Payments Interface (UPI) was launched, changing the digital payment landscape by supporting instant, bank-to-bank transfers through smartphone apps using a phone number or UPI ID. UPI usage, however, reveals significant disparities between men and women and income groups [7]. Data reveals that women are 28% less likely to use digital payments than men [8]. While women's mobile phone ownership stands at 75%, compared to 87% men, only 35% women own smartphones versus 51% men, with 29% relying on basic or feature phones [8]. To overcome access barriers, National Payments Corporation of India (NPCI) introduced 123PAY BHIM Voice IVR in 2022 (123PAY). An Interactive Voice Response (IVR) service available in 12 languages, it targeted the estimated 400 million basic/feature phone users and low-literacy communities [9]. It works on both basic/feature phones as well as smartphones and does not require a data connection.

1.2 Literature review

Mobile phone ownership has rapidly expanded in the developing world along with data connection and networks linking many people for the first time to more services and information [10–12]. Mobile phones have provided the means for access to financial services and products known as mobile money, digital money, or mobile banking penetrating markets that banks have avoided due the high cost of building and maintaining physical bank branches [3]. Kenya's M-Pesa is a famous example of how USSD mobile money platforms can drive the adoption of digital payments and banking services. Jack and Suri [13] show how M-Pesa expanded financial services for the unbanked—specifically for those in rural areas who faced challenges in accessing physical bank branches.

While digital financial technologies can increase banking access for marginalised communities, studies highlight persistent barriers women face in adopting digital financial services [14, 15]. As a result, recent literature has focused on strategies to overcome these challenges. Lee et al. [3] show that tailored training and support can significantly increase women's use of Bangladesh's USSD payment service, particularly when adoption is reinforced through family networks. However, their study focused on young migrants who were more open to technology and motivated by remittance obligations. More broadly, demographic factors such as gender, age, and education influence adoption: men are more likely to trust technology than women [16, 17], educated individuals are more likely to understand digital transactions, and younger users tend to be more familiar with digital tools and therefore more likely to adopt digital payments [18, 19].

Research on IVR-based payment systems remains limited. Existing studies largely examine how IVR can improve awareness of digital financial services by increasing access to information. IFMR Lead [20] finds that IVR systems can support micro-entrepreneurs by providing information on digital payments, although system failures reduced confidence and users preferred speaking with financial correspondents for financial matters. Nonetheless, the intervention helped close information gaps. Similarly, Raheem et al. [21] highlight the importance of designing digital technologies that reflect the needs of low-income women in Ghana, showing that IVR-based financial literacy systems are more effective when shaped by user feedback, environmental context, and sociotechnical considerations.

Theories of technology adoption provide an understanding of the factors that can inhibit adoption. They highlight that adoption is not only influenced by structural factors but also by perceptions of trust, risk, and the social meanings embedded in technological design. Trust is an important factor in technology adoption because it requires individuals to rely on a system under conditions of uncertainty. Mayer et al. [22] define trust as "the willingness of a party to be vulnerable to the actions of another party." This definition is relevant in digital financial services as the user must trust and engage with complex systems involving banks, digital interfaces, and invisible infrastructures. Trust therefore becomes a prerequisite for individuals to take the risk of adopting digital technologies that may involve financial loss.

It is argued however, that trust and distrust are separate constructs with distinct behavioural outcomes [23, 24]. Evidence shows that distrust can independently reduce technology adoption, even in situations where there is a level of

trust [25, 26]. Dimoka [27] supports this finding by demonstrating that trust and distrust activate different regions of the brain, with distrust linked to emotions such as fear, panic, anger, and anticipated loss. This suggests that distrust functions as a warning signal rather than simply reflecting low confidence. This distinction matters in practice because increasing trust does not automatically eliminate distrust, meaning adoption strategies must address both.

Trust in technology is more than technical reliability. It denotes that the system is dependable and will perform to a certain standard of performance. Nickel [28] shows that when technology fails to meet expectations the user experiences a betrayal of trust which can result in the abandonment of the technology. These insights are specifically important for women's digital payment adoption as feminist literature argues, women often believe that technology is not designed for them so they approach technology with lower levels of self confidence and trust in their ability to use it.

Feminist scholars have explored the issue of trust within technology systems. Hardley et al. [29] explore the "gender-technology-trust" relationship, showing that women's trust in mobile technology is complex and shaped by lived experience. Donna Haraway's work on human–technology relations [30–32] similarly argues that technologies are deeply entangled with gender, race, and class, shaped through histories of patriarchy, colonialism, and capitalism. Rather than viewing technological progress as inherently positive, Haraway emphasises struggle and the need to recognise our limited perspectives and complex relationships with non-human actors. Likewise, Judy Wajcman [33] highlights how technology design and use are shaped by gendered power structures. Women's access to and confidence with technology are constrained by social norms that associate technology with masculinity, reinforcing stereotypes of women as technically incompetent. This has contributed to gendered divisions of labour in financial management and technology use, in which men often control access and security while women are positioned as users rather than decision-makers.

Within technology adoption literature there is a general belief that digital inclusion leads to modernity and in the case of digital financial technologies, socio-economic benefit. In the paper titled "Technology as an Amplifier", Toyama [34] states that technology cannot inherently perform a liberative function. It is incapable, if left unaided by public policy and sufficient intervention, of solving the problems of social inequities. If improperly done, it has the opposite effect, amplifying existing rifts. Sassen [35] supports this perspective with her analysis on the new digital divide that focuses on how digital technologies are developed and applied. She demonstrates how digital tools are primarily created for the middle class and high-end workers, neglecting the specific needs of low-income workers. This entrenches existing inequalities by failing to create digital apps and tools that could empower vulnerable communities in their workplaces and neighbourhoods. She shows how people on the edges of marginalisation are at risk of becoming invisible as their actions are not counted and their needs are not addressed.

Wyatt [36] takes a closer look into technology users and non-users and argues that understanding why some people choose not to use digital tools in their current form could provide important insights for policymakers. Wyatt's [36] work focuses on users and non-users distinguishing between "resisters," "rejecters," "excluded," and "expelled," highlighting that not all non-use is involuntary. She shows how some people reject technologies that they view as unnecessary, unsafe, or misaligned with their values. This theory highlights how non-users can influence technological development by resisting "digital imperatives" and expose the limitations of current systems, thereby revealing alternative possibilities for what technology could look like.

1.3 Case study: Digital Budget Rani

Digital Budget Rani was designed in response to evidence that, despite high levels of bank account ownership and access to mobile phones (predominantly basic handsets), many women remained low users of formal banking services. Limited access to debit cards and continued reliance on informal borrowing highlighted persistent barriers to meaningful financial inclusion, alongside a clear demand for improved access to formal credit. 123PAY BHIM Voice IVR (2022) was identified as a timely solution with the potential to increase women's bank account usage with the technology women already had access to.

By leveraging 123PAY, Digital Budget Rani's central idea was simple: if women could access UPI through their own mobile number linked to their bank account, it could provide them with the means to send, store, and receive money—a prerequisite for financial inclusion [6]. This access could then pave the way for greater control over their finances, stronger relationships with banks, and improved eligibility for formal financial services.

The initiative used a community mobiliser model. Community mobilisers were trained from within the target communities to deliver hands-on support to help women to adopt UPI. Community mobilisers were also tasked with supporting women to open bank accounts and ensure their mobile numbers were linked to both their bank accounts and *Aadhaar* (a 12-digit unique identification number). Community mobilisers were equipped with an offline digital curriculum in the form of Telugu-language videos that covered UPI requirements, onboarding, transaction processes, and safety practices.

The programme aimed to train 40,000 women—70% using feature/ basic phones via 123PAY and 30% using smartphone apps (PhonePe and Gpay) in Telangana and Andhra Pradesh. The target group was women aged 18–60 from low-income households, typically engaged in informal work and owning a personal mobile phone but with little or no prior UPI experience. Mobilization was carried out through partner organizations including the Telangana Domestic Workers Union to reach domestic workers, the Greater Hyderabad Municipal Corporation (GHMC) to access *Safai Karamcharis/* street cleaners and the Society for the Elimination for Rural Poverty (SERP) and Mission for Elimination of Poverty in Municipal Areas (MEPMA) to reach women members of the group loan and saving programmes known as Self Help Groups (SHGs). Community mobilisers reached women through SHG and union meetings, group sessions, and door-to-door outreach.

1.4 Data sources and analytical approach

This paper presents a mixed-methods, implementation informed case study drawing on multiple-data sources collected for programme implementation. Programme monitoring data, baseline-endline evaluation, and qualitative field evidence are used to examine how UPI design and adoption interact with gendered barriers in practice.

Baseline-endline survey: A baseline and endline quantitative survey was conducted in one urban community in Hyderabad among women aged 18 years and above. This micro-level study was designed to examine observed changes and identify patterns in digital financial behaviours following the implementation of the Digital Budget Rani training programme and was not designed to detect statistically significant treatment effects. The survey was intended to capture directional shifts rather than to estimate causal impact. A low-income community was selected based on registered slum data that represented the target community. Participants were recruited through door-to-door enumeration within the locality. In total, 244 women participated across baseline and endline survey rounds.

Data was collected by independent enumerators using a pre-validated, structured questionnaire translated into Telugu. The survey captured socio-demographic characteristics, access to and use of banking services, mobile phone ownership and use, and engagement with digital financial services, including UPI. In the survey location women were asked if they wanted to take part in UPI training, if women rejected their reasons for rejection were noted. The study protocol was approved by an internal review board. All participants provided written informed consent, and confidentiality was maintained throughout the study.

Management Information System (MIS) data: A robust MIS tool was designed and implemented to capture real-time training data—such as the type of phone, UPI method taught and basic demographic details such as age and education. Caste related data was not recorded to reduce the data collection burden on community mobilisers. Furthermore, it was assumed that women associated with SHG groups, domestic workers and *safai karamcharis,* are from marginalised caste groups and this data was not required for programme monitoring. MIS data was collected for each participant across 13 Telangana and 2 Andhra Pradesh districts with 9 rural and 6 urban districts. In total, 40,552 data entries were recorded.

The MIS data was initially captured through Google Forms and then a Telegram Bot was created for easy data entry. Community mobilisers answered basic questions in a chat form in Telugu to make data entry easier for semi-literate community mobilisers. Community mobilisers were paid based on each training they completed after they entered the data into the MIS system. To demonstrate that a participant had completed the training, possessed a bank account linked to her phone number, and was able to conduct UPI transactions, each participant completed a symbolic ₹1 transaction with her community mobiliser. This transaction verified her ability to send and receive digital payments. Screenshots of the transactions were uploaded to the MIS system for verification. The MIS tool used AI-based checks to prevent duplication and identify inconsistencies in data entries.

Field visits and training workshop insights: Qualitative field insights were collected through field visit reports and post-training review sessions. These reports documented case studies, programme implementation challenges and women's reactions to UPI technology. They also documented women and community mobilisers who could not use UPI or rejected it as well as insights to women's relationships with technology, financial services and household dynamics. A total of 11 field visits were conducted across project locations. In addition, 36 community mobiliser training workshops were conducted across 6 rural districts and 5 urban districts in Telangana and 1 urban district in Andhra Pradesh. Through these workshops, 980 community mobilisers were trained.

1.5 Analytic strategy

This paper presents a convergent mixed-methods analytic strategy to examine enabling and constraining factors to women's UPI adoption of UPI apps and 123PAY IVR. Quantitative and qualitative data sources were analysed and then integrated through triangulation to identify convergent patterns and themes. By combining mixed-data sources used

for programme implementation, this paper aims to bring a human-centric perspective to women's UPI adoption.

Quantitative analysis drew on baseline–endline survey data and programme monitoring (MIS) data. Survey data was analysed descriptively to examine observed changes in indicators related to access to banking services, mobile phone use, and engagement with digital financial services. MIS data was analysed to assess programme reach, onboarding outcomes, phone type and UPI modality use, and the types of support required during implementation at scale.

Qualitative data from field visit reports and post-training review sessions were analysed thematically. Reports were reviewed to identify recurring themes related to digital access, usability, household dynamics, and perceptions of trust and risk in relation to UPI. Triangulation of the findings were conducted to contextualize observed patterns and identify dynamics shaping women's adoption of UPI. This triangulated approach aimed to ground the descriptive quantitative trends in lived experiences and implementation realities.

2 Results

MIS data shows that women participants ranged in age from 15 to over 60 years with 50% were between 30 and 60 years, 39% were between 15 and 18 years, and 11% were above 60 years, with the mean age of 33.8 years. Women participants came from varied education and occupational backgrounds; most had received some formal schooling with approximately 8% with an education of up to Class 5, 12.9% between Class 5–10, with the largest proportion of women, 56% having completed 12 years of education. Approximately 6% of women trained had no education and 16.6% of women trained had a college degree and above, see Table 1. Occupation levels show that 55.6% identified as housewives, 10.69% were employed, 15.51% were self-employed, 15.78% students and 2.40% women said they were unemployed. It was found that many women would rather identify as housewives than informal workers such as domestic workers.

Table 1 Key statistics of participant data from MIS data

Indicator	MIS data	Percentage (%)
Total women participants	40,552	
Age (average)	33.8	
Occupation		
Housewife	22,558	55.63
Unemployed	972	2.40
Employee	4333	10.69
Self-Employed	6290	15.51
Student	6399	15.78
Education		
No education	2592	6.39
Up to class 5	3327	8.20
5–10 class	5231	12.90
Class 12	22,680	55.93
College and Above	6723	16.58
Mobile phone ownership		
Basic/feature phones	1716	4.23
Smartphone	39,502	95.77
UPI adoption type		
App Based (PhonePe and GPay)	22,547	55.60
123PAY IVR	3568	8.80
Both (App based and IVR)	14,437	35.60
Additional support		
Open bank account	661	1.63
Link mobile number to bank account	8118	20.02

Women programme participants had high digital access with 96% women recorded as smartphone owners. Despite strong demand for UPI among basic phone users, only 4% were onboarded to UPI on basic phones. This contrasts sharply with the initial target composition of 70% basic phone owners and 30% smartphone users. MIS data showed that 55% of basic phone users had an education less than Class 5 indicating a strong link between low literacy levels and technology access. MIS data indicates that 20% of participants received extra support from community mobilisers to link their bank accounts to mobile numbers.

Demand for the IVR UPI services was demonstrated in MIS data as 35.60% women smartphone owners learnt both UPI apps and 123PAY IVR. This preference was observed consistently across both rural and urban areas of Telangana, with 32% of smartphone users in Hyderabad and 39% in rural districts opting to learn the IVR method additionally despite having access to smartphones. In total, 3568 women were trained to use 123PAY with 1716 onboarded using a basic phone, indicating that 1852 women with smartphones opted to learn 123PAY instead of a UPI smartphone application. Furthermore, MIS results show that 8281 (20%) women did not have access to debit cards and were supported to get access to digital banking through *Aadhaar* verification.

Table 2 shows the key baseline demographic and technology access indicators recorded from 244 women in the identified urban survey location. The majority (64%) women fell in the age group of 30 to 45 with the average age (median) of 33 years. Women were vastly from marginalised caste groups with 63% from Open Backward Caste and 28% from Scheduled Castes. Similar to MIS data, the majority (51%) women identified as housewives rather than domestic and informal workers. A large proportion (50%) women had completed more than 10 years of education and (21%) women were illiterate. Almost all (98%) women owned a bank account and (86%) women had access to a smartphone suggesting high digital and banking access. Additionally,

Table 2 Key baseline demographic and technology access indicators

Indicator	Baseline	Observations
Age (range)	33 years	244
Median annual household income (INR) (Range)	20,000 to 29,000	244
Primary income category within household (top 3)	Housewife (51%), private salaried employed (15.6%), Daily wage earner (15.4%)	244
Education	Illiterate (21.5%), 0–9 years of school (27%), class 10 and above (50%)	244
Mobile phone ownership	Smartphone (86%), basic/feature phone (14%)	244
Bank account ownership	98%	244

Table 3 Key baseline-endline indicators

Indicator	Baseline (%)	Endline (%)	Endline observations
Knowledge of UPI (Awareness)	64.61	72.56	215
Use of the internet	55.56	86.51	215
Use the internet for banking and finance	21.81	34.88	215
Use UPI	19.34	55.81	215
Phone number linked to bank account	78.19	96.74	215
Aware of safety precautions while using UPI	81.48	91.16	215

85% percent reported that they could use the phone on their own with 14% stating that they could only sometimes use the phone with 2% stating that they could not use it. High bank account ownership combined with smartphone ownership and independent use suggests readiness for digital payments. Regular access to the internet was however, limited, acting as a barrier to make digital transactions, especially for smartphone users. Overall, 55.56% reported having access to the internet. On the other hand, 14% of women reported they had access to a basic mobile phone. Analysis shows that 99% of those with basic phones were from marginalised caste groups such as Scheduled Castes, Scheduled Tribes and Other Backward Classes. Furthermore, 54% of women with a basic or feature phone were illiterate and approximately 75% of all basic phone owners had less than nine years of education. Women also reported a dependence on informal financial systems with 85% taking loans from informal means such as family members or friends and just 4% saving their money in the bank.

Table 3 presents key indicators of respondents' digital access and financial technology engagement, comparing baseline and endline results. Endline data surveyed 215 women from the baseline. In total, 29 women dropped out of the study and did not agree to undertake UPI training. Reasons for their rejection were recorded with the majority of women (58%) stating that their family objected**.** Even with access to smartphones and financial services, initial usage of UPI was only reported by 19.34% women. Post training, improvements were observed with this increasing to 55.81%. This usage was largely reported by women of ages less than 40 with a 10th standard and above education attainments (72%). Awareness of UPI increased from 64.61 to 72.56%, while general internet use rose substantially from 55.56 to 86.51%. The proportion of respondents using the internet specifically for banking and finance also increased, from 21.81 to 34.88%. Structural readiness indicators also improved, with the percentage of respondents reporting their phone number linked to their bank account increasing from 78.19 to 96.74%. Finally, awareness of safety precautions while using UPI remained relatively high in both the baseline and endline, increasing from 81.48 to 91.16%.

3 Findings and discussion

This section integrates quantitative results (MIS and survey data) with qualitative evidence (field reports and TOT workshop observations). Drawing the quantitative and qualitative findings together, this paper identifies three trajectories related to women's use of, and relationship with, UPI. Users represent a distinct demographic group who have the access to the necessary financial infrastructure and 'digital identity' able to adopt UPI and have the necessary technology access to do so. Non-users, however, are divided into two categories. Non-users Category A are those excluded due to structural and social barriers that prevent their uptake of digital financial services. Non-users Category B are access-ready but have rejected UPI due to issues of trust and fear of misuse.

3.1 UPI users: access ready

The initiative showed that UPI users were predominantly young, smartphone-owning, and literate. MIS data indicated most participants were under 40, had smartphone access, and had completed up to 12 years of education. This trend was supported by endline survey data reflecting a similar median age to MIS data of 33 years and 72% of UPI users with at least a 10 years of education. This underscores that since educated individuals are more likely to understand digital transactions better and younger individuals tend to be more familiar with digital technology, they are more likely to adopt digital payments [18].

The programme fell short of its 70% target of basic phone users. Rather, MIS data shows that 95.77% of participants were smartphone users. The programme employed

an incentive-based structure where community mobilizers received payments for each training session they delivered. Analysis of this method showed that this shifted the focus of the project to women who had all the necessary UPI requirements (debit cards, smartphones, bank account—phone number linkages) and could easily be subscribed and consequently less attention was given to more challenging circumstances and the most marginalized women resulting in a larger 'access ready' participant cohort. This situation reflects a system that focuses on smartphone access among users more comfortable with digital systems, greater agency and financial inclusion.

3.2 Non-users Category A: structural and social barrier exclusions

Non-users Category A represent women who were unable to access digital financial services due to external factors such as access to the digital public infrastructure or gender norms.

For many women the digital public infrastructure presents a hostile environment. The system and processes required to meet UPI's digital identity requirements, such as a mobile-linked bank account and *Aadhaar* or a debit card, were cumbersome for many to navigate. Field reports provide the case study of *safai karamcharis* (street cleaners), most of whom had low literacy and basic phones. Banks often refused to issue debit cards to *safai karamcharis* unable to sign, leaving *Aadhaar* as the only registration route. However, *Aadhaar* verification was added later to both IVR and smartphone applications, initially excluding women with low literacy and limited financial inclusion even if women demanded the service.

Aadhaar-linked mobile verification also posed a major challenge, as many women's *Aadhaar* and bank accounts were linked to male relatives, outdated numbers, or intermediaries. Correcting these digital identity gaps required considerable time, costly *Aadhaar* centre visits and online appointments, making the process unrealistic for women and community mobilisers. Although quantitative data showed high bank account ownership, women still faced barriers in opening accounts. In total, 661 women were supported to open zero-balance accounts, yet women reported hostility from bank staff, who often redirected them to service centres charging unofficial fees. Community mobilisers were successful in supporting women to raise complaints and to overcome hurdles opening accounts. This situation is supported by baseline findings that 19% of women did not know whether their bank account was linked to their mobile phone and that 42% required someone to accompany them when travelling outside the community. Community mobilisers helped women overcome these barriers, with MIS data showing that 20% received support to link their mobile number to their bank account.

Women's literacy levels also presented a UPI access barrier. Baseline data showed that 90% of women with 0–9 years of schooling did not use UPI demonstrating a link between education levels and technological access. Many women found the fast nature of UPI apps and reliance on the Latin alphabet challenging, reducing their confidence in their ability to use the apps without making a mistake. IVR provided a solution to overcome limited internet access and low literacy levels. Many women, both smartphone and basic phone owners, were excited about IVR's slow, repetitive language interface, which repeated the name and bank details of the recipient as well as the fact that that IVR did not require a data connection. This process reduced errors and made women feel comfortable and in control. During a field visit one woman said, "*Being able to confirm and give consent multiple times made me feel like they were looking out for me.*" Low literacy ability reflects the World Bank Group's Global Findex Insights [6] that just 23% of women could read a text message in English. Most app-based UPI interfaces are designed with assumptions of data access, English literacy and smartphone familiarity, excluding non-English, low-literacy and low-tech users by not offering inclusive, multilingual, or voice-based interfaces. This situation reflects Sassen's [35] analysis that shows how digital systems are designed around the use cases of dominant social classes, thereby excluding the most marginalised people who could benefit the most. It also underscores the requirement for human-centred technology design to support adoption among women and other marginalized groups [21].

In the field IVR was met with many technological issues that prevented its uptake and excluded basic phone users. While designed for basic phones, most devices could not exit the IVR call to retrieve and enter the OTPs required for UPI registration, effectively excluding basic phone users. This was the reason the 70% target of basic phone users was not achieved, rather just 4.23% was achieved. Additionally, the IVR technology experienced bugs which meant that the technology often stopped working and would not progress to complete the transaction. Varying accents, dialects, and rural languages also created exclusions as many times the IVR technology did not recognise the voice commands or the service was not available in regional, rural languages. It was also found that some local banks had not approved UPI payments or their banks were not recognised during the onboarding process highlighting an additional structural exclusion. Failed registration attempts confirmed women's belief that "*technology is not meant for us,*" making it hard for community advocates to rebuild interest. This situation

supports Nickel's [28] argument that when technology fails, it can result in the abandonment of the technology.

Patriarchal social norms were an additional barrier to women's adoption of UPI, as men often controlled both financial decision-making and women's access to technology. Gendered stereotypes framed women as more vulnerable to fraud, reinforcing the belief that they should not use digital payments. Women frequently stated, *"Why do I need to learn UPI? My husband and sons take care of all this."* Men actively discouraged participation, saying, "*She's not educated; she won't be able to do all this. Please don't teach her, or the family will lose money."* Such beliefs were internalised by women, reducing their confidence and willingness to engage with the technology. Control of women's technology access was reflected in survey findings: among women who refused training, 58% cited family objections.

Fieldwork further illustrated how men's "protective" behaviour functioned as a form of restriction. Some women had UPI apps installed but could not use them independently because husbands or children had set them up. During one training session, an older woman faced repeated PIN errors, but when the community advocate suggested calling her son, he responded, "*Of course that's the correct PIN. Why do you need it anyway? What are you doing?*" The woman stopped the training midway, citing his discomfort and distrust in UPI. In other cases, family members had enabled PIN-protected app downloads, leaving women unaware of the PIN and unable to independently access applications. These examples demonstrate that women's access to app-based UPI is shaped not only by technical infrastructure, but by patriarchal norms that limit women's autonomy over money, mobility, and technology use reflecting feminist theories that technology design, adoption and use are not gender neutral [29, 31, 33].

3.3 Non-users Category B: technology rejectors

Non-users Category B reflect women with awareness of UPI, high financial inclusion i.e. all the requirements for digital payments but have personally made the decision to not use UPI.

Significant resistance to learning UPI was encountered by community mobilisers. One major reason women rejected signing up for UPI was the concern that easy access to money would lead to misuse by family members. They preferred the safety and control of withdrawing money from the bank themselves. For instance, a case study of a *safai karamchari* shared her experience of her son misusing her debit card to withdraw money for drinking. She resorted to destroying the card to prevent further misuse. In these cases, women felt that signing up for UPI would not be empowering but rather detrimental to their interests and agency. This situation demonstrates a finding of the World Bank's [6] Findex Data report that emphasised the importance of women's strategies to take control of and manage their finances for financial inclusion. Historically, women have developed coping mechanisms in cash, transferring this same skill and confidence to digital mechanisms is important for financial inclusion strategies.

Field reports highlighted how women found other UPI uses more empowering than payments alone. For example, women found learning how to check their bank account balance and to change their UPI PIN numbers empowering. It allowed them to confirm whether government scheme payments had been credited or whether any money had been withdrawn, helping to address women's concerns about losing control over their finances. One case study highlighted how an older woman suspected that her son had been using her ATM card without permission. "*Going to the bank is too much for me,*" she explained. *"I was worried my son was using my ATM card, so I burned it. Then our community worker showed me how to check my balance with UPI. Now I can see my money anytime. It gives me peace of mind.*" This illustrates that UPI's value for women lay not only in enabling transactions, but in strengthening their financial control, and confidence. The IVR system helped some women improve financial control by offering a stepping stone to app-based UPI. It enabled them to check balances and manage PINs without relying on smartphone apps, highlighting varied pathways to technology adoption.

The high rate of digital financial fraud created one of the most significant barriers for UPI adoption among women, demonstrating considerable distrust in the UPI system. Community mobiliers reported that many women feared they were fraudsters and that they did not want to take the risk of losing money and could not be convinced otherwise. Any redirection to safety and awareness modules made by the community mobiliser could occasionally result in questions that laid their fear bare; "*And if I do lose money using this UPI, who will pay me back? You?*". This supports the finding of Dimoka [27] that emphasises that distrust was linked to emotions of fear, panic, anger and anticipated loss. Given the structural barriers women face in accessing formal financial services, distrust in the financial system is already high, and many women fear they will be unable to access recourse if payments go wrong. At present, there are limited effective fraud prevention strategies. Field reports show that, in the name of protecting marginalised low-literacy users, fraud prevention currently relies on exclusionary strategies such as refusing debit cards or imposing low daily transfer limits on 123PAY IVR. However, these approaches do little to address women's underlying distrust.

4 Conclusion

This paper demonstrates that UPI adoption is not linear and that non-users are not a homogeneous group. It draws on qualitative and quantitative data collected during the implementation of a digital financial inclusion initiative. On its own, the programme MIS data is not representative of the wider participant population, as the incentive-based delivery model disproportionately captured women who were already more "access-ready" for UPI. However, triangulating MIS findings with the programme baseline-endline study, TOT workshop reports, and field visit reports provides a clearer perspective on women's access to digital public infrastructure and UPI.

The analysis identifies three trajectories in women's relationship to UPI. First, UPI users were predominantly younger, smartphone-owning, and more literate women. Second, Non-users Category A consisted of women excluded due to structural and social barriers. Low literacy, limited technology access, and weak integration into formal banking systems—combined with UPI design assumptions of smartphone ownership, English literacy, and high financial inclusion—excluded many marginalised women even when demand was present. Gendered household norms further restricted women's access to technology and financial services. Third, Non-users Category B represented women who rejected UPI due to distrust in digital payment systems and concerns about losing financial control within the household.

The paper also highlights the role of community mobilisers in helping women overcome structural barriers and providing the handholding required for technology adoption. IVR-based payment systems have potential to build user confidence through their slow, repetitive interface, allowing users to feel more in control. This indicates how human-centred design can support adoption among marginalised women. However, technical failures and design limitations—particularly the inability to onboard basic phone users—demonstrate the importance of reliable systems and design grounded in the technological realities of target users.

Finally, the initiative focused primarily on training and onboarding, but did not adequately capture user experience and sustained usage post-training. Future interventions must place greater emphasis on continued engagement and daily-use needs if UPI is to support meaningful financial inclusion. By examining the experiences of non-users, this paper reinforces Wyatt's [36] argument on the importance of studying non-use. Further research on UPI non-users is necessary to support the development of a more inclusive digital public infrastructure that reduces, rather than reproduces, existing inequalities.

Declarations

Conflict of interest Not applicable.

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