

A Multilevel Cross-Regional Analysis of Gendered Digital Inequality in Underserved Contexts

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Abstract – Gendered digital divide is a long-standing international issue, especially in situations where it has not been fully analyzed, thus limiting the place of women in digital economies and societies on similar grounds. The research paper presents a qualitative synthesis with a quantitative aspect of 93 peer-reviewed sources and clarifies the overwhelming prevalence of women-specific digital barriers across the access, utilization, and outcome dimensions. Methodologically, the investigation addresses the multidimensionality and intersectionality nature of women to be digitally excluded and coded by theme, frequency, assessed regionally, and synthesized by network. Findings show that first-, second-, and third-order variations in digital divides are significantly geographically uneven, and education and digital skill levels turn out to be prevailing limitations to the reduction of digital inequality, especially to women in underserved and marginalized communities.

Keywords – Gendered Digital Inequality, Underserved Communities, Women’s Digital Inclusion, Digital Inequality, Technology Adoption.

I. INTRODUCTION

Ghobadi and Ghobadi [1] hypothesizes that digital inequality is a skills gap, physical access gap in the Information Technology (IT) space, and both often compound each other in a circular causality manner. The technological access is inevitable to the development of the technical competencies, though the presence of the technology itself is made useless without the necessary skills to utilize it to their full potential. The repetitiveness of this issue is highlighted by Laleye [2]. Over twenty years ago, the gap in Internet penetration levels led to the emergence of the idea that upcoming technologies may only enhance inequality, but not reduce it, which made researchers interested in the discrepancy between online and offline access, which is now referred to as the digital gap [3].

The concept of digital inequality is usually interpreted as the distinction between the people who possess the requisite Information and Communication Technology (ICT) facilities and those who do not. According to Stevenson [4], digital inequality is a terminology that is short term and adds all the inequalities of the online world, the differences in accesses between the developed and developing areas, the differences in socioeconomic statuses in those societies as well as the gender inequalities between the societies. He singles out digital inequality as a relevant fault line in the field of democratic

participation and establishes a bifurcation between those who have access to the broad opportunities of digital access and those who do not.

Digital inequality affects more than one tier including the social, political, cultural, technological, labor, cognitive, and philosophical levels. In turn, this gap erodes the fundamental right of educating the most vulnerable communities including women, indigenous people, individuals with disabilities, students with economically disadvantaged backgrounds, and so on [5]. Women are caught in a different digital inequality where the existing inequities in ICT distributions in society continue the disadvantageous conditions of women as perpetrated to them by their positions in the western culture.

Presently, women are limited by a myriad of gender disparities in many aspects compared to their male counterparts such as education, employment, society, and the digital world. A gender gap in education is a phenomenon that has been observed over decades and proves that male and female students have different performance trends and learning styles. On the one hand, digital inequality in the digital realm is a disproportionate disadvantage to women in comparison with men, which can be explained by the presence of deeply ingrained gender norms and stereotypes reinforced in the realms of Western civilization [6].

The gender digital divide (GDD) refers to inequality in the access, utilization, and use of digital ICT by women with the mediation of the roles of society and the social expectations of male and female ICT use. Such an inequality may be expressed in many ways, such as access to the Internet, the possession of technical hardware, ability to use digital technologies, involvement in technological industries, and fair representation in technology enterprises [7]. This phenomenon may vary depending on nationality, socioeconomic status, race, access to education, qualifications, age, and the social status of women, and thus introduces barriers or differences in access, use, and benefits of using ICT compared to men.

Our research aims to synthesize the existing literature in a methodical way to determine, categorize, and critically evaluate women-specific digital obstacles at the levels of access, utilization, and outcomes of digital inequality, especially in underserved groups and regional differences, to inform the inclusion and gender-responsive digital policy and interventions. The rest of this manuscript is structured in the following way: Section II reviews related work on gendered digital divide (GDD) in underserved contexts. Section III describes the methods for data identification, thematic coding/classification framework, and analytical/synthetic approaches. Section IV discusses our findings, which integrates technology and barriers, regional digital inequality, and access/use and outcomes. Lastly, Section V concludes our research supporting the assumption about the GDD in underserved contexts.

II. RELATED WORK

According to James [8], there has been a substantive evolution of the concept of digital inequality since its inception which has been determined by both the technological development, in terms of the diversification of the modalities of Internet access as well as the increased sophistication of the conceptualization of the phenomenon. The term became a part of academia in the mid-1990s to define unequal distribution of Internet access between individuals and households, which is conceptualized mainly as a way to disseminate information. One of the most commonly used definitions is based on OECD: the gap between individuals, households, businesses and geographical locations with regard to their possibilities to make use of ICTs and their use of the Internet in a wide range of activities.

Digital inequality is a highly researched field, and it includes peer-reviewed journal articles, state-official reports, and consultancy documents prepared by firms. In academic circles, it reached a peak in the early 2010s with 117-148 thousand search-engine query results between 2000 and 2005, 2010 and 2015 respectively, and an even smaller number (around 130 000) since 2016. Despite the fact that systematic reviews have been conducted during the last ten years, a small number of research studies, such as the one by Brignardello-Petersen, Santesso, and Guyatt [9], has carried out extensive systematic literature reviews. The literature on digitization and employment, in general, is substantial, and there is a lack of empirical studies addressing directly the issue of women employment in the context of OECD.

The study by Ngoa and Song [10] covered 60 developing nations, with the records of the positive effects that information and communication technologies (ICTs) can produce on the labor participation of women. The scholars also assumes that the results have a wider implication in the developing countries, highlighting the possibility of digitalization to alleviate gender inequalities. Li [11] also emphasized the necessity of reskilling the labor force in the Industry 4.0 context and also the potential of digital technologies to change labor markets, such as promoting inclusivity when introduced successfully. However, many studies also suggest that digitization can lead to the further intensification of current inequalities in case the inequalities in skills and cultural settings as well as systemic biases have not been addressed.

As described by Rashid [12], digital inequality between men and women exists not only in developing countries but even in the industrialized world, women face the challenge of digital exclusion. In such a way, the problem goes beyond the access to technology and gets much more complex. Although the socio-cultural and economical aspects are also relevant, the dominant power structure is critical in determining accessibility to technology and its use. The power manifests as sociocultural regulations and institutional structures that shape the role of women in online space. The patriarchal systems that are dominant in many societies have a negative impact on the inclusion of women in the digital world. Digital inequality existing between genders lies in the very fabric of societal power relations that reflect gender inequality trends.

Morrow [13] disapproves the idea of the neutrality of technologies, claiming that technology is always partial. This kind of bias is caused at the very beginning when women are not included in the process of design of technology. Judy Brey [14] claims that technologies are social constructs, which are introduced into existing power relations and argues that digital

technologies are often male in nature. These masculine attributes of technology reflect on how representations of women in digital space are being reflected, hence pointing to the fact that digital inclusion of women is not just a symptom of infrastructure or even the socio-cultural customs; it is a product of the structural power dynamics in the gendered technology relations.

According to Ahl and Marlow [15], an academic negativist literature, basing on the postfeminist theory, questions the alleged freedoms and meritocracy benefits of digital entrepreneurship to women. Post feminist theoreticians argue that masculinity mediates the traditional forms of entrepreneurship, their deviations are hindered by the lack of access to digital entrepreneurial capital like platforms, and femininity values face discrimination in access to digital entrepreneurial resources. This view is influenced by complex and conflicting accounts of the definition and experience of digital entrepreneurship through the digital medium in relation to women.

In [16], it is argued that sites designed exclusively by women might reinforce the status quo by causing bias, not resolving digital inequality where the former do not have equal access to technology, and not helping to overcome the problem of work-life balance in an ever-digital world. Even though digital platforms have a wide range of benefits, they can still contribute to the spread of gender stereotypes in case they are conceptualized without the inclusiveness promise, thus compromising the effectiveness of female entrepreneurs. The emerging post-structural feminist work has in some way set forth to disrupt the usual gender dichotomy between male and female in the realm of business.

III. METHDOLOGY

The research utilizes a systematic research approach that incorporates both qualitative and quantitative synthesis in order to discuss gender-based digital inequality by conducting the analysis of available literature comprehensively. The approach would ensure that the multidimensional aspect of digital inclusion of women is embodied through thematic analysis, quantitative synthesis (in terms of frequency) and regional comparison and network interpretation. The general methodology process is depicted in Fig. 1, which describes the consecutive steps of identification of literature until the synthesis of the analysis.

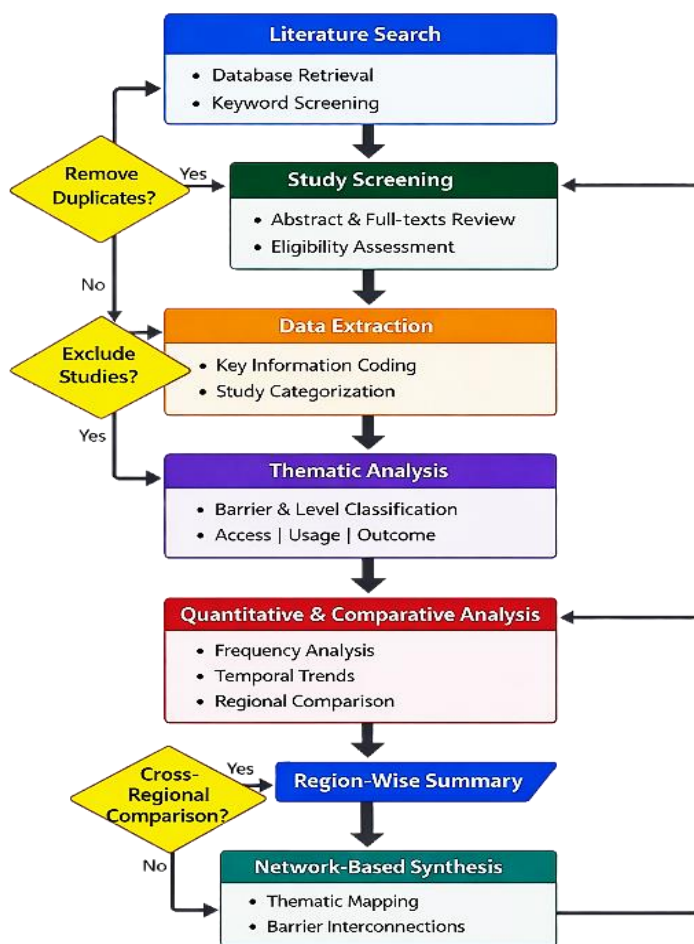


Fig 1. Overview of Research Methodology.

Data Identification and Study Selection

The initial phase in the approach is the systematized process of identifying and selecting pertinent literature that explores the involvement of women to digital technologies and the detriments causing the GDD. Predefined keywords such as gender, digital inequality, technology adoption, and digital inclusion were used to gather peer-reviewed journal articles through the established academic databases. After retrieval of the databases, similar records were deleted and screening of studies was done on basis of title, abstract and contents of the full text to make sure that the studies were in line with the scope of the study.

Those studies that explicitly discussed women-specific digital barriers, the use of technologies, or the results of digital literacy were only retained. This has led to a final dataset of 93 studies being used in the analysis. The process of selection and screening is represented graphically in **Fig. 2** that gives a flow diagram of the steps of identification and screening, assessment of eligibility and final inclusion to guarantee transparency and reproducibility of the review process. In order to present a summary of the chosen literature, **Table 1** presents the numeric information about the distribution of the studies by technology domain, region, and level of digital inequality under consideration.

Table 1. Overview of Data and Analytical Dimensions to Be Employed in the Study

Dimension	Categories Considered
Technology domains	Mobile and Internet usage, online education, online finance, online jobs, STEM, online entrepreneurship.
Barrier categories	Economic, socio-cultural, infrastructural, educational/skill-based, psychological, security and privacy, institutional.
Digital inequality levels	Access, usage, and outcome
Geographic regions	Africa, Asia, Western regions
Analytical methods	Frequency analysis, time trend analysis, comparison by the region, thematic network analysis.

