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Determinants, Impacts, and Regional Perspective of the Gender Digital Divide: A Review and Future Research Agenda

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Abstract
The gender digital divide, known as real-world gender inequality replicated in the digital world, has become "the new face of inequality". Bridging digital divides is vital for achieving the United Nations' 5th Sustainable Development Goal on gender equality. The objective of this research is, by using a feminist approach, to review the existing literature on the gender digital divide published between 2010 and 2022 through keyword searching on ScienceDirect, Proquest, Sage Journal, JSTOR, EconLit, Google Scholar databases, and research from international organizations. 42 articles were selected in total and analyzed using a systematic review method. Results show that extant research could be divided into three categories: 1) determinants of the gender digital divide; 2) impacts of ICTs and bridging the gender digital divide including positive effects on sustainability, gender equality, empowerment of women, economy, education, and politics; 3) the regional perspective consisting of case studies on specific regions and countries. The results from a feminist perspective analysis indicate a lack of pragmatic policy implications. The findings can provide an innovative perspective for future researchers to consider in gender digital divide studies, especially for policy recommendations and future research agendas. Therefore, the results contribute to the literature on digital inclusion, women's empowerment in technology, as well as gender and feminist studies altogether.

Introduction
With the rapid development of information and communications technology (ICT), gender-equal access to ICTs is not guaranteed and the gender digital divide has become an important and highly controversial issue (Minguez, 2005, Subramanian, 2007, Al-Rababah and Abu-Shanab, 2010, Tobola, 2010) [44, 62, 5, 63]. This was originally brought to international attention when it began showing up in many United Nations (UN) reports and has since become a key concern for organizations, governments, and researchers in a variety of sectors (Ganesh and Barber, 2009, Van Dijk, 2020) [24, 71]. According to the United Nations International Children's Emergency Fund (UNICEF, 2021) [68] and the United Nations (UN, 2021), the gender digital divide is when "gender inequality in the physical world is replicated in the digital world." Some argue that the rapidly changing development of technologies leads to gender-based harassment and safety concerns for women, which is why they should be barred from using these "dangerous" devices (Cardoso *et al*. 2019) [13]. Others argue that progress towards digital gender equality brings numerous impactful benefits, such as it being vital for achieving the UN's 5th Sustainable Development Goal (SDG) on gender equality. Moreover, if the problem of the gender digital divide is not addressed, there are grave consequences, especially for growth, education, and the economy (Organisation for Economic Co-operation and Development [OECD], 2018). Besides this, the linkage between bridging the gender digital divide and achieving the UN SDG 5 on gender equality is strong (Kerras *et al*. 2020) [37]. Bridging this gap can also nourish global economic growth and help achieve the 2030 Agenda for Sustainable Development (OECD, 2018) [49].
Reviewing existing literature finds that an abundance of research focuses on determinants (e.g. Abu-Shanab and Al-Jamal, 2015, Campos-Castillo, 2015, Potnis, 2016, Mumporeze and Prieler, 2017, Maric, 2018, Omotoso *et al*. 2020, Acilar, 2020) [1, 12, 52, 45, 41, 48, 3], impacts (Gurung, 2018, Treuthart, 2019, Kerras *et al*. 2020) [28, 65, 37], and/or a regional perspective of the issue (e.g. Antonio and Tuffley, 2014, Ponge, 2016, Fatehkia *et al*. 2018, Omotoso *et al*. 2020, Vassilakopoulou and Hustad, 2021) [8, 51, 20, 48, 73]. Otherwise, it is not even pertinent to gender inequality (e.g., Lythreatis *et al*. 2022) [40]. None of them take a feminist approach to review the existing literature on gender digital divide issues. Thus, there is an apparent research gap that this research paper would like to focus on. The present study, therefore, will address the following research question: What are

the key findings in recent existing research on the gender digital divide examined from a feminist perspective?

Literature Review
In the recent decade, the digital divide has received a lot of attention because of the need to balance technological development across the world and study its societal repercussions (Abu-Shanab and Al-Jamal, 2015) [1]. The existing literature shows that the digital divide is the outcome of many factors, particularly insufficient bandwidth and expensive purchase or rent costs of hardware and software (Bansode and Patil, 2011) [10]. Another factor is a physical disability and lack of ICT skills or support. Research into the digital divide has focused more on the accessibility of technology and the level of penetration based on geographic area, and less on other reasons for the gender digital divide (Abu-Shanab and Al-Jamal, 2015) [1]. Moreover, it is well documented that women in many parts of the world lack equal access to ICT services (Minguez, 2005, Subramanian, 2007, Al-Rababah and Abu-Shanab, 2010, Tobola, 2010) [44, 62, 5, 63].

The United States Department of State (2017) defines the gender digital divide as "when women and girls lack access to, the ability to use, and growth through ICTs." It further goes on to explain how oftentimes social norms prohibit women and girls from fully participating in formal economies, workplaces, and educational institutions, which widens the gender digital divide. The United Nations International Children's Emergency Fund (UNICEF, 2021 [68], p.5) provides another definition: "when gender inequality in the physical world is replicated in the digital world. There is a large gap in women and girls' digital adoption and use compared to men and boys." Kerras *et al.* (2020) [37] give the third definition, stating "the gender inequalities in the level of not only computer and internet connection use but also participation in basic internet functions."

These definitions all focus on Internet/ICT access and usage plus gender inequalities. According to Antonio and Tuffley (2014) [8], the gender digital divide is a problem that is far beyond just this. It is recognized that the gender digital divide is an expansive formulation that captures the myriad of ways in which men and women differ in their relationships with ICTs (Fuchs and Horak, 2007) [22]. One aspect of that difference pertains to the disparity in ICT access and use in many countries that favor men (Jin and Cheong, 2008) [34]. The second extends deeper into facets of the sociology of ICTs, including how ICT leadership, decision-making, content, and applications are issues controlled by men and squarely organized to concur with men's worldview (Van Dijk, 2006, Yuguchi, 2008) [70, 74]. Obviously, factors--such as technical skills involved and opportunities to learn how to use ICTs--and the implicit social or financial backgrounds that hinder engagement, all need to be considered. Hence, this study will use the first definition provided by the United States Department of State, because it paints a more comprehensive and thoughtful picture of the issue.

Feminist perspectives toward the gender digital divide can be grouped into three categories including liberal feminism, standpoint feminism, and poststructural/postcolonial feminism (Frey and Dingler, 2001, Hernandez-Truyol, 2011) [21, 30]. The first category, or liberal feminism, is based on classic liberal contract theory assuming that all people are equally capable of reason and are therefore entitled to the same rights and opportunities. Reflected in the digital world, the liberal feminist perception of the root of gender digital inequality lies in how women and girls have not proven themselves as equals in a male-dominated world. Hence, strategies to overcome this inequality are based upon a process of "masculinization," meaning women's adoption of traditionally male values, norms, and behaviors to reach their goals.

The second category, standpoint feminism, advocates for the needed societal transformation as values and norms should no longer be oriented on the ideal of manhood and its "hierarchic, violent and destructive structures" (Frey and Dingler, 2001) [21] that produce all-embracing oppression of women (Saulnier, 2008). As a result, empowerment means opposition to existing male-dominated digital structures.

The third category, poststructural/postcolonial feminism, rejects the coalescence of women and the assumption of a common female identity and interest; it demands acknowledging differences between women (Frey and Dingler, 2001, Kabeer, 2009) [21, 36], which originated from the south and those of Afro-American origin. As their experiences differ considerably from that of Whites, they criticize feminists that neglect factors other than gender that result in discrimination (Spelman, 1988, Collins, 1991) [60, 16]. Thus, strategies to narrow the gender digital divide shall be manifold and not only limited to girls and women's empowerment in hardware (e.g., computers and mobiles), software (convenient and easy-to-use applications and websites), and the skills required to use ICT tools. Political, economic, and social measures must be taken.

Methodology of Research
As indicated in Figure 1, this research used a systematic review method to review the existing literature on the gender digital divide published between 2010 and 2022, through keyword searching on ScienceDirect, Proquest, Sage Journal, JSTOR, EconLit, Google Scholar databases, and research from international organizations. Systematic reviews are a way to find and synthesize all existing research on a subject (Scheerder *et al.* 2017) [57]. According to Tranfield *et al*. (2003) [64], although this credible, meticulous method can be more tedious than traditional reviews, it provides a comprehensive overview of research topics. Furthermore, it is replicable by being straightforward and trustworthy, which is why it was applied (Lythreatis *et al.* 2022) [40]. Drawn from the systematic review method (Tranfield *et al.* 2003) [64], this paper undertook the following three steps:
▪ Step one: Outlining and planning the review,
▪ Step two: Performing the review,
▪ Step three: Writing the review.
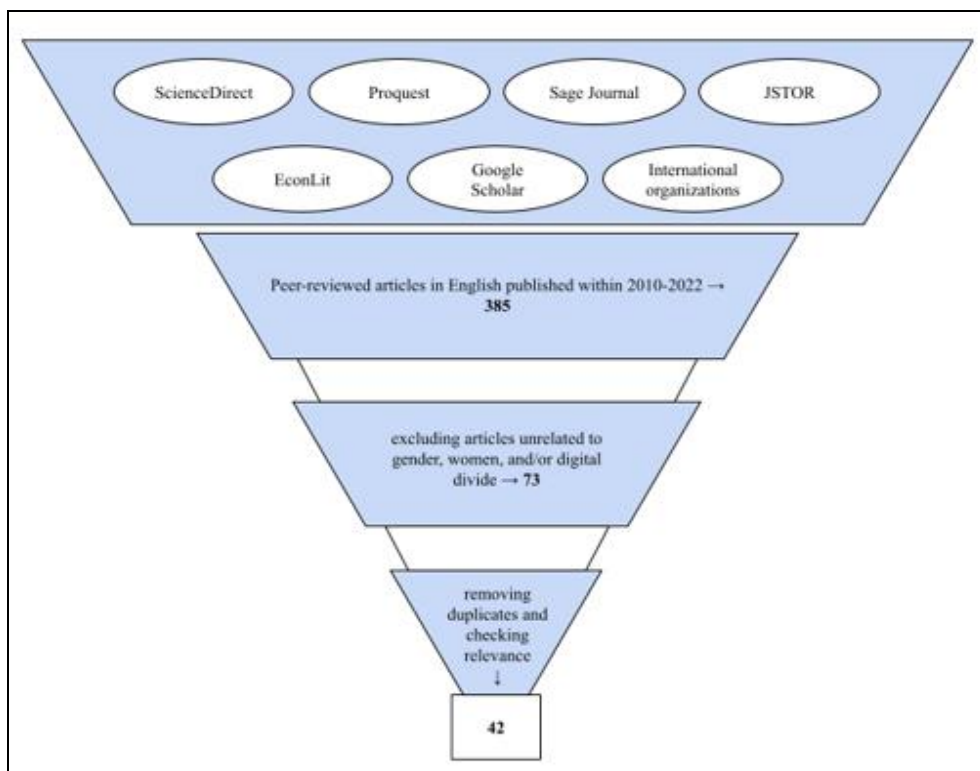
Source: Author's summary

Fig 1: Literature selection procedure

During step one, the plan for this review was formulated after careful consideration of the research topic. For this particular research, the topic is to provide a feminist perspective in literature reviews for future researchers to consider in gender digital divide studies, especially in the aspect of policy recommendations and future research agenda. Then, a thorough outline, including a list of precise keywords to search, the inclusion/exclusion parameters, and a list of resources (e.g., databases and journals) was written for a clearer direction. This procedure was determined ahead of time to avoid any possible bias and confusion during the process. Additionally, establishing the inclusion/exclusion practices eliminates unfairness from potential preconceived ideas and ensures high-quality selected papers, which strengthens this review (Vassilakopoulou and Hustad, 2021) [73].

During step two, conducting the research put the plan created in step one into action. Firstly, the selection of the timeframe is based on how more research into the gender digital divide has emerged in the past decade. Secondly, to ensure fair coverage of related research, the author searched six widely used multidisciplinary academic research databases, namely ScienceDirect, Proquest, Sage Journal, JSTOR, EconLit, and Google Scholar databases in the field. Research from international organizations, such as the 11 UN organizations and OECD, were also included since they notably carry out reliable and comprehensive studies. The author browsed for full-text publications from the selected databases including articles, books, and book chapters-- excluding conference proceedings, book reviews, theses, commentaries, letters, and short surveys. To identify the literature to be reviewed, the author searched for "gender digital divide" in the abstract, title, or keywords within databases. Inclusion and exclusion criteria were established to reduce selection bias, guarantee the quality of the literature selected and increase the review validity. For example, in ScienceDirect, the author typed "gender digital divide" in "title, abstract or author-specified keywords" and generated 86 papers. For the Proquest database, she searched the phrase in "abstract" and "subject" and generated 129 papers. For Sage Journal, she typed the phrase in the "abstract", "title", and "keyword" search options and generated 49, 1, and 0 papers respectively. For JSTOR, she searched via "abstract", "caption", and "title" and found 3, 0, and 0 papers respectively. For EconLit, she searched via "abstract, subject, or title" and found 2 papers. For Google Scholar, she filtered by time, relevancy, title, and selected review articles only to generate 114 publications. Finally, she found a complete report from the OECD to include. This added up to a total of 385 initial articles, which was finally reduced to 42 papers due to duplicated articles from the previous databases and excluding articles unrelated to gender, women, and/or the digital divide.

Table 1: List of selected papers

Author	Publication Year	Journal/Book/Chapter	Context	Method	Data Source	Theories/Concepts
Abu-Shanab, Emad, & Al-Jamal, Nebal	2015	*Gender, Technology and Development*	Jordan	mix (quantitative and qualitative)	primary (survey)	E-government; gender digital divide; ICT
Abu-Taieh, Evon	2014	*International Journal of Social Science & Interdisciplinary Research*	International/Global (162 countries)	quantitative	secondary	gender digital divide; social media; effect of literacy rate, GDP, and country location
Acilar, Ali	2020	*International Journal of Public Administration in the Digital Age*	Turkey	quantitative	secondary	gender digital divide in e-government use; historical trends and differences; gender gap in Internet use; literature review; factors contributing to the GDD
Acilar, Ali, & Sæbø, Øystein	2021	*Global Knowledge, Memory and Communication*	International/Global	qualitative	secondary	gender digital divide factors; ICT access and use; literature review
Alozie, Nicholas O., & Akpan-Obong, Patience	2017	*Development Policy Review*	Africa	mix (quantitative and qualitative)	primary (survey) and secondary	gender digital divide; gender policy; ICTs
Ancheta-Arrabal, Ana, & Pulido-Montes, Cristina, & Carvajal-Mardones, Víctor	2021	*Education Sciences*	Latin America	mix (quantitative and qualitative)	secondary	gender digital divide in ICTs and education
Antonio, Amy, & Tuffley, David	2014	*Future Internet*	Developing countries	qualitative	secondary	gender digital divide; digital literacy; education; developing countries
Bala, Shashi, & Singhal, Puja	2018	*Journal of Information, Communication and Ethics in Society*	India	quantitative	primary	first and second order of digital divide; internet availability and use
Brännström, Inger	2012	*Government Information Quarterly*	2 low-income economies in Sub-Saharan Africa	quantitative	secondary	communication technologies; gender; human development; information science; Sub-Saharan Africa; women
Campos-Castillo, Celeste	2015	*Social Science Computer Review*	the USA	quantitative	secondary	gender digital divide; Internet access; race/ethnicity
Dixon, Laura J., & Correa, Teresa, & Straubhaar, Joseph, & Covarrubias, Laura, & Graber, Dean, & Spence, Jeremiah, & Rojas, Viviana	2014	*Journal of Computer-Mediated Communication*	Austin, Texas	mix (quantitative and qualitative)	primary (interviews) and secondary	public libraries; gender digital divide; Internet; structuration theory; public access
Eneh, Onyenekenwa	2010	*Information Technology Journal*	Nigeria	quantitative	secondary	gender digital divide; literacy levels and ICTs of students
Fatehkia, Masoomali, & Kashyap, Ridhi, & Weber, Ingmar	2018	*World Development*	International/Global	quantitative	secondary	gender inequality; Internet; mobile phones; global digital gender gaps; development indicators
Galperin, Hernan, & Arcidiacono, Malena	2021	*Telecommunications Policy*	Latin America	quantitative	secondary	digital gender gap; labor markets; Latin America; decomposition analysis
Garcia, Olga Patricia Mendez	2011	*Gender, Technology and Development*	Southeast Ohio, the USA	qualitative	secondary	mobile phone use; women's participation/empowerment; gender digital divide in a small community; immigrant women
Garg, Chhavi	2021	*Indian Journal of Gender Studies*	India	qualitative	primary (survey and interviews) and secondary	gender digital divide; mobile phone use; rural women
Gray, Tricia, & Gainous, Jason, & Wagner, Kevin	2016	*Social Science Quarterly*	Latin America	quantitative	secondary	gender digital divide; Internet use
Gurung, Lina	2018	*Dhaulagiri Journal of Sociology and Anthropology*	N/A	qualitative	secondary	gender digital divide; technological empowerment; women and ICT; women and technology
Heger, Katharina, & Hoffmann, Christian P.	2019	*Social Science Computer Review*	Germany	quantitative	primary (survey)	gender digital divide; online political participation; feminism
Hidalgo, Antonio, & Gabaly, Samuel, & Morales-Alonso, Gustavo, & Urueña, Alberto	2020	*Technological Forecasting & Social Change*	Spain	quantitative	secondary	digital skills; sustainable development; ICT; advanced machine learning techniques
Ikolo, Violet E.	2011	*Handbook of Research on Information Communication Technology Policy: Trends, Issues and Advancements* (pp. 222-242)	Africa	qualitative	secondary	empowerment (gender equality); ICT access; socioeconomic factors (illiteracy, lack of income, and more); policy strategies
Jiang, Wun-Ji, & Luh, Yir-Hueih	2017	*Qual Quant*	Taiwan	quantitative	secondary	gender digital divide; patriarchal society; theory of time allocation; computer and internet use at home; Blinder–Oaxaca decomposition
Joshi, Ashish & Malhotra, Bhavya, & Amadi, Chioma, & Loomba, Menka, & Misra, Archa, & Sharma, Shruti, & Arora, Arushi, & Amatya, Jaya	2020	*Journal of Medical Internet Research*	(urban slums in) New Delhi, India	quantitative	secondary	mobile phone ownership, internet access; knowledge of SMS text messaging
Kerras, Hayet & Sánchez-Navarro, Jorge Luis, & López-Becerra, Erasmo Isidro, & de-Miguel Gómez, María Dolores	2020	*Sustainability*	European Union and the Maghreb	quantitative	secondary	sustainable development goals; gender digital divide; equality; ICTs
Lee, Micky	2021	*The Routledge Handbook of Digital Media and Globalization* (chapter 7)	International/Global	qualitative	secondary	feminist perspective of the digital divide; feminist political economic approach; definition, explanation, and dealing with the digital divide; role of international organizations
Maric, Josip	2018	*Journal of Innovation Economics & Management*	France	mix (quantitative and qualitative)	primary	fablab; women's inclusion in the Maker culture; gender equality; possible root causes of women's underrepresentation; STEM
Miller, B. Paige, & Shrum, Wesley	2011	*Gender, Technology and Development*	Ghana, Kenya, and Kerala	quantitative	primary	gender digital divide; ICTs; access; development
Mumporeze, Nadine, & Prieler, Michael	2017	*Telematics and Informatics*	Rwanda	qualitative	primary (interviews)	gender digital divide; ICTs; Rwanda; stereotype; qualitative analysis; socioeconomic factors
Mushtaq, Toyeba, & Riyaz, Saima	2020	*Global Academic Journal of Humanities and Social Sciences*	Kashmir	mix (quantitative and qualitative)	primary (survey) and secondary	gender digital divide; ICT; stereotype; Internet access
Omotoso, Kehinde Oluwaseun, & Adesina, Jimi, & Adewole, Ololade G.	2020	*African Journal of Gender, Society and Development*	South Africa	quantitative	secondary	economic empowerment (labor market participation); internet use
Organisation for Economic Co-operation and Development (OECD)	2018	*OECD*	International/Global	mix (quantitative and qualitative)	secondary	gender digital divide; policymaking; digital economy; participation of women; sustainability; women's empowerment; determinants
Pawluczuk, Alicja, & Lee, JeongHyun, & Gamundani, Attlee Munyaradzi	2021	*Digital Policy, Regulation and Governance*	N/A	qualitative	secondary	gender digital divide; gender digital inclusion programmes evaluation; future research recommendations; ICT availability, use, and benefits; sustainability
Ponge, Awuor	2016	*International Journal Of Innovative Research & Development*	Kenya	mix (quantitative and qualitative)	secondary	gender digital divide; ICTs; access; utilization; Kenya
Potnis, Devendra	2016	*Information Development*	India	mix (quantitative and qualitative)	primary (survey)	gender digital divide; women; India; economic barriers; mobile phones; gender digital divide factors
Purushothaman, Aparna, & Zhou, Chunfang	2014	*Gender, Technology and Development*	Developing countries	qualitative	secondary	gender digital divide; ICTs; barriers in using Internet
Ragnedda, Massimo, & Muschert, Glenn	2013	*The Digital Divide: The internet and social inequality in international perspective*	International/Global	qualitative	secondary	digital divide theories; demographic and socio-economic factors affecting internet use and access; inequality theories; comparative analysis
Saha, Sumi Rani, & Zaman, Md. Ohidur	2017	*IOSR Journal of Humanities and Social Science*	Bangladesh	quantitative	primary (survey)	gender digital divide; aspects of ability, access, and usage of ICTs
Straubhaar, Joseph, & Spence, Jeremiah, & Tufekci, Zeynep, & Lentz, Roberta G.	2012	*Inequity in the technopolis – race, class, gender, and the Digital Divide in Austin*	Austin, Texas	qualitative	primary (interviews) and secondary	digital divide in Austin, Texas; race, class, gender inequities; technology access; impact of digital inclusion programs
Treuthart, Mary Pat	2019	*Gonzaga Journal of International Law*	International/Global	qualitative	secondary	gender digital divide; women's rights; gender equality; benefits and barriers to women's access to ICTs; Internet access
Tsuria, Ruth	2020	*Journal of Information, Communication and Ethics in Society*	N/A	qualitative	secondary	ICT access and participation; women's empowerment; religion in gender digital divide
Vantin, Serena	2021	*Women's Studies International Forum*	N/A	qualitative	secondary	gender digital divide; feminist legal studies; equality
Vassilakopoulou, Polyