

"My cousin bought the phone for me. I never go to mobile shops.": The Role of Family in Women's Technological Inclusion in Islamic Culture

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The intersection of Islam and gender affect technological and social interactions for Muslim women in significant ways and remains an understudied domain for CSCW and related fields. Building on 73 qualitative interviews with low-income women in Punjab, Pakistan, we analyze the complexity of family relationships and the subsequent dynamics of authority around technology uptake and usage by women within non-Western contexts, and, specifically, within the Islamic world. We argue that a Pakistani woman's experience with technology depends on many factors, including gendered roles, generational differences in a family, and wider socio-cultural and religious influences against the backdrop of a culturally conservative and patriarchal society. Our paper highlights the rich family dynamics, including key life events, that transform the roles of both Muslim women and their relatives. Our work is intended to inform scholars, practitioners within development agencies and industry, and other individuals studying technology and development about household dynamics that influence Muslim women's use of technology to encourage them to consider these dynamics during design and implementation processes for technological inclusion.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**; *Empirical studies in collaborative and social computing*; • **Social and professional topics** → **Gender**; *Religious orientation*; *Cultural characteristics*.

Additional Key Words and Phrases: Pakistan; Women; Islamic Contexts; Intersectionality; HCI4D; Gender; Qualitative; Technological Inclusion; Digital Divide; ICTD; Family;

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1 INTRODUCTION

CSCW scholarship has focused on families through the lenses of collaboration, learning, and ethics. Often, the definition of the family refers to the basic unit of human society. Technologies¹ play an important role in family relationships. Research in CSCW and related fields has shown how the use of technologies can extend or enhance relationships between family members and has indicated how to include families in the design process [50]. For example, after reviewing 84 papers from CHI and IDC, Isola et al. noted that HCI researchers have viewed families as users, informants, testers, and design partners, reminiscent of Druin's designing for children taxonomy [30]. However, beyond this taxonomy, families can play secondary roles. One important impact of families is their effect on the use of technologies by an individual. The socio-cultural foundation of the family affects what one owns to what one creates, consumes, or shares online, and, thus, warrants further study. This is especially important when considering a user's gender, religion, or cultural heritage, which can impact technological use within a family. In such cases, the family also plays a role in suggesting, regulating, or limiting how and what technology is available and how it is used.

ICTD research has illuminated the affect of family dynamics in discussions of technology engagement in non-Western contexts. For instance, [54] illustrated how, in rural India, women exhibit agency and successfully access support networks despite strict social conventions and patriarchal values that inform interactions between men and women. While highlighting the challenges faced by women in conservative and patriarchal contexts within South Asia and elsewhere, the literature on family and technology is less developed with regard to the analysis of religious norms, especially those prominent throughout the Islamic world, and their impact on technology engagement.² Researchers have examined the role of technology in the family in the contexts of the Middle East and North Africa, but they do not directly discuss the impact of religion. Norah Abokhodair's research on social media in the Gulf states and her call for culturally inclusive research and design highlighted women's use of technology within a distinctly patriarchal society [1]. Dodson et al. [28] drew our attention to gender gaps when considering technology use by Berber-Muslim women in Morocco and how these gaps are fueled by gender-specific cultural norms that limit women's ability to seek assistance and overcome barriers to mobile phone use. While Dodson et al. sought to extend their claims to other indigenous communities within North Africa, we argue that the nuances of family dynamics and the challenges for Muslim women to engage with technology also have far-reaching implications across geographical regions. In this paper, we describe such

¹We discussed with the participants a range of technologies, from digital devices to everyday appliances to sewing machines. In this paper, *technology* includes basic phones and smartphones, the internet, computing devices, daily household devices, and the features of such devices. Technical and social roles pertaining to these devices (mentioned in this paper) apply universally, whereas acts such as monitoring and restricting use apply primarily to mobile devices.

²Several scholars explore the intersection of religion and technology but not directly in relation to the family. For instance, Genevieve Bell urged the exploration of ICTs for spiritual practices, which she called "techno-spiritual re-purposing" [14]. In response to Bell's paper and her keynote at CHI 2010 [33], Buie and Blythe [21] explored the gaps in techno-spiritual research in the HCI literature. They discussed additional techno-spiritual themes for HCI researchers, including the adoption and adaption of new technologies, enabling spiritual practices, and spiritual experience. Wyche et al. recommend the use of religion and faith as a lens through which to view these practices [106] and explored these techno-spiritual practices for everyday life [103], including use by American Christians in homes [106], use by American ministers in their religious work [107], and use of prayer time application by US Muslims [104, 105].

a context observed in low-income Pakistani households, where technological use was gendered and family-guided decision making played a key role in how and why women did and did not use technology.

This study accounts for the family dynamics that dominate technology access against the backdrop of a culturally conservative and patriarchal Islamic society. We present the complexity of family dynamics around technological inclusion. Further, we articulate the different stages of technology access, knowledge, and use by women, as well as how these stages are influenced by family members³. Many social actors beyond a woman's household can influence a woman's engagement with technology. Some prominent actors in our data include mobile shopkeepers, women employers, and technologically savvy neighborhood women. All these actors supported women's technological interaction. However, our paper focuses on family members and their impact on women's technology use and inclusion.

Pakistan offers a unique setting for this research since it holds the next-to-last place in the world for magnitude of gender gap [100]. Pakistani women face issues that arise from gendered norms interconnected with religious and cultural practices [97] [86].

In this study, we analyze 73 qualitative, semi-structured interviews with women from various low-income communities across and around six major cities in Pakistan to answer the following:

- Who among a woman's family members dictates, mediates, supports, or limits her technology access, use, and understanding?
- What are the various relationships between women and their family members, and how do these relationships define the roles of each family member?
- How do key life events transform and evolve the roles of women and their family members with regard to technology engagement and technological inclusion?

To answer these questions, we identify the various actors, from direct enablers to limiters, as well as secondary roles that collectively inform the usage of, access to, knowledge of, and interaction with technology for Pakistani women. These actors influence the way women engage with technologies in addition to the type, quality, and frequency of interactions that are possible for these women. We demonstrate the richness of interactions of these women with technology. Their stories form the basis for our analysis of how socio-cultural, technical, and personal motivators enable and limit women's ownership, access, and use of technology. We argue that the family unit and family considerations are the strongest motivators for low-income women's decisions about technology.

In the remainder of this paper, we first outline the context, background, and related research for this work. We next describe our methodology and present two representative cases studies intended to show the complexity of familial relationships. Then, we share our findings, which address the stages of technology engagement and technological inclusion, the actors in women's engagement with technology, and the drivers of authority. Ultimately, our discussion reinforces our claim that we must take family dynamics into account when assessing technology engagement and technological inclusion of women in contexts that emphasize religious and cultural norms. These norms affect gendered roles within families, the gendering of public and private spaces, and notions of authority that are linked to age, gender, and status within the family.

2 BACKGROUND

Studies have investigated technology design for collective use within the family. However, the impact of family dynamics on the use of technology designed for individuals requires attention, especially since it directly affects technological interventions designed for improving aspects of women's lives. "Designing for Families," a special interest group at CHI 2009, highlighted the

³We refer to both immediate and extended family members (nuclear and joint) as 'family'.

fact that a family can extend beyond biological relations and committed relationships to include cohabiting familial boundaries (e.g., roommates) [75]. We define *family* as both individuals related to one another and individuals living together as a household.

In Pakistan, as in other parts of the Islamic world, family structures are driven by bonds of biological relations and created through marriage. Sons and daughters tend to live with their parents until they are married. After marriage, the patriarchal structure demands that daughters leave their paternal homes to live with their husband's family, while sons remain with parents and take responsibility for them, their wife, and children as the primary earner. In a joint household, the kitchen and courtyard are spaces shared among parents and the families of their sons. As family size increases, a couple might decide to move to an independent home. Islam grants a woman the right to demand a space for herself that is separate from her husband's parents. The duty-bound son must consider his wife's requests but balance them with the needs of his aging parents, who may require additional care-giving from the younger generation. Because of this, multi-generational families are commonplace in Pakistan and other parts of the Islamic world. In light of these living arrangements, in addition to the prescriptive practices to respect and provide care for elders, the opinions and decisions of the eldest family members (regardless of gender) carry great weight. This stems from the teaching of being answerable (to Allah) for the people for whom you are responsible. This responsibility is explained in the following hadith:

Take care! Each of you is a shepherd and each of you shall be asked concerning his flock; a leader is a shepherd of his people, and he shall be asked concerning his flock; and a man is a shepherd of the people of his house, and he shall be asked concerning his flock; and a woman is a shepherd of the house of her husband and over their children, and she shall be asked concerning them. [Sahih Al-Bukhari, Al-Adab Al-Mufrad and Sahih Muslim 1829]

Furthermore, the Qur'an emphasizes the role of men as the protectors and maintainers of women, as described in Sura an-Nisa' (The Woman):

Men are the protectors and maintainers of women, because Allah has given the one more (strength) than the other, and because they support them from their means. Therefore, the righteous women are devoutly obedient, and guard in the (the husband's) absence what Allah would have them guard. Q4:34

These passages and other excerpts from Islam's sacred texts demonstrate a particular way of defining the roles of men and women in the family and the household. The shepherd has responsibility for others, but this does not imply absolute control. Our observations in Pakistan showed that immediate families (i.e., nuclear families) lived in separate households, demarcated areas of a collective home, or in proximity to other related nuclear families that belonged to siblings, cousins, etc. This type of shared living arrangement supported the lending and sharing of household goods, supplies, and services, such as childcare.