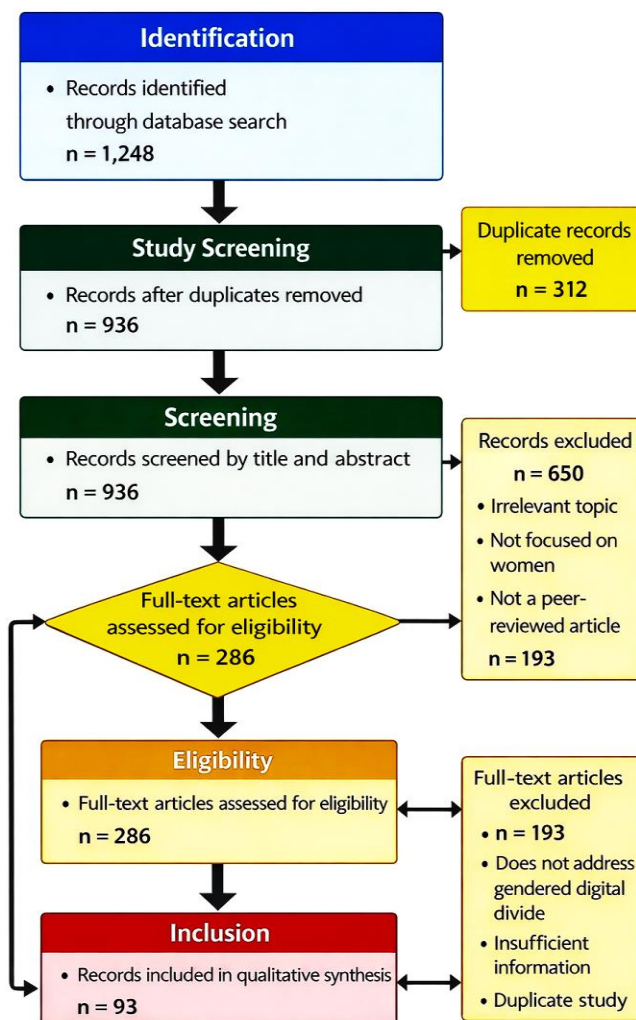


Fig 2. The Process of Study Identification and Selection.

Thematic Coding and Classification Framework

The second step involved a systematic thematic coding of the identified articles to obtain valuable themes concerning the digital inclusion of women. All studies were systematically coded on four dimensions, namely the type of technology studied, the category of barrier in the study, the geographic region, and digital inequality level. The operationalization of digital inequality was made at three levels of outcome, usage, and access through theoretical frameworks that have been developed in digital inequality studies.

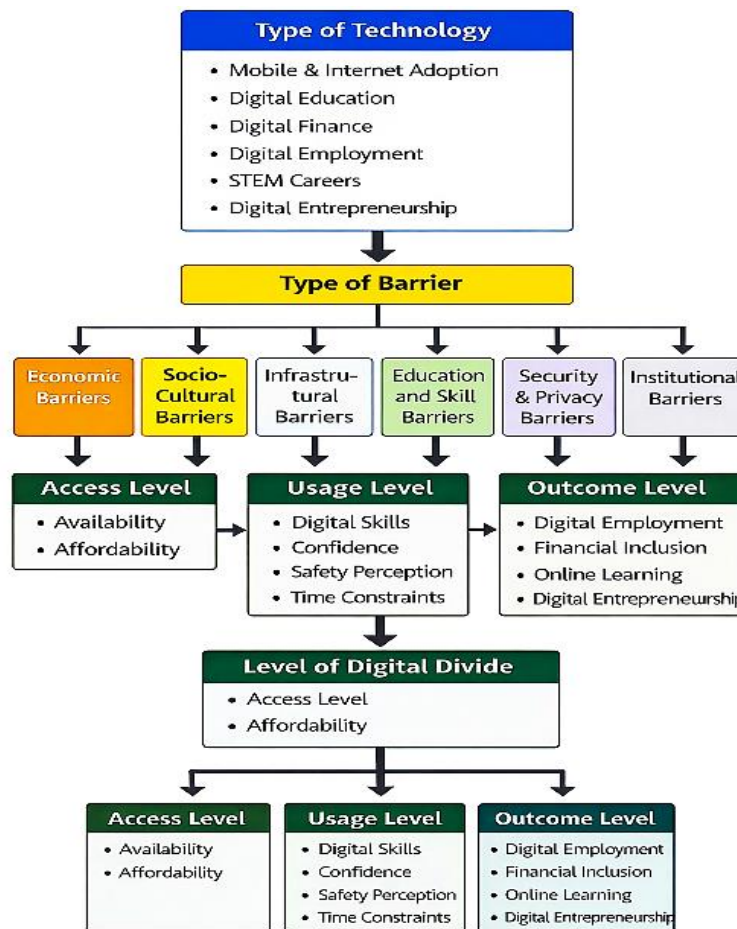


Fig 3. Thematic Coding and Classification System of the GDD.

The categories of barriers were developed inductively and deductively, which made it possible to classify the economic, socio-cultural, infrastructural, educational, psychological, security, and institutional barriers. In cases where researchers covered a range of barriers or levels of divide, they were coded so that they reflect intersectionality. **Fig. 3** demonstrates the thematic coding framework and its hierarchical structure following which the association between the types of obstacles and the three levels of digital inequality was made possible at the same time a number of studies could be compared as the contextual richness of the individual results was maintained.

Analytical Techniques and Synthesis Strategy

The last phase of the methodology combines different analysis methods to integrate findings per theme and region. To determine the prevalence of various technologies, levels, and barriers of digital inequality among the studies reviewed, a quantitative frequency analysis was performed in the first place. Temporal trend analysis was used as well to see the change in research focus with time, especially pre-pandemic and post-pandemic.

Second, comparative analysis of the regions was conducted based on the differences in nature and strength of barriers in the African, Asian, and Western settings in order to test them. Using this analysis, region-specific digital divides that correlated with first-, second-, and third-order inequalities were found. Finally, the visualization of the relationship between barriers and levels of digital inequality based on network analysis was performed through thematic analysis, which displayed groups of very significantly linked constraints on the digital inclusion of women. **Fig. 4** shows the process of analytic work flow and synthesis and how quantitative summaries, regional comparisons and thematic networks are aggregated to qualify insights.

IV. RESULTS

Technology and Barriers

We have analyzed technology in various situations as captured in **Table 2** (Column I). Among the 93 articles reviewed, 39% explore the interaction of women with technology by using mobile phones and the internet; 17% feature a strong gender gap in the industry of science, technology, engineering and mathematics; 14% discusses the gender gap in online education; 13% discusses digital banking; 10% discusses digital employment, including remote work and online gig economies; and 8% discusses digital entrepreneurship. The radical COVID-19 epidemic dictated the digitalization of all the economic domains, making the definition of technology expand and apply it to educational, financial, and business areas.

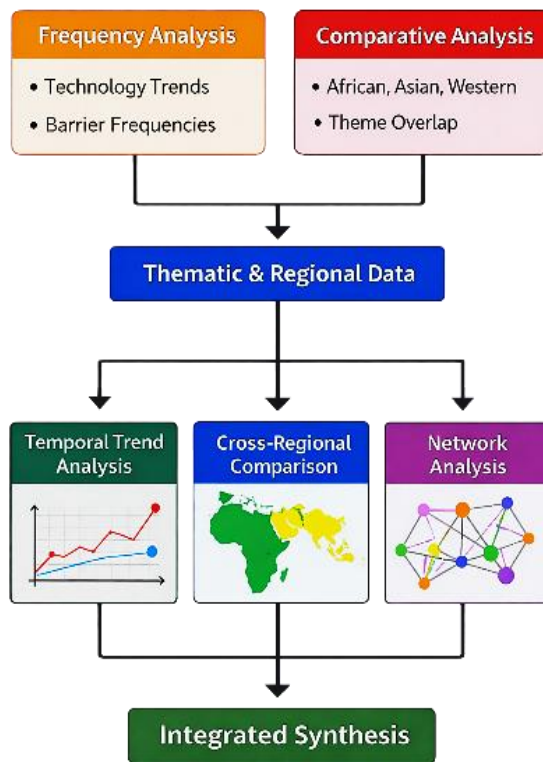


Fig 4. Analysis Methods and Analyzing Model.

The obstacles to women gaining digital inclusion are a mixture of various socio-economic and psychological challenges (see Fig. 5). **Table 2** (Column VII) outlines those obstacles found by the analyzed literature hindering the use of the digital environment by women. 22% of the peer-reviewed works found a lack of digital abilities and education as a significant obstacle. 34% cited socio cultural constraints, and then economic limitations (15%), infrastructural barriers (10%), gender discrimination at work (15%), and privacy/security (9%).

Table 2. Statistical Overview of the Research Under Analysis

Category	Basic ICT Adoption (mobile phone, internet)	STEM-based Careers	Online Learning	Digital banking (mobile payments and savings)	Digital employment (gig economy, WFH)	Digital entrepreneurship
% (Technology focus)	39	17	14	13	10	8
Key Barriers / Issues	Education and Skill Barrier	Socio-cultural Constraints; Psychological Barriers	Economic Constraint	Gender discrimination	Gender discrimination	Infrastructure; Security and Privacy Concerns
Level of Digital Divide (IDI)	Access	Usage	Usage	Usage	-	-
% (Digital inequality)	24	56	45**	45**	15	10

Most cited barrier	Lack of digital skills (40%)	Lack of digital skills (38%)	Work–life balance pressures (34%)
Second major barrier	Economic constraints (35%)	Socio-cultural constraints (27%)	Gender pay disparity (30%)
Other barriers	Online gender violence (17%)	Economic constraints (24%)	Digital skill gaps (19%)

Access, Use and Outcomes

A thematic analysis of the GDD through the lens of network assessments demonstrates that most of the barriers that women encounter in terms of digital attachment have been discussed in the context of psychological, socio-cultural, financial, and personal aspects in their intersectional dynamics. Considering the development of study tendencies towards the clarity of these obstacles, it is vital to withdraw and take a closer look at each of them in more detail, keeping in mind the magnitude of each barrier at various degrees of digital inequality spectrum. The current research is a thematic assessment of 93 present literature works and greatly assists in enumerating the various challenges encountered by women, besides assessing their importance and seriousness at the three dimensions of digital inequality: Outcomes, Use, and Access.

Accessibility

Digital technology is one of the most important elements that enable interaction in the digital field and society [18]. However, significant obstacles to digital access among women still exist and they include structural barriers, including limited digital infrastructure and lack of access to economic and financial resources, structural phenomena including embedded socio-cultural notions. Such restrictions to access can be divided into four related groups and they are reflected below and displayed in **Table 4**.

Economic Barriers

The first factors affecting women at the accessibility level of digital inequality are resource and economic limitations due to structural constraints in the form of poverty, low income, and employment opportunities. It has been empirically proven that wealth and income levels play a critical role in determining the use of the Internet by women and the lack of income restricts women in the acquisition of the necessary digital tools, such as hardware and Internet connectivity. Without measures to curb these economic constraints, digital inclusion can only be a far-fetched dream to most women who live in marginalized societies.

Table 4. Digital Inclusion Barriers Faced by Women and Where They Occur as Well as Their Frequency

Barriers	%*	Frequency (N)
Ability and education (digital and monetary incompetence, lack of education)	18	4
Infrastructure (e.g. poor electricity, expensive mobile phone)	27	6
Social-cultural restrictions (mobility restrictions, parental permission to use of phones, gender preconceptions, traditional roles)	36	8
Economic challenges (poor, joblessness, lack of income)	45	10

Note: *The percentage estimates a cumulative number of literature publications on accessibility level to the technological inequality

Socio-Cultural Barriers

The existence of traditional gender roles and norms often hinder female autonomy, focusing on household chores and restricting the possibilities of using the Internet. Further obstacles to access and maintain digital inequality are the family related ones, like the need to receive permission to use their mobile phones or go online, mobility limitations, and a gendered understanding of technology as a male domain.

Infrastructural Barriers

One of the major barriers to this area is the unaffordable price of internet and a low standard of the broadband connection which creates a major setback to the process of engagement and affects women in rural and underserved settings disproportionately. On the same note, the high price of mobile technologies and the unreliability of power supply and the instability of the internet connection is also a hindrance to the successful application of digital technologies.

Education and Skill Barriers

The absence of formal education directly affects the working opportunities and, therefore, the economic capacity of the people to buy modern computer-related devices and afford an uninterrupted internet connection. In addition, illiterate women

are also refused the right to be informed about the growing trends in digital technologies, which prevents their ability to use the online media intelligently.

Usage

The access must also be transformed into meaningful use since the very presence of digital tools does not imply substantial use. Moreover, there are serious obstacles that hinder the successful use of the given digital tools and services among women. These barriers are deeply based on systemic issues, such as lack of digital literacy and skills, lack of confidence in technology application, time-based limitations caused by the domestic demands, and concerns about risks and frauds on the internet. The usage barriers can be divided into five categories, which can be represented in **Table 5** and further described below.

Table 5. Barriers to Digital Inclusion That Women Experience at the Level of Use, and Their Occurrence Rates

Barriers	%*	Frequency (N)
Barriers to infrastructure (design)	6	3
Privacy/security hurdles (violence, internet, loss of privacy)	10	5
Social-cultural hurdles (family surveillance, work-life balance, conventional roles, gender stereotype)	21	11
Psychological hurdles (lack of drive, high-risk perceptions, lack of trust/motivation, computer phobia, lack of confidence, lack of digital self-efficacy)	27	14

Note(s): * The percentage is computed based on the cumulative count of journal articles that investigate the utilization dimension of the technological inequality.

Education and Skill Barriers

Ample evidence shows that there is a strong lack of digital skills among women, which was proven by the 36 articles of scholarship indicating a gap in digital skills as the first hindrance to the effective application of digital technology. Besides, the lack of digital literacy, education, and Internet acquaintance is a significant obstacle to women in their process of including online resources and the Internet in their daily lives. Lack of information about internet application is another factor that is further damaging the implementation of technology in personal and professional life. To worsen the situation, financial illiteracy heightens the issue, especially in cases where women use online financial products without the necessary knowledge on how to use the implementations efficiently.

Psychological Barriers

The large empirical data shows that the lack of digital confidence and self-efficacy are some of the key aspects that prevent women's involvement in technology. Moreover, the psychological resistance is caused by technophobia and fear of exposure to online communication because many women believe they are under threat of significant dangers when going online. Also, the lack of motivation and inability to establish the physical outcomes of the Internet has often led to a lack of engagement with the digital opportunities.

Socio-Cultural Barriers

Women are often limited to technology and their control over it because of gender stereotypes and deeply ingrained conventional roles. When examining gender inequality, there is a need to see how there are underlying mechanisms that perpetuate sex-based inequality in access to resources, power and opportunities. One can primarily divide these mechanisms into structural and systemic, and social norms and gendered stereotypes. Structural and systemic determinants have been studied in a considerable amount of literature, and, at the same time, programs aimed at eliminating the disparities have focused on the fields that social institutions shape women rights and access. Some of the examples include the paid workforce and the efforts to correct the imbalance in the number of representatives of the gender population through recruitment practices and policies, the retention practices, including the flexible working conditions, and the promotion practices.

Privacy and Security Barriers

The possible issues of privacy invasion and threats of online harassment make many women unwilling to engage fully in online platforms. Women are at a greater risk due to the rising cases of harassment over the internet and cyber-attacks, thus reducing their trust in online space.

Infrastructural Barriers

Women and girls are often affected by the consequences of infrastructural inadequacies. A lack of public transportation has been shown to affect the mobility and safety of women disproportionately and hence access to education and employment opportunities. In the same vein, schools that do not comply with safety, hygienic, or sanitary conditions to ensure that women feel safe, respected, and supported may result in high absenteeism, school dropout rates, child marriages, and other negative consequences.

The obstacles that face women in accessing financial services and identification documents are more than those faced by men because currently, the design and delivery of the services in the public have not yet adopted a gender-responsive approach. Also, there is still a digital inequality of gender. The difference in the physical world is also portrayed to the digital one in the fact that girls and women are statistically less likely to possess and to use digital technologies than boys and men, which a significant amount of research and data prove.

Outcome

Digital inclusion is achieved through the realization of benefits, which include digital jobs, economic integration, enterprises, and education. Nonetheless, females encounter institutional obstacles, which do not facilitate their productive use of digital resources and achievement of non-discriminatory results in the digital sector. Socio-cultural divide, lack of educational opportunities and competency training to employ the technologically advanced products well, gender-based discrimination in the workplace, and women competency stereotyping in ICT and STEM sectors are some of the salient factors that eliminate women digital economy marginalization. The obstacles that are found in the literature on the outcome level have been categorized into five, as summarized in **Table 6** and described below.

Table 6. Frequencies of Outcome-Level Digital Barriers in Women

Barriers	%*	Frequency (N)
Digital gender-based violence, economic/financial abuse, and other security and privacy barriers	12	5
Psychological barriers (lack of self-efficacy and self-confidence, hate towards technology)	16	7
Examples of skill/education barriers include a lack of awareness/data, technical expertise/education, and financial/digital competence	28	12
Gender barriers to the workplace and opportunities (the glass ceiling, the gender pay gap in the platform economy, no employment opportunities, anti-digital bias, etc.)	35	15
Social-cultural barriers (male dominance in STEM/ICT field, child bearing/ homemaker roles, professional/ household roles, gender stereotype)	37	16

Note (s): The percentage has been estimated based on the number of research studies that mention the level of outcome of digital inequality that forms 43.

Socio-Cultural Obstacles

The obstacles associated with this are socio-cultural, which are one of the most prominent obstacles facing women in their use of digital platforms. When people consider such a concept as technological culture, questions that arise would involve the cultural aspects of technology that are culturally embedded within the social, political and economic environments and consequently within the gender relations.

Gender characteristics are found in technological artifacts. One of the main goals of technical culture involves providing analytical instruments that can deconstruct the natural gender processes inherent in technology and shedding light on the prejudices and inequalities that come with it. This, in turn, creates an acute necessity to strengthen the research and pedagogical activities that address such problems so as to endow people with the skills needed to analyze and evaluate the socio-political (and consequently, gendered) features of digital technologies on a critical level.

Gendered Workplace and Opportunity Barriers

The obstacles that are gender-related continue to hinder the complete involvement and progress of women in the digital and professional sphere. Gender separation in the digital sector is still pervasive and even worsening in certain cases. This phenomenon is somewhat counter-intuitive, as such that the technical competencies, which are highly quantifiable and performance based, are theoretically supposed to reduce the subjective bias. Nonetheless, the exclusion of women based on their social status in technical education, observable stereotypes about the lack of technological skills in women, and the self-affirming aspects of occupational concentration all play a role in the perpetuation of underrepresentation of women in ICT-populated occupation [19].

Moreover, digital industry appears to reward not only technical capabilities, but also certain sense of self-confidence, aggressiveness, and risk-taking behavior; all of them are usually restrained by the socio-cultural gender norms. As a result, though technical competence can be measured in a quantitative manner, the process of evaluating and expressing such competencies is mediated by gender-specific behavioral expectations.

Skill and Educational Obstacles

The lack of formal education typically integrated with a lack of technical competence is an obstacle to the full use of technology by women. The means to overcome the gendered gap in technological literacy by traditional methods of the technological pedagogy is problematic by itself. Evidence has indicated that an array of international and national projects over the span of several decades and affecting different countries have failed to eradicate this gap. The traditional approaches require a lot of resource contributions which are highly not available in the developing economies. The limited nature of these resources compels governments to designate policies that will unfairly disadvantage socioeconomically vulnerable groups and especially women.

Resource allocation is also prone to be centralized in the densely populated urban centers and hence increasing the education gap faced by the women in the rural and remote areas which is even further compounded by the cultural values which are more fixed in such locations. Moreover, the allocation of resources is often given to the vocational education to prepare individuals to work in the demanded fields of labor market. This selection exercise of educational expenditure has tended to be more favorable to male beneficiaries and here the inherent bias that is inherent in the working markets that favor male employment is reinforced.

Psychological Barriers

The unwillingness to use technology due to doubts about its usefulness is an obstacle to using digital resources by many women to develop mentally and spiritually. The lack of self-efficacy and self-confidence is often exacerbated by this tendency, which leads to worsening the gender gap in the use of technologies.

Security and Privacy Barriers

Online threats (cyberbullying, stalking, gender-based violence) target women more often and, consequently, deter women users to use digital technologies in the workplace or as a means of personal growth. The phenomenon of cyberviolence has recently been complicated due to the emergence of new technological advances, especially artificial intelligence (AI). The devices that can produce deep-fake pornographic material have helped in the creation of fake explicit media, thus blurring the boundary between original and fake material. When victims of such crimes are exposed to such materials, they face huge challenges in proving the authenticity of such materials that increases their psychological distress.

Internet resources and messaging also contribute to the rapid proliferation of harmful information through social media. Algorithms that give priority to user interaction inadvertently increase the abusive nature, and encrypted communication services give anonymity to the perpetrators and protect them against any regulation. It is highly alarming, therefore, that women are threatened by cyberviolence. Even the possibility of exploitation in the emerging digital environments, i.e., the metaverse or virtual reality, has already attracted attention since those who commit such crimes keep focusing on more advanced methods to reach vulnerable people. The internet has a global character and hence cyberviolence has a habit of going beyond national boundaries making it hard to prosecute and convict of criminals. Lack of unity of legal systems or poor legal systems only worsen the situation, as most victims have no proper avenue.

V. CONCLUSION

We hypothesize that the GDD is a stratified phenomenon, which is spatially heterogeneous, with women in underserved contexts being disproportionately affected. The combination of thematic, quantitative, and network-based analyses makes the paper clarify how structural and socio-cultural constraints change in a restrictive environment and access conditions affect unequal results of digital participation. Although women in under-served settings face the first and the second level of digital inequality, women in developed ones still have to face a third level of inequality that manifests in the labor markets and digital access. In the contexts of the world, the lack of education, digital skills, and internet security remains one of the widespread limitations. In this respect, GDD mitigation demands a policy framework that covers not only the provision of access, but also providing skills, transforming institutions, and developing gender-responsive digital ecosystems.

CRedit Author Statement

The authors confirm contribution to the paper as follows:

Conceptualization: Anandakumar Haldorai and Lin Xiu; **Methodology:** Lin Xiu; **Data Curation:** Lin Xiu; **Writing-Original Draft Preparation:** Anandakumar Haldorai; **Visualization:** Anandakumar Haldorai; **Supervision:** Anandakumar Haldorai; **Validation:** Anandakumar Haldorai and Lin Xiu; **Writing- Reviewing and Editing:** Anandakumar Haldorai and Lin Xiu; All authors reviewed the results and approved the final version of the manuscript.

Data Availability

No data was used to support this study.

Conflicts of Interests

The author(s) declare(s) that they have no conflicts of interest.

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Competing Interests

There are no competing interests.

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