Beyond these prescribed roles for men and women, Islam provides agency to women in choosing their spouse, refusing to stay with their spouse, and annulling a marriage [2, 51]. Furthermore, scholars have called for understanding the primary texts of Islam in the time and place in which they first appeared when considering their implications within modern contexts [36]. Some then apply these verses to convey a message of respect, honor, and women's rights that speak to the core agendas of many contemporary feminist movements [87].

Religious beliefs and practices influence gender relations and the resulting socio-cultural and technological interactions. However, this influence remains an under-explored area of research in CSCW, HCI, ICTD, and related fields. Part of the hesitation to engage in this type of analytic framework is discussed in Section 3.3.

2.1 Women, Digitization, and Contemporary Pakistan

We conducted our research in Pakistan, a Muslim majority country, founded in South Asia in the mid-20th century. Although its name, the Islamic Republic of Pakistan, suggests an underlying religious orientation, Pakistan's secular legal system does not implement regulations for women, such as covering one's head in public spaces or enforcing that a male relative must accompany a woman outside the home.

However, Islamic beliefs and practices persist through social norms that maintain gender segregation in places such as mosques, marketplaces predominately populated by male vendors, events such as weddings, and educational institutions, from primary school through university. For example, one university imposed fines on female students who wore jeans or who did not wear a dupatta⁴ [96]. Another university fined women for breaking the rule that *male and female students should maintain a distance of at least six inches while sitting or standing together* [77]. These stories illustrate how educational institutions enforce gender segregation based on conservative values that form the basis of society. This gender segregation has created wider gender gaps in areas of education, health, political participation, and employment [97]. Besides this, Pakistan has gender-segregation in the form of women police and security personnel specifically for interaction with women as well as gender-specific times for the use of gyms and swimming pools, all which reinforce the notion of gender segregation.

With a population of 101 million women in a country of 207 million people, Pakistan is the world's fifth most populous country. However, it is second to last in the gender gap per the World Economic Forum's annual Gender Gap report [101]. South Asia has the largest gender gap, 26%, with respect to mobile phone ownership [35]. According to GSMA's Gender Gap Report, 44% of Pakistani women have a mobile phone compared to 80% of Pakistani men [percentage of the total adult population]; only 10% of Pakistani women use mobile internet compared to 26% of men. In urban settings, this gender gap in mobile phone ownership and internet use is 40% but increases to 49% in rural settings [35]. Pakistan has 35 million Facebook users, with 77% male and 23% female profiles [92.06% of its online population] and the sixth-highest worldwide male ratio on Facebook [98].

GSMA research identified Pakistan as the most conservative society in South Asia in terms of social norms regarding women's mobile internet adoption, followed by Bangladesh, India, and Sri-Lanka. This research outlines the enormous pressures women face to follow social norms and protect their families' reputations [34]. Significantly, it reinforces how conservative social norms, as informed by religious and cultural practices, are deeply embedded in family dynamics and the way people make decisions about technology.

3 RELATED WORK

Our work intersects with and builds on several bodies of scholarship within CSCW, ICTD, and HCI, including those that analyze gendered engagement and consumption of ICTs, technology uptake and use within families, and feminist HCI.⁵ While the understanding of gendered norms and relationships across genders and ages are critical to these areas of research, our work extends these areas in crucial ways, primarily by considering non-Western and Islamic contexts.

⁴A scarf worn around the neck or over the head by women in South Asia.

⁵Here, too, one might consider the rich literature within the field of digital anthropology, which examines the ways people adopt and adapt new technologies within a broader social and cultural context. Through extensive ethnographic research, these works explore how new digital communities are formed, the impact of digital technologies on people, and the uses and consequences of digital technologies. See [24, 25, 45, 66]

3.1 Gendered Engagement and Consumption of ICTs

A rich body of work in HCI and ICTD literature explores women's interactions with computing technologies. A full description of the work done at the intersection of gender and computing lies beyond the scope of this paper. However, a few key areas of this research are particularly relevant to this work, including gendered access and use of technology, women-focused technology design, and women's empowerment through technology. Some of this literature focuses on sexual harassment through various communication platforms and design implications for different experiences around it [16, 26, 27], including cyberstalking, impersonation, and personal content leakages in South Asia [88], and the role of technology in financial life cycles of women in Pakistan with respect to finances for circumnavigating patriarchal society [72]. A parallel body of work in HCI and related fields emphasizes the systematic (and often invisible) marginalization of women in various computing-related fields [20, 23, 29, 80]. Besides computing, [10] describes the marginalization of women through their absence from digital photographs. Most strikingly, gender affects a person's access to and knowledge of technology [47] and also influences how technology is consumed [108].

Depending on a given context, men and women are socialized to make gendered associations with technology. [81] discussed how Qatari women use creative approaches to interact online while adhering to social norms. [46] observed that women have different technological challenges than men in terms of understanding and adopting technological and financial services in Pakistan. This can include a fear of technology, which is more pronounced for women than men. For example, Sultana et al. demonstrated how rural Bangladeshi women face barriers to technology access, especially the fear of using mobile phones; they also describe how mobile interfaces in the West do not address the values and needs of these women [95]. Nova et al. advanced this discussion by showing how women in Bangladesh are often harassed over anonymous social media by friends and relatives who hide their identities [76]. Hassan and Unwin [38] described the fear of harassment and bullying faced by Pakistani women and how it affected the construction of online identities by Pakistani youth. Hassan et al. advanced this argument, showing why many Bangladeshi women did not participate in the online #MeToo movement [40]. Another study argued that even though men can be the subjects of sexual harassment on Pakistani digital media, women experience sexual harassment far more frequently, which the authors attribute to the patriarchal and Islamic character of Pakistan's society [39]. These fears can be mitigated through a technology consumption framework that allows others, mostly men, to intermediate the engagement and consumption of technology [47]. Our work contributes to this line of research by illustrating the technological status of women in Pakistan, especially within families where certain members act as technological intermediaries [90]. We present nuanced stories to extend the conversation of intermediaries beyond input and output.

Some works focus on women as end-users of technological projects, while others discuss existing adoption practices and how they shape women's use of technology. These include projects targeted at women's increased consumption of knowledge through health videos [55] and improved device literacy for mobile phones [102] to tackle gender injustice and enhance critical agency [84]. Other research outlines the differences in technological engagement between men and women using call logs. While men more actively use phones in the morning, women used the phone more at night [64]. In both Rwanda [18] and Pakistan [82], researchers observe consistent gender disparities in mobile phone use. Gender differences also exist in terms of women's learning of technologies [83] and adoption of technology [74].

Previous research explored the use of technology for women's empowerment and enactment of agency [43, 68] and for overcoming social barriers [79]. [53] investigates men's perceptions about the use and non-use of technology by women, and how notions of non-use and digital illiteracy are

imprecise in the case of women in rural India. In other contexts, such as low-income settings in Bangladesh, [4] found that one's gender impacts and limits one's technology use, and that gender inequality with respect to technology requires a three-pronged approach that addresses design, policy, and theory.

3.2 Technology and Families

Beyond the gendered dimension of technology engagement and consumption, a body of research on technology and families exists [31, 41, 42, 91]. Most of this scholarship focuses on Western contexts where, for example, researchers discuss parents' restrictions concerning their children's technology use (e.g., at the dinner table) [41]. This extends to parents seeking direct oversight of their children's technological devices and apps, even when they may struggle to understand unfamiliar technologies [17]. For low-income families, regardless of the context, parents may have significantly less education and technology exposure than their children. Technology can bring families closer together and act as a source of entertainment. For example, [48] illustrates how families in France, Sweden and the U.S. utilize technology to coordinate within and across families as well as maintain playfulness and have fun, even at a distance. Relevant to our work is that of [9], which found that matchmaking technologies in Saudi Arabia lacked the necessary features to include the roles of family members, who would typically participate in such a process.

Several studies show that decision making in families affects technology use, especially user privacy, in shared phone settings. Within patriarchal societies, social and gendered norms for use and non-use of mobile phones exist [53, 94], and, in turn, these norms shape how married women, in particular, use mobile phones [71]. [6] observed the gender dynamics that impact women's privacy in the instance of shared phone usage as well as practices for protecting data. This work closely relates to our own in that it reveals the sharing of devices between family members. [22] illustrates how husbands exclude women from phone use, letting them talk on the phone but not dial it. They also found that women receive phones as gifts but were denied permission to decide how to use them. Other studies have shown that dependency – in the form of usage, access, or sharing models – can limit women. Relying on others because of their lack of functional literacy and numeracy, phone sharing, and gendered cultural norms can lead women to cede personal privacy [5, 28, 70].

3.3 A Feminist HCI for the Islamic World

Viewing HCI research through a feminist lens is emerging as an important theoretical approach within the HCI field [85]. Pioneering this approach is Shaowen Bardzell, who proposed six agendas to make computing more gender-inclusive [12]. Feminist approaches are now well-accepted in HCI as research methods [13]. While such a turn is thought-provoking, most initial work in this area focuses on the Western world, omitting experiences of women in developing countries.

This is slowly changing due to the work of a group of ICTD researchers, who began to focus on this issue.⁶ A growing body of research situated in developing contexts has begun to call attention to women. For example, [8] argues that in Bangladesh, the failure of a mobile application that combats sexual harassment is a result of post-colonial conditions for women. In related work, [4] highlights how women's access to computing is limited by social and cultural politics. [53] demonstrates how women in rural India manage to use mobile phones despite the barriers imposed upon them by others and argues that Western feminist frameworks often cannot address the problems in India.

⁶The feminist lens allows researchers to understand the effects of gender on technology design, consumption, and use as well as the intersection of other markers of identity (e.g., race and ethnicity). Generally, the work on non-Western contexts focuses on understanding the lived experiences, needs, and desires of women.

Other scholars stress the need to consider inclusiveness and the intersections of identity [99] or propose the use of a feminist lens to understand care [52]. [6, 7] furthers this discussion by finding tensions around women's privacy and ownership of mobile phones in Bangladesh. [89] reports how women in South Asia perceive, manage, and control their privacy differently on shared phones. This and related ICTD work that addresses gender and digital technologies have begun to reveal salient features of the challenges faced by women in different non-Western contexts. It has led to a call for context-specific design that considers women's experiences, needs, and desires.

While feminist HCI in non-Western contexts has illuminated various hidden challenges for women, scant work has focused on women living in predominantly Islamic societies. A few studies have shown women's struggle to access technologies due to misogynistic social values. For instance, Abokhodair surveyed social media and gendered relationships in Arab contexts, specifically in the Gulf states [1]. These studies positioned women as marginalized and have not framed the problem in a wider socio-religious context to understand women's capabilities within it. Doing so requires a thorough examination of Islamic family values and cultural practices as well as an understanding of the complexity of women's lives.

Part of the intellectual contribution of this paper is based on long-standing scholarship about women's empowerment within Islam and the interpretations of Islamic values in the modern period.⁷ In many forms, popular beliefs and scholarly arguments have criticized Islam as a mechanism for disempowering women [37]. Scholars of Islam have debated these points, with some emphasizing certain passages within the vast textual tradition to point to a more egalitarian view of men and women; others caution that Islam's textual tradition is, by its very nature, patriarchal [3].

Departing from this theoretical discourse, we turn to anthropologist Saba Mahmood's work to develop a deeper understanding of how women can be empowered within an Islamic society [60]. Mahmood conducted ethnographic work in Cairo, Egypt, and studied a local mosque movement that, as she argues, was primarily driven by Muslim women who enacted change in society through their Islamic values and practices. Mahmood demonstrates how, within an Islamic value system, 'shyness' and 'civility' can be a source of strength rather than a weakness [61]. Her work builds on that of Talal Asad, who illustrates how Muslim values have often been interpreted as negative and disempowering within secular neoliberal political contexts, and how women's disempowerment is caused by those broader socio-economic conditions and not by Islamic values [59] [11]. Asad, Mahmood and other scholars, such as the anthropologist Lila Abu-Lughod, have called for an understanding of the condition of Muslim women through an ethnographic lens that recognizes those women's lived experiences and voices, rather than through an external gaze [57, 58, 67].⁸

This growing literature around Islam and feminism opens a novel avenue for CSCW and HCI research to conceptualize Muslim feminist interactions with technologies. This is the context for our study. We demonstrate how family dynamics, as influenced by Islamic values and local cultural practices, shape Pakistani women's use of technologies. Moreover, our paper further advances the agenda of addressing feminism through a 'feminist' lens, i.e., one that considers the historical, social, and political context through a series of social practices, including decision making, maintaining relationships, and understanding authority.

⁷In various forms of intersectional feminist scholarship, especially in post-colonial literature, imposed standards and values have often been seen as a mechanism for silencing (and disempowering) women. For example, Gayatri Spivak's magnum opus "*Can the subaltern speak?*" [69] and bell hook's celebrated book, "*Aint I a girl?*" [44] denounced colonization and racism as the overarching drives (along with misogyny) for silencing women.

⁸Abu-Lughod pushes us further to consider similarities rather than differences when we seek to understand Muslim women. She points to the work of the historian Asfaneh Najmabadi, who cautions us not to view the West and Islam too simplistically or in direct opposition to one another.

Age		Marital Status		Education	
Range	Total	Category	Total	Bracket	Total
15 - 25	19	Single	14	Non-literate	26
26 - 35	32	Married	54	Up to 5th grade	8
36- 45	17	Separated	2	Up to 8th Grade	11
46 - 55	4	Divorced	1	Up to 10th Grade	10
> 55	1	Widowed	2	Higher Secondary	7
				Undergraduate	6
				Graduate	5

Table 1. Demographics data for the 73 study participants.

4 METHODOLOGY

We report our findings from a two-year study (2017 and 2018) that included in-depth, semi-structured interviews and participant observations. For the study, we initiated direct conversations with 73 women participants in Punjab, Pakistan. We conducted interviews in various cities: Lahore, Multan, Sheikupura, Gujranwala, Kasur, and Faisalabad and the surrounding suburban areas (both developed and underdeveloped).

The participants, recruited in three phases, ranged between the ages of 17 to 56 (see Table 1). We recruited them through social contacts, word of mouth, vocational training institutions, and local microfinance institutions (MFIs). Of these women, 54 were married, 14 were single, one was divorced, one was separated, and two were widowed. The participants were housewives as well as women who worked outside their homes as maids, office staff, teachers, seamstresses, clothing retailers, and proprietors of tuck shops (grocers), beauty parlors, midwifery clinics, schools, shops, and cafes. Some housewives had previously worked or currently ran their enterprises from within their homes (i.e., jewelry makers, home-based beauty parlors, and embroiderers).

The first author, a Pakistani woman fluent in Punjabi, Urdu, and English, conducted the interviews, while the second and third authors (also women fluent in these three languages) took handwritten notes. The decision to have same-gender researchers was based on previous literature about impacts of gender [56] especially when communicating with Muslim female participants [73]. To ensure privacy and remove potential bias due to the presence of others (e.g., family members, employees, etc.), interviews were conducted individually for each participant. Nonetheless, participants' children, other family members, or customers occasionally interrupted the interviews. Interviews lasted between 30 minutes and an hour based on details shared by the participants and their degree of technological engagement.

Depending on the participant's preference, the interviewer asked questions in Urdu or Punjabi, and, because the discussion focused on technology, borrowed English words came up regularly. Again, depending on the participant's preference and comfort-level, conversations took place in homes, shops, offices, and branch offices of MFIs that provide micro-loans. None of the participants received compensation. During the interviews, women told us about their lives (e.g., family, education, employment), family dynamics (i.e., relationships with parents, siblings, husband, and in-laws), and their and their family member's engagement with technology. While participants described the various ways they use these technologies for diverse purposes, we focus only on the role of the family in technology engagement in this paper.

With the participants' consent, we audio-recorded the interviews and paused the recordings upon a participant's request. Usually when women requested that we stop recording, they shared sensitive information about their personal lives and instances where their husbands or other male relatives behaved badly or imposed restrictions.

4.1 Reflexivity

The first three authors – women born, raised, and educated in Pakistan – all completed university degrees in STEM fields. Together, they have 20+ years of conducting field-work in the areas of gender, health, financial technologies, and technology use.

Participants welcomed them by escorting them to special guest areas or by offering chairs instead of allowing them to sit on the floor. At times, the participants offered beverages such as soft drinks even when they did not themselves partake. These actions emphasized the socio-economic and educational divide between the interviewers and participants.

After transcribing the audio recordings, the authors coded and clustered all instances of technology interaction. The authors analyzed and presented the themes with careful consideration of the participants' descriptions of events, reactions, and reasoning, being mindful that they may view these differently based on their personal experience. Participants shared other stories about technology, but this paper focuses on conversations and themes related to a family's impact on participants' technology engagement and technological inclusion.

4.2 Interview Observations

Our observations about the social settings of the interview locations provide a lens into the gendered nature of both public and private spaces.

4.2.1 Physical Spaces. In urban and peri-urban settings, the doors of both homes and places of business (often part of participants' home) remained open; a cloth curtain partially obscured the doorways, leaving uncovered the lower portion where one could see the floor. We observed that men and women from the street would stand outside the house and speak loudly to seek permission to enter or to make inquiries. While women could enter the home, men would have entire conversations from the exterior side of the curtains. These curtains offered a form of privacy yet allowed interactions between women of the home and unrelated men from outside.

Urban low-income areas had some roads with vehicular traffic. Women would occasionally walk with us to their shops or to other women's shops that were nearby. In peri-urban settings, the houses were in neighborhoods with narrow streets that had no outlet and were away from the markets. Women would walk down the streets with us to introduce us to their neighbors. They approached the door of a neighbor's home, knocked, and asked the children about their mother's whereabouts. In rural areas, we met with women in one- or two-room centers of MFIs. Institution employees would ride their bikes to women's houses, often far from the centers, to invite them to the centers for interviews. Women would then walk to the center for the interview.

All women participants covered their heads. All but two of the MFI offices had women employees, and participants referred to MFI employees as "brother" or "sister" during the conversations. Some of the officers went with us to visit participants at their homes, while others inquired about women's families or their children's health.

4.2.2 Gender Dynamics. During some of the interviews, male relatives of the female participants would interact with them or with us, which gave us a view into the gender dynamics within families. The presence of male relatives occasionally generated challenging situations for both cohorts. For example, in one interview a woman's husband joined us in the room of the house where she was being interviewed. He continuously interrupted, stating that, "*She doesn't know.*" or "*She doesn't need it [technology or financial services].*". At other times, he commandeered the conversation altogether. This particular interview was later discarded from our initial analysis since the wife's answers were likely influenced by the husband's presence. The fact that the husband chose to answer for

her may suggest that he thought he was better able to answer questions about technology or that she did not have the authority to make decisions regarding technology and finances.

During another interview with a woman who ran her shop from home, a man entered the shop and greeted her toward the end of our interview. He paused for a while, observed us, and then asked her who we were and who had sent us. Nearly all of our remaining questions were interrupted by him with a joke or a rhetorical remark. The female participant explained that this man was her nephew and her husband's business partner and that we should ignore him. This proved difficult because he stared at the female interviewers and other women customers in this all-woman shop. The research associate taking notes mentioned being 'uncomfortable as he constantly stared at the interviewer and research associate.' This observation is important both in terms of gender and generational dynamics for two reasons. First, the nephew feels that he should answer on behalf of his aunt or possibly protect her from disclosing any personal information. Second, because it reveals the challenges of conducting research by women in a socially conservative and patriarchal society.

We observed that women had concerns about the public portrayal of their family members, especially their husbands. While they readily shared difficult circumstances or negative incidents that took place in their families, some participants would quickly change their stance if their response involved their husband. In all these instances, no male relatives were present. This suggests that women wanted to maintain respect for their husbands and their perceived responsibility to uphold and protect their husbands' image and honor.

5 CASE STUDIES

Here, we present two case studies to demonstrate the technology engagement of low-income women in Pakistan through their interactions with family members.

5.1 Case Study 1: "*Our brother does not trust us, and our parents prefer his decision.*"

Amna and Sara are teenaged sisters, both single and living with their parents, two brothers, and the wife and child of the elder brother in a rented house in an underdeveloped urban area.⁹ They came from a large family of ten siblings, all of whom were married except Sara, Amna, and their younger brother. Amna, Sara, and their mother worked to support the household. The eldest brother would contribute occasionally when he could find work. The sisters consider their mother to be the head of the household because their father is ill, which makes it impossible for him to take responsibility for decision-making.

Amna, the elder of the two sisters, was 17 years old when we met her in the summer of 2017 at a vocational training center. Due to financial issues, she did not attend school but instead received tutoring to prepare for her tenth grade exams. She studied in the late evenings because she worked at the vocational training center in the morning and held a job at a beauty salon in the afternoon.

That same summer, the second sister, Sara, was 15 years old and in the eighth grade. Household chores, such as buying groceries and vegetables from a market (two hours by foot from home) and cooking meals for the family, were her responsibility. In addition, she was learning to sew at the same center as her sister, and she made clothes to contribute to household funds.

With the father being ill, the mother made all family decisions. The sisters mentioned that the family put the needs of the sons above those of the daughters. The resulting dynamics of authority within the family gave the eldest brother the role of gatekeeper regarding technology use by Amna, Sara, and the younger brother. Although the sisters contributed to the household funds, doing so did not improve their ability to access, select, or use technology. "*(Why does your brother make*

⁹ All names have been changed for anonymity.

restrictions?) I do not know. Maybe he has some trust issues. He does not believe us and even our parents take his point of view. (If you get a job, would you be allowed to use a phone?) Maybe, but it depends on my brother. (Are your cousins or other female relatives allowed to use phones?) Yes, all of my cousins have phones and there are no restrictions on women's phone usage among our relatives. Only our family restricts women's phone usage."

The sisters depended on their brother to purchase technology. Amna had a feature phone that she used to stay in touch with family members while she was out of the home for work. She gave her brother money and asked him to buy her a smartphone. When he returned from the market, he handed her a feature phone, saying that she did not need a smartphone. Amna wanted a smartphone so she could access the internet, which her friends had explained was a great tool for learning. The brother thus acted as gatekeeper, restricting internet use for the house. Amna used her feature phone for SMS and calling, and she asked her friends at the vocational center for technical support regarding phone use. Even with a feature phone, Amna's brother monitored her phone usage by checking her call and message logs when she returned home each night.

Although Sara could afford a phone, she did not have one because her brother forbade it. Sara often saved money from sewing clothes to buy things for her younger brother. Once, the younger brother even asked for a computer. His mother refused because she could not afford it. Like Amna, Sara saved money and gave it to her older brother, asking him to buy a computer for the younger brother. This time, the elder brother did not have an issue with the younger brother using a computer and brought one home with the money Sara had given him. Sara had also saved money through a savings' group to buy a refrigerator for storing her father's medication and travels to the market alone in the evening to buy groceries when the prices are lower, which shows her responsibility and dedication to family. Yet, her brother refuses to let her have a phone. In this situation, an unmarried woman is considered to be more at risk if permitted to have a phone than to walk alone to a market at night.

Both sisters agreed that their brother was skeptical of girls using phones because he believed they would contact boys and find boyfriends. Sara shared that, *"Yes, I have asked him twice [for a phone], but he replied, 'Why do you need the phone? There is no need to use the phone.' The problem is that he does not trust us. One reason for this is that my elder sisters, who are married, had phones before they got married but used them for purposes that questioned their trustworthiness, and, consequently, we have to face restrictions. My father once agreed and told my brother to get me a phone, but he refused. (What are the reasons that your brother does not allow you to use a phone?) Girls use phones for getting in touch with boys and making friends. My elder sisters did this, and that is why my brother does not believe us."*

Amna and Sara believe that girls should not talk to boys when given access to phones. They say that such precedence creates problems in getting access to phones for girls like them because it generates unfounded suspicions from their family.

5.2 Case Study 2: "I was not using it (the smartphone) as per their wishes, so my mother broke it out of anger."

Sana is a 21-year-old single woman living with her parents and brothers in an urban locality. A member of her extended family, her paternal uncle, introduced technology by gifting a phone to the family. Women in Sana's family never considered or initiated phone purchases, and the two phones she has interacted with were gifts from relatives. When asked if she had ever bought a phone or visited a mobile shop, she replied, *"No, my family does not allow [me] mobile phones, so I never thought about buying it for myself."* When we met her, she had been using her smartphone, which she referred to as *her* first smartphone, for six months. Before this, she shared her mother's smartphone [gifted from an uncle to the whole family]. Sana's excessive use of the phone made

her mother furious. Her mother subsequently threw the phone and broke it. *"My chachu [father's brother] gave it [the smartphone] to my mother as a gift for everyone for the first time. I was using it a lot, so my mother broke it out of anger. I was not using it as per her wishes (i.e., in moderation). I had it in my hand all the time. (What do you use your mobile phone for now?) I text and use it to make calls. I do not use it a lot now. I have no internet package."* Apart from that, only her father had a mobile phone. When asked whom the phone belonged to, she kept switching between the narrative of *"her phone"* and *"her mother's phone,"* but mostly used by her.

"(Does your mother have a mobile?) Well this mobile belongs to mom and we all use it, although it is mostly with me. (Do other women in the house have permission to use a mobile phone?) Yes, although my little sister does not have a mobile and does not use it. (Why?) She is little so she is advised to focus on her studies. She also does not have a need to use it. She only uses it for pictures sometimes." Sana's father is the head of the household. He provides for the family and makes decisions about expensive purchases, such as a new refrigerator. Sana's mother takes the roles of advisor and supporter of the head of household's decisions. She also persuades her husband to make purchases. *"(So who handles the financial decisions or is the head of household in your family?) My father. (Not your mother?) No, mostly my father, but mother contributes by making suggestions as well. If we want something we ask our mother, and she helps us out with our father. Also, we bought a refrigerator this Eid (Muslim holiday). We wanted to get a refrigerator so we talked to Mom, and she convinced Abbu. (But there is a need to convince him?) Yes, there is."*

When asked who would buy a phone if Sana needed one, she replied that it would be her father. This illustrates how the dynamics of authority for this family lead back to the working father, who controls finances and purchase decisions. According to Sana, her father was less restrictive than her brothers. Her brothers did not let her have her own phone; instead, they asked her to share theirs. But with her father's support, she can now own and use a phone. *"At first my brothers did not like that I had a phone. Now they see that my father is at work, so they allow me to keep a phone."* She acknowledged that her family does not consider it appropriate for girls to have phones, and that, even in the case of her own phone, she tells people it belongs to her mother.

Extended family members influenced access to technology, but they also disapproved of technology for women. *"(Who else restricts you from mobile usage in your family?) Some relatives, some uncles, not all of them. We have such a trend with our relatives."* Sana learned to use the phone through experimentation and by directly observing her cousins use it. *"(Who helped you in learning the mobile for the first time?) I got some help from cousins but mostly learned myself. My cousin – she is married, so she used a mobile. I got help from her in WhatsApp. We do not use internet that much. I did learn YouTube."*

FINDINGS

We present the various roles that family members play in women's technology engagement as understood from our conversations with low-income women. We then illustrate the effects of family dynamics and decision-making on women's technology engagement.

6 THE STAGES OF TECHNOLOGY ENGAGEMENT

Technology engagement involves more than active use. It is influenced by deeply intertwined social and religious norms. Our participants shared the roles of their family members in deciding to buy technological devices, visiting shops to make purchases, learning how to use a device, using the device, and troubleshooting and repairing devices. These insights form the basis for this paper. We found that each instance of technology engagement may require different types of intermediaries, skill sets, and/or other support structure. Likewise, each stage of technology engagement is affected

by gendered divisions of space (both public and private), time constraints, and perceived duties as influenced by a system of Islamic values.

We observed that family dynamics and decisions made by relatives on behalf of women are the primary components of how our participants engaged with technology. All of the participants relied on their families or considered their families' needs when making decisions about technology. Many technological advisors to these women were neither highly literate nor expert in technology. Instead, they were individuals who could visit a shop on the woman's behalf or had minimal device exposure. Thus, one could conjecture that those in the women's family and social networks may have had limited and, at times, imprecise knowledge.

We now identify the various stages of technology engagement, each of which is gendered and not necessarily linear. Pakistan is a male-dominated society with androcentric patterns of technology consumption and knowledge diffusion.

- We consider the **introduction of any new technology** to be an important first stage, especially for the women we interviewed. For these women, their male relatives most commonly introduced them to new technologies. This pattern of introduction defines both the permissions around and perceptions of technology use as well as the types of technology available to women.
- The second stage is the **purchase of technology**, which typically occurs in technology markets and shops populated by male vendors and customers. If a woman cannot visit these places, she must rely on a male relative to select and procure the technology on her behalf.
- The third stage of technology engagement is **learning to use basic or advanced features of a technology** (e.g., phone, television, etc.). To learn how a certain technology works, women explore by themselves or must be taught by someone.
- The fourth stage is **access to supporting services** (e.g., airtime top-up, repair, installing or upgrading content) that are required once a woman has access to a technology.
- In addition to these four stages, we also saw family playing a role in **monitoring or restriction of technology use**.

The segregation of men and women in physical spaces creates a gendered *diffusion* of technology. Diffusion is a social process, and the diffusion of technologies in Pakistan is dominant in spaces that are outside of women's homes and social spheres. Segregation of physical spaces stems from the Islamic concepts that restrict the mixing of unrelated men and women. Thus, Pakistani women's discomfort in interactions with unrelated men limits their information sources to relatives or women in their social spheres and is the basis for their reliance on male family members for procurement, engagement, repair, and maintenance of technological devices.

7 ACTORS IN TECHNOLOGY ENGAGEMENT

To understand Pakistani women's technology engagement, we must consider the various actors involved in each of the stages described above.¹⁰ These actors, their knowledge, and their relationship with women dictate the engagement and limitations faced by women. We will see that none of these actors works independently from a complex system of interconnected relationships, negotiations, and power dynamics, all of which determine the ways in which a given technology is accessed, consumed, repaired, etc.

7.1 Technology Introducers

Technology introducers inform a woman about new technologies that they might have observed, heard about in the market, used, or brought home. Typically, male relatives introduce women

¹⁰ Beyond this point, we use *technology engagement* to mean any or all of these levels of technological interactions.

to new technologies, but occasionally women who previously learned about a new technology through their own network will fulfill this role.

Informed about the Existence of a Technology. To uphold piety, unmarried women from low-income communities in Pakistan are not allowed to have phones [47]. Many married participants' husbands informed them about a new technology or new features of a technology. We observed this pattern. One participant explained how she does not have a smartphone, but that her husband shows her videos and searches the internet on her behalf.

Yes, that I keep watching. There are hairstyles, etc., that come up or some henna colors and designs, etc. He [the husband] looks them up for me and then I keep watching them [laughs] .. He also shows them to me sometimes when, while browsing the internet, these things pop up in front of him so he says to me to check out these new designs. (P41_2018)

Used in the Presence of Women. Some women reported learning about a new technology, application, or use by observing a family member. One participant recounted her experience with email:

My employer [a woman] taught me how to make an email. I observed my brother using email as well but did not tell him much about my email account. I made it [the account] first, and, just very briefly, informed him that I have an [email] account. (P4_2017)

Got Them to Use It (Trial). Some women who were not active smartphone users reported that their family members, especially husbands, gave them their devices. This was not only for a particular occasion (like watching a video or making a video call over the device), but, at times, to make participants comfortable with devices and seek their feedback on potential ownership of such a device. One participant rejected smartphone ownership after trying her husband's phone because of a lack of knowledge and the possibility of her children sharing the phone.

No, I don't know how to use it that much. If I knew how to use all of the features, I would have bought one of my own. He did give me his mobile once or twice for me to use, but I don't know how to use it. And also I have a son and kids who use it, and then they learn bad things, so that isn't right. (P38_2018)

7.2 Technology Sharers

As noted in previous ICTD literature [6], we observed various actors who shared technology with low-income women in different ways. It is important to comprehend these sharing dynamics to understand the flexibility of time, access, and services available to women.

7.2.1 Equal Sharing. This type of sharing was seen when a device at the home is used by all family members. Women from this category also reported the phone as their own. Upon deeper questioning, we formed a more nuanced understanding of the dynamics of phone sharing. As one woman from Kasur said:

Yes, I have (a phone). It is a feature phone. (Does every family member have their own personal phone?) No, only one phone is used by all family members. He (my husband) has a phone, but most of the time he leaves it at home. If we need to contact him, we used to contact him on his boss's phone. My brother-in-law has a separate phone, but his wife doesn't. In our family, girls are not allowed to have their own mobile. (P14_2017)

Later in the interview, the same participant mentioned that she does not mind if someone else uses the phone since "it is a family phone." We observed that smartphones, be it a participant's or their family member's (mostly husbands), were the most shared devices. These phones would be used like a family computer: children would play games, women would watch videos or talk to family

using WhatsApp, husbands would engage in social media, and the family would take photos. Most smartphone ownership and use by women focused on communication and entertainment.

7.2.2 Borrowed Use. This type of use occurs when the device or technology is owned by one person, and another person borrows and uses it only for a finite time. For example, a husband returns home and gives his phone to his wife for a particular purpose, or a mother gives the phone to her children to play games. Here, one important distinction is the subcategory of **limited borrowed use**, where women were allowed to do only a specific activity on the phone. For example, a husband would call his wife's mother and give the phone to his wife, or a husband would allow the viewing only of YouTube videos, or a mother would let children play only one particular game. One participant explained how she used her nephew's phone even though her brother also had a smartphone.

If we have to do this [look at designs or something embroidery-related on the internet], our nephew has a phone we take from him. We never take from our brother. (Why?) His work is like this that he can't leave his phone at home. The nephew can leave the phone at home. (And nephew?) He can. He is 18 years old. (He has a smartphone?) Yes, it is a smartphone. (And you use his phone?) Yes, for the internet or for designing, we use that. (P40_2017)

A few participants asked family members (brothers and married sisters) who had computers to let their children use them. Two women had computers for their children's school assignments, one purchased by a brother and the other with an accompanying nephew "who knows about computers."

7.3 Technology Selectors and Buyers

An important step that defines these women's engagement and experience with technology is its selection and acquisition. We saw two major types of technology purchase in low-income families: (1) where women buy the technologies themselves, and (2) where a family member purchases the technology. Selection and buying dynamics impact the devices that women eventually receive.

7.3.1 Women as Buyers. For a woman to buy a technological device, the ability to go to mobile shops took precedence over required technical knowledge. The transaction depended on a woman's confidence and her ease of traveling to and conversing in these shops. Many women informed us that they feel comfortable traveling to various shops, but, due to a large presence of men inside and outside technology shops, they do not feel comfortable entering and sometimes accompany other individuals.

We bought (this phone) ourselves. Just like we go to buy things for our work, we (me and my sister) went to buy clothes for embroidery. We went to the market and bought this [phone] as well. We asked our dad. We told him that we need a phone for our work, and he said ok you can buy it. (P40_2017)

However, women who worked or engaged in daily activities that required conversing with men were comfortable in these situations. One woman shared how she procured everything herself:

Even then (when her husband was in the city), I used to go myself. When I have made my parlor, then it means that you have to work like a guy. This chaddar (head cover) is what we are wearing, else all our work is like men. (P8_2018)

Some women were accompanied by the men in their family, for safety, travel purposes, or technological input. One woman, who went to buy her phone with her brother from a shop in the city, shared how she bought the phone of her choice even though her brother did not agree.

My brother said that this is a very cheap phone of 12-1300, and it won't work well; but I said no it will work because I only had to use it for my work. So then I used that one for 5-6 years. And then after that, my kids spilled water on it, and I sold it for 700. (P9_2018)

7.3.2 *Family Members as Buyers for Women.* Family members frequently include a male relative who can go to the market and buy the devices for the women. Buying on behalf of women can take several forms.

Buyer-Recommended Purchase occurs when women explain their needs and budget to an informed buyer, e.g. "I use it only for calls" or "I like the one with a radio," and buyers bring the latest or best available option as per their understanding. As one participant shared, "*My cousin went to buy the phone for me. I don't go to mobile shops. (Why?) I don't know much about mobile phones. If I have any problem, I ask my cousin to go and fix for me. (P49_2017)*"

User-Recommended Purchase (Transactional Purchase) happens when the person going to the market and buying phones for women is informed by end-users (women) about requirements for the type of phone (feature, basic, or smart) and quality (expensive, low-quality or China) required. The buyer then purchases the phone according to the woman's specifications.

Choosing a Phone is when women have the agency to pick from and react to different phone types, even though they do not go to the shop themselves. These transactions were usually made possible by men in the family, who either worked themselves or knew someone who worked at the mobile shops, or when there was enough trust with the shopkeepers to borrow phones for decision-making. Since most of these purchases include used or second-hand phones, it is easier to have them returned, which might be difficult for new or boxed phones. Women chose from a selection of mobile phones. Participants also reported returning the purchased phone when they disliked a particular buyer-recommended purchase, or they asked to exchange it for another phone type.

Many women relied on their children as liaisons to technological markets and shops. One woman, sharing a story about her son's role in choice and selection of phones, mentioned, "*No, I still don't know which one I want. I know this much, that the son got the other touch one, and I returned it. I said, son, I don't know how to use it, then what is the use of getting it? He then changed it for this [button] phone, but my grandson broke it. Then he got me this one.*" (P39_2017)

Another shared that, "*The phone that I have, my son-in-law (who is also my brother's son) bought for me, and the previous was bought by her brother. They care for me a lot, and people praise how my brothers and their sons care for me, even though my parents are dead. I tell them which phone to buy and give them money, but they go and buy for me. They come and show me the bought phone if I approve of it. Before I had any phone, I used to request whoever had a phone in the street at their homes to help me call. Before this, I used to live in Noshera thus did not need a phone.*" (P4_2018)

7.4 Family as Technology Providers

Yet another distinction of the role of family was seen in terms of devices made available to women. Besides devices purchased using any of the preceding dynamics, women were also given phones by their family members. The two most commonly seen themes follow.

7.4.1 *Hand-Me-Downs from Immediate Family Members.* In many of the contexts where husbands or relatives with a higher income upgrade to a newer technology, they also give their old phones, TVs, or fridges to their family members. This occurs mostly within an immediate family or at the household level.

7.4.2 *Devices Gifted by Family Members.* Where hand-me-down devices were mostly exchanged within the same household, sometimes devices were gifted to women, both by immediate and extended families, including uncles and in-laws. One woman reported that

I got this phone within two years of moving here (to the city). My brother came to my house and gave me this phone. He said that you don't have a phone, and you cannot buy, and you don't ask (for it). Just take this phone and use it. I never paid for it. (P4_2018)

In this instance, the women previously lived in a close-knit community and reported not needing a phone. She also related how she would visit someone or use someone else's phone to make infrequent contacts. However, once she moved to the city, she did not have a phone, nor did she ask anyone. But her brother gifted one to her.

Many unmarried women are not allowed to use mobile phones in Pakistan [47, 92]. Thus, once women marry, communication with their husbands and parents introduces the need for a phone. When asked about their first phone, most women, especially from conservative households, reported that they were given/gifted mobile phones by their husbands on or after their wedding. These gifts were given without any requests from the women.

7.4.3 Devices Requested from Financially Able Family Members and Friends. Sometimes, women asked family and friends to give them devices when they had the means, either by selling them used devices or by buying them new, affordable ones. One woman reported that she requested that her sister, who married into a well-off family and had a supportive husband, procure her a device. The sister asked her husband for an old television and got it for the participant. *"I asked her (my sister) a long time ago for a television. I said to her that I go to the neighbors to watch television, so she said when I have money, I will buy you a television."* (P18_2018)

7.4.4 Technology as Part of a Dowry. The custom of dowry is prevalent in many parts of the world, especially in South Asia. Islam has no teachings regarding dowries because it grants women inheritance rights. Thus, Islam does not permit women to be owned or traded. Yet, dowries are still prevalent in many households in Pakistan. Some participants reported the provision of everyday technological devices, such as televisions, refrigerators, or washing machines, as part of their dowry, while others reported taking small loans to pay for their daughters' dowries.

7.5 Technology Advisors

Due to limited technological knowledge, the lack of technology-competent peers, and the existence of gendered technology spaces, women relied on male relatives for technology advice and women thought men had "more exposure" or "knowledge about these things." Advisors are the technology experts or individuals with more technological exposure than the women themselves. These mostly consist of men in the family who have been to the electronics markets or technology markets or have friends there and thus have knowledge of available offerings and their differences. Note that not all information provided by these advisors was accurate, complete or adequate, but women still relied on it in the absence of alternative sources.

7.6 Technology Tutors

Many women reported learning or using technology with the help of their children or brothers. Learning tasks was need-based, where women actively asked for a certain feature or help (e.g., calling their husbands). One woman shared that her children told her how to use the internet. She said, *"My children taught me how to use it. They have downloaded 'IMO,' and I know how to use it."* (P35_2018). The accuracy of their knowledge depended on their children's skills.

When women learned from their children, we then asked how their children learned about technology. One participant revealed that her children learned by watching people on the street. Her children knew how to use airtime packages and the internet. She shared, *"No, those people who*

are sitting outside on benches and stalls [in the streets and markets]. So they [children] keep watching them how they use [phone]. Then I learned it from them [my children]." (P42_2017)

7.7 Technology Maintainers

After selecting and buying devices, actively maintaining them requires many types of support (e.g., financial support for repairs or technological support for upgrades and troubleshooting). In addition, we saw that women need social support when family members would make a case for their ownership and access.

7.7.1 Technological Support. Technology maintenance requires accessing information, troubleshooting, installing updates, and performing repairs. In many developing countries, mobile users can buy airtime, *known as topping up airtime*, in corner shops either by making a specific payment or through scratch cards (with numbers that must be entered into the mobile phone). Due to financial considerations, women preferred topping up airtime at shops because it allowed them to purchase with lower denominations than the pre-paid card amount of PKR 100 (0.81 USD) or more. Regardless, women relied on men to top-up for them or buy scratch cards because sharing phone numbers in public top-up shops could lead to harassment either from men in the shop or someone obtaining their phone number. GSMA reports that retailers in Pakistan sometimes actively discourage women from buying data or topping up in shops due to men in shops [34], and the shops are male-dominated sites where women felt uncomfortable [47].

My husband does that. You know why? Because these people later start making wrong calls to you. When they see that a girl has come to them to get her balance loaded, then they later start making calls on those same numbers. So if my husband goes that way, they know that it's a gent's number and not a ladies number. So this is why my husband goes for it every time. (P6_2018)

Some participants' children assisted the women so they could more easily use their phones. One woman shared how her son set up speed dial for her to call them, though she still has to ask them to search for other people's numbers. *"I have this [phone] since last five to six years. But it is that my children have done this (while pointing to the screen) 1,2,3,4,5,6; they set this up, then I can call them using this [referring to speed dial]. And when my elder son or my third son calls, I can yes the call [receive the call]. And if I have to search for anyone else's number, I ask my children to take the number out. It is working like this, thanks to God."* (P28_2018)

Brothers as Technological Support emerged as one of the most important, multi-faceted actors in the technology engagement of women. When unmarried, women's technology use was restricted by their brothers. But once married, the same brothers emerged as strong supporters of their sisters. Many married participants reported that they rely on their brothers to learn how to use new technology, for support in the selection or purchase of new technology and for advice or action on matters of troubleshooting and repair.

So because I'm at home so I have to do all the chores. My brother bought it for me. [When asked about previous phones and learning to use them.] This is my first phone. I learned it from my brother. He knows how to operate it. If it ever stops working or an issue occurs, I take it to my brother. (P20_2018)

7.7.2 Social Support. Like technological support plays a role in every step of technology usage, social support also plays a role, from acquisition of technology to its long-term, continuous use. These supporters can be immediate or extended family. One participant explained that since her brother does not approve of her phone use, she had two supporters who enabled her access to a smartphone, namely, her mother and her male cousin. She used to share a phone with her

mother; once her mother's feature phone broke, she convinced her mother that they should buy a smartphone. When her brother disagreed, her mother intervened and "*handled him.*" The male cousin then helped them buy the smartphone.

7.8 Technology Disapprovers

Besides active restrictions, we also noticed active and passive disapproval of technology from both the household and the community. Disapprovers included men and women who do not actively restrict any use of technology but build a negative image of technology access or use by quoting instances, hearsay, or commenting on the downsides of women's technology access and use. It also included social disapproval or suggested alterations in behavior as a consequence of technology use by women.

We refer to these actors as '*disapprovers*' rather than limiters because they do not directly limit use. Rather, they cast the issue in a negative light, e.g., sisters-in-law suggesting women with phones are not good, or sons saying sisters are not married so mothers cannot have a phone, or brothers saying girls should not be allowed to use phones.

7.9 Technology Gatekeepers

We observed men acting as gate-keepers to women's use of technology. This behavior is driven both by a need to protect women in the family and to ensure conformance to the religious and social norms of not mixing with the opposite gender or having inappropriate contact as a consequence (a perspective developed primarily from hearsay).

7.9.1 Restricted Use. Women who were allowed to use technology also had to face many conditions to its use, a very important factor when considering women's uptake or usage. These conditions included: 1) being allowed to use a feature phone, but not a smartphone, 2) being allowed to use a smartphone but not to own one, 3) being allowed to have smartphones but not allowed to use social media (or the internet), 4) not being allowed to have a device of their own but allowed to share one with the family, and 5) not being allowed to interact with any device.

One unmarried participant shared that she had a Facebook account that her brother had helped her create. Her brother later asked her to delete it, and she had to ask her employer to help her make a new one. This is the same brother who helped this participant buy a phone a few years earlier. His change of heart could possibly be the result of his social interactions or hearsay specifically related to Facebook because he still allowed her to use Whatsapp and upload photographs. Given that the participant did not know about technology, phone selection, or account creation, it is also possible that the privacy settings of her Facebook posts could have led to some event, hearsay, or conversation that prompted her brother's request to delete the account. The participant later mentioned that

Yes, he [my brother] ended my Facebook account. Actually told me to end it, so I had to. Then I asked madam here [at the parlor she works] to help me make an account. Brother does not have an issue with WhatsApp usage or other things. I can even upload pictures on WhatsApp. (P4_2017)

7.9.2 Monitored Use. Monitored use occurs when men, especially husbands and brothers, allow women to use devices but then observe or review the women's activities on those devices. This includes male relatives allowing women to use technology but only in their presence; checking the women's devices later for logs, messages, and interactions; or sharing a personal device with the woman but only to use a certain feature. Sometimes the monitoring is verbal, where men inquire about a call's recipient, the sender of a message, or content on the phone. In the first case study

(Section 5.1), the elder sister Amna shared that when she goes home from work, her brother goes through her feature phone and all its contents (messages, call logs) daily.

7.9.3 Prohibited Use. Prohibited use occurs when family actors limit a woman's use or interaction with technology altogether. This can be due to existing family and socio-cultural situations or changes in opinions or decisions makers. The prohibition of mobile phone use by low-income unmarried women was mostly based on stories or hearsay about women getting in contact with estranged men, developing romantic entanglements, and even eloping with these men.

No, I never got the phone. We don't have the permission. Girls do not have the permission to keep the phone. Only males can keep the phone. (Why?) I don't know the reason. (Did something happen for the family members to believe this ?) Yes, they observed some females using phone for some wrong purpose, and they restricted the use of other females afterwards. Prior to that, girls were allowed to use mobile phones. (How do you call someone?) I use my brother's phone. He is living very closer to our house. (P33_2017)

8 EFFECTS OF FAMILY ON WOMEN'S TECHNOLOGY ENGAGEMENT

8.1 Family Structures & Dynamics

We observed that family structures and dynamics impact: 1) who decides about a woman's technology access, 2) how these decisions are communicated and enforced, and 3) how family relationships and life events change who makes decisions.

8.1.1 Marital Status. In our research, marital status determines women's technological engagement: a married woman typically has greater access to technology if her husband grants permission. While a husband has the final say about his wife's technology engagement, he would often consult or negotiate with other family members regarding these decisions. When a (married) participant's husband did not allow her to have a phone yet her brother's wife had one, she expressed the following:

It totally depends upon permission. A female can use a phone if her husband has allowed her to use the phone. My brother permitted his wife to use the phone, but we have no permission. Also, his wife doesn't work anywhere and stays at home. (P33_2017)

We observed that if a husband was absent or incapacitated for any reason, a woman's autonomy in the decision to access, own, or use technology changed. Whether the husband's absence was short-term – due to ill health, incarceration, or temporary separation – or permanent – due to amputation, divorce, or death – these circumstances forced women to learn to use technology in ways previously unknown to them. In these cases, women had to rely on their own income sources and earning capabilities, with limited to no support from their immediate family members. This changed the dynamics of income in the household as well as decision-making abilities and restrictions. *“My mother-in-law is the head of the household. My father-in-law is mentally weak, so my mother-in-law makes decisions.” (P15_2017)*

A woman's independence to earn income or make decisions in the absence of a male support network did not always facilitate her technology engagement. Many women intentionally avoided mobile phones since their use is associated with a lack of moral character, and women fear societal retaliation and questioning about their character. Such participants reported reducing or limiting their mobile usage or interaction after being divorced, widowed, or separated to prevent rumors of immorality or affairs. They also reported feeling more vulnerable to theft or harassment in such situations.

No, I never used [a phone] from the start. At my in-laws' home, I was not allowed to use a phone. My husband did not like that I should have a phone or that I go outside all dressed

up. Thus, I started living in their way. Then, my parents got me a phone. My brother bought my first phone for me. He bought it as my birthday gift that this is simply, keep it with yourself. (Was it after your separation or when you were living with your in-laws?). It was after my separation my brother bought it for me. Even now, when I go out with the phone in my hand, I fear what would happen if someone snatches it from me. I am not divorced; that is why. (P36_2018)

Once a son married, his marital status increased the mother's authority because of the addition of a daughter-in-law to the household. Even though a mother-in-law could not dictate her daughter-in-law's technological engagement, she could weigh in on the engagement of younger women in the house.

8.1.2 Household Dynamics and Authority. Besides marital status, we observed the influence of family structures and dynamics in how family members exercised authority in decision making. This was expressed through gender and strengthened by earning status.

- *Household members (joint vs. nuclear)* and household dynamics (authority based on age) played a role in deciding women's technological engagement. *Joint families* are households with two or more generations living together. The presence of more than one family, including grandparents at times, resulted in greater restrictions to enable uniformity and perceived conformance to traditions, culture, and values. Technology advisors, sharers, and tutors were available in such situations, but such households also had an increased potential for disapprovers or monitors from the extended family. An individual's rank can include both the position (eldest sibling, youngest, only child) as well as the rank among all household members (grandparents, presence of multiple families' children). Rank is important as elders, especially fathers, uncles, or brothers, can decide what technology women could or could not use.
- *Earning Status.* Since technology access, consumption and retention (repair or upgrade) require financial investment, the economic status of the family member plays an important role in decision making. Many times, ill health or the death of a father force an elder brother or daughter to step up and support the family financially if the mother is unable to earn, is uneducated or is deceased. Even for a family where parents were alive, but brothers were providing financial support to the family, decisions about technology access were agreed upon. Though true for men, women's earning status did not necessarily affect technological autonomy; due to stereotypes associated with the technological engagement of women, some working women refrained from or limited their technological engagement.

Life events such as marriage and death affected women's technology engagement, and a woman's health status or change in health could also transform her ability to engage with technology. Women with vision problems, migraines, trauma, injuries, or stress all reported limiting their use of technology (by prescription or through their own will). One woman reported that she relied on her children to dial numbers for her due to her poor vision. In this case, she had access to a phone but needed the younger generation to assist her.

8.2 Family as Motivation for Technology Engagements

The most popular use of personal or shared smartphones was to make video calls to relatives, followed by watching videos on YouTube or social media. *"I have kept that only for video calls. My brother is in the military and posted at various locations. At times here, at times there. So, when we have to talk to him, we do a video call. Sometimes on IMO, sometimes on WhatsApp."* (P26_2018)

Children have also emerged as a reason why women were buying technology such as televisions: mothers wanted to prevent children from standing in the streets and watching screens at shops or

visiting other people's houses to watch television. The motivation for buying televisions is mostly, if not always, prompted by children's behaviors. One woman shared, *"I did not like that my children used to go to neighbors for watching television. So, we decided to buy a television."* (P22_2018) and another shared *"They would go to other people's house and would stand there."* Televisions were typically the first technological device that many interacted with at the household level, followed by washing machines and refrigerators. It is mostly the women who decide to buy the television, although they might rely on someone else's support to execute the purchase.

Initially, only the children watched the television, but engagement with it eventually expanded to other family members, including the women themselves. *"Mostly my girls used to do it, so after watching them I started switching it as well."* (P3_2018). Some women engaged with it for specific information. *"I just listen to the recitation in the morning, read Qur'an and offer prayer, and if any Naat or any Islamic Speech is broadcasting, I do watch that and ask my children to show me speeches on TV and nothing more."* (P39_2018)

8.3 Women-Children Considerations

Where women's families acted as the motivators or enablers for their technological interactions, women also reported refraining from or abandoning technology because of their young children.

8.3.1 Children as Reasons for Refraining from Technology Use. Women said they refrained from using technology either because of affordability or due to its potentially negative consequences for children. One woman refused to bring home a computer from her privately owned school. She said, *"They are children; they will just play games on it. So, I find not good for them."* (P22_2018). Participants also mentioned children as reasons for not owning smartphones. One shared, *"He (her husband) does say so [to buy a smartphone], but my kids are young, and they don't let my phone be. Once they come back home, they play games, etc., or other times they watch cartoons on it."* (P41_2018)

It is considered inappropriate for unmarried women in rural and peri-urban socio-cultures to own a phone [47]. Thus, the presence of unmarried daughters at home also acted as a limiter.

8.3.2 Children as Reasons for Abandoning Technology. Besides refraining from technology use, some participants reported non-use of a previously used technology due to their children. One previous smartphone-owner reported selling her phone out of anger. She said, *"It's just that I don't feel the need for it; my kids won't get off of it as they kept playing games on it, so then I sold it out of anger."* (P9_2018). Women also stated that their children were misusing the technology and thus they did not want them to use it any longer. Misuse included wasting time through excessive use of social media or games.

8.3.3 Children Damaging Technological Devices. Women reported downgrading to cheaper or older technology and sometimes giving up technology altogether because of children's abuse of or damage to technological devices, mostly phones. A few women reported never owning, or non-use after initial smartphone use, because of the cost of repair to smartphones. *"...so at times when you are not near them and away, the kids get hold of them [phones] and throw them. The youngest daughter that I have also has broken down two phones [laughs] while playing. And now this one right now, she threw it down, and its back got damaged and then threw it down again, and its screen got cracked."* (P16_2018) When we asked the participants why they do not use screen locks or app locks for children, many responded that children are ahead of them in unlocking. *"No, I used to have one [smartphone], but because the kids don't let it be so this is why I now keep this one [feature phone]. These days the kids are so clever that we change its password every other day, but the kids unlock it every time."* (P41_2018) Another shared, *"They are kids and they also learn how to open*

the lock [laughs]. So they look at it once or twice, and then they learn how to unlock it, so that's why."(P38_2018)

While some women asked family members to fix their phones, many gave up on smartphones and reverted to feature phones. P4 described that one smartphone was thrown by her children and damaged, one fell in the water, and one in tea; she also bought a touch screen phone, which had its screen damage because it was dropped. A vendor was unsuccessful in repair even after taking PKR. 1000. Thus, she switched back to a button phone. These situations often mean that women revert to shared phone usage.

8.4 Technology Engagement through Cousins

Cousins have emerged as a strong secondary support system in case brothers in the immediate family are unable or unwilling to support women in technological engagement. In this case, cousins include mostly sons, and sometimes daughters, of paternal and maternal aunts and uncles. The nature of support extended by male and female cousins varied.

Some participants also rely on cousins to bypass or overcome restrictions placed by their brothers. Male cousins were relied on mostly to accomplish buying and maintaining technology when brothers would disapprove and therefore not help in buying or when women did not have brothers. One participant relied on a male cousin to help purchase mobile phones for her, and another male cousin used to send a balance to her if she needed it because she did not have any brother of her own. In Section 7.6.2, we see mother and daughter taking help from a male cousin to buy a phone for the daughter when her brother did not approve of her having a phone.

Female cousins who did not face similar restrictions as participants were seen acting as technology tutors and technology supporters. In Case Study 2, we saw Sana learning to use YouTube by observing her female cousin, and the same cousin tutoring Sana on how to use WhatsApp because she was married and had fewer restrictions.

8.5 Use of Technology to Disempower

Technology access and ownership are equated with empowerment and agency. However, some participants shared stories where technologies were being used to monitor their communication or whereabouts. One participant told us how her husband gave her a phone for her to seek his permission before leaving the house.

No, he bought one [phone] on his own and gave it to me saying that you can use this to talk to your father and you can also talk to me, or, if you need to go somewhere, you can inform me on the phone that you are going. So it's that he doesn't let me go anywhere, even with my mother, without asking him. He says that unless I give you permission to go somewhere, you cannot go anywhere at all. (P16_2018)

She later told us that he is a laborer and mostly away from the home for work. If she does not receive a response from him, then she will not leave the house. Once he told her to call her father's number (her father works at the same job site) if a call to him did not go through.

9 DISCUSSION

In this paper, we highlight the direct and indirect roles played by family members in women's technology access in Pakistan, a predominantly Muslim country. Our analysis shows that some family members make decisions for women, and others enable or limit access. The roles of family members – including young and adult children, brothers, husbands, cousins, and parents – evolve and form complex dynamics around women's technology engagement and inclusion.

9.1 Protectors and Maintainers

Our findings around family, especially men's roles in the different stages of technology engagement, emphasize how religious norms can impact interactions between men and women, and, therefore, these norms must be considered when trying to understand technology engagement and technological inclusion.

In Pakistan and elsewhere in the Islamic world, men are socialized through culture and religion to behave as protectors of women, and women participate in this socialization in how they raise their children. These practices are not experienced as 'paternalistic' by the research participants. Instead, it suggests a holistic practice of protecting women's rights and rightful choices when necessary. While enacting their role as protector, men were supporters, buyers (to protect women from public interactions and vulnerability), enablers (as providers or funders), limiters, monitors, and prohibitors (to prevent personal or social damage) of technology engagements. Although some women assumed these roles, men's decisions typically took precedence and were considered more pervasive. In literature on the family in Western contexts, women, and most definitely older women, do not defer to family members (especially those who did not live with them and were not paying for the technology) about decisions regarding technology purchases or use. In Pakistan, women's choices concerning technology are tied to the decisions and influences of their relatives. While some might view this as disempowering to Pakistani women, men are duty-bound to serve women through rightful practices. By acknowledging this different approach to decision making based on Islamic values, new avenues for technological inclusion become available.

9.2 When Designing for Women, Design for the Family

Our findings show that while the stages of technology engagement for men are based on their personal decisions and preferences, women's technology engagement depends on collective decisions and preferences within the family and wider social network. Women consider their families' opinions and needs, which can enable or limit their technology engagement. The socio-cultural and religious underpinnings of how men and women interact within families are crucial for understanding technology decisions. To include women technologically in the context of Pakistan and elsewhere in the Islamic world, the role of different family members must be considered. This argument necessarily extends the work on intermediated technology use (to enter input, to decipher output, and to engage on a users' behalf) [90] in that it carefully describes the different stages of technology engagement and the complex dynamics between family members at each stage.

To successfully design technology for Pakistani men and women might require different processes if the goal is to work within the cultural and religious framework. To design for Pakistani women, we propose consideration of "design for the family." By ignoring the role of the family, technology will result in "unintended consequences" [32] for women and their relatives. In low-income households where a device will likely be shared, women, as wives and mothers, consider the impact on the family.

Women situate or limit themselves for the family, and they strategize and bypass restrictions via other family members (e.g., cousins). These supportive actors, like mothers, must also be considered when designing for women's technological inclusion. Similarly, designers can pay attention to these nuanced interactions and add more granularity to their interventions (e.g., women with supporters vs. women who endure monitored use) rather than blanket figures (n% smartphone women users).

Low-literacy can cause fear of, intimidation by, or skepticism of technology [62, 93]. It can be correlated with lower cognitive skills required to learn technology [63] and become a limiting factor in the exposure to and experience with technological devices [62]. However, our interviews showed that children of parents who had low-literacy did not face such challenges. Most of the

children were better educated than their parents, had more technological exposure, and possessed a willingness to experiment with technology compared to their family members. These children, who spend most of their time with their mothers, can be a source of knowledge for their mothers and guides for women more generally. They have the potential of being change agents, teachers, and influencers. Low-income parents actively rely on them and are proud of their technological skills [78].

9.3 The Interplay between Authority and Knowledge

The roles of various family members and the dynamics of authority that govern these roles provide a lens into the tensions created by technology. While interpretations of Islam form the basis for much of this gender-based and age-based dynamics of authority, we observed that this foundation was, at times, questioned and contradicted when there was a need for knowledge about technology.

Contradictions may occur in instances where technology or its presence affects cultural norms and upsets how and what knowledge is maintained and shared. Technology can also influence access to different types of knowledge that may be contrary or supplementary to the knowledge held by the older generation. Thus, the younger generation influences the knowledge of what technology does and how people might use it (including benefits, abuses, and misconceptions). This transforms authority structures around knowledge and can result in a transfer of authority to the younger generation, especially if its members are considered technology experts. This shift in the dynamics of authority and knowledge caused by technology is at the center of understanding how family influences technology engagement.

Another point to note in the context of Pakistan is that information sources – the technology experts, news broadcasters, and local storytellers – are all men. This may magnify the stories of women's misuse of technology that can tarnish a family's reputation. Technology has been characterized as an enabler of good, which can lead to women's empowerment and enactment of agency [43, 68], and as a tool for overcoming social barriers [79]. However, our analysis demonstrates that technology can lead to greater regimenting, monitoring, and controlling of women. Designers and those who implement new technologies must understand the tensions between the positive and negative effects that result from a design and deployment of technology.

9.4 Voice, Freedom, and Religion

Beyond the immediate tensions we have discussed thus far, this paper addresses some of the core concerns of CSCW and HCI research communities around equity and ethics. Modern computing technology is largely based on an assumption of an individualistic society with values rooted in neoliberalism, consumerism, and capitalism, and the model of 'personal computing' reflects these values. Under this value system, 'community' is grown artificially by connecting individuals in a digital space with optimism of 'unity' and 'growth.' Starting from Nokia's slogan, "*Connecting people*," [65] to Zuckerberg and Bono's speech, "*To unite the earth, connect it.*" [19], we see a pattern of isolating a person from their organic social context and imposing an artificial community on them through digital means. This pattern of design and use of technologies may conflict with local or family value systems that have a distinct understanding of identities, relationships, and accountability. The contradictions that can arise between these value systems give rise to a debate centered on liberty and asks whether communal values allow freedom for individuals.¹¹

Through our work, we advance this discussion and argue that Islamic values, as observed in our study, do not necessarily limit women in accessing technologies unless they meet with misogyny, which Islam does not support. Our findings parallel those of Saba Mahmood's ethnographic work

¹¹This is sometimes (perhaps problematically) viewed as a confrontation between opposing value systems observed through the lens of post-colonial computing, as the West meets the global South [49].

in Egypt, where Mahmood illustrates how women's empowerment happens from within a culture guided by Islamic norms[61]. In doing this work and listening to the voices of women who told us about their lived experiences with technology use and non-use, we set out to establish a precedent for others to look first at what women want and need before assuming that a new technology or a technology touted as offering freedom in any form is released as the new champion of women's empowerment.¹² With this in mind for the women we interviewed, considerations of family and Islamic norms as explained by these women are critical to understanding the complexity of decisions where technology use and non-use are concerned. Instead of considering a woman as an individual isolated from her social network and family, we join Mahmood in considering a Pakistani woman as a member of Pakistani culture who is guided by Islamic values. We envision that positive changes for Muslim women of Pakistan can occur by bringing positive changes in the social functioning that is also supported by Islamic values. This argument prohibits positioning feminism orthogonal to Islam and calls for understanding feminism within Islamic values that are shared by millions of women across the globe.

In doing that, we build on the work of the political philosopher Isaiah Berlin, who distinguished between 'positive' and 'negative' liberties and showed how an individual-level, accountability-free liberty can actually result in diminishing the essence of freedom: it may be guided by ignorance, instant reflex, psychological influence, and narrowly selfish behaviors[15]. On the other hand, 'positive' liberty refers to a collective effort of empowerment of each member of the community so that the community can achieve the goals appreciated through commonly held values. This line of argument is aligned with scholarly work in the social sciences influenced by Marxism, postcolonialism, and South Asian feminism. This body of scholarly work sees human liberty in the freedom from the limitation imposed by various historical and social injustices through collective movement. We argue that for Muslim women, technologies should be deeply engaged with their social context and religious values to help them achieve their goals [94].

10 CONCLUSION

We interviewed 73 low-income Pakistani women about their technology knowledge, access, ownership, use, and non-use. For these women, the family was the source of their motivations, and family members enabled or limited women's use of technology. We demonstrate how different family members in an Islamic society held roles as those who introduce, teach, maintain, and buy technologies in addition to restricting, monitoring, and disapproving of technology use. This work is significant because it offers a lens into how to assess technology engagement and technological inclusion of women in non-Western and Islamic contexts.

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¹²Here, we are influenced by the work of Lila Abu-Lughod, who offers a balanced perspective on how to approach understanding Muslim women's rights and freedom [58]

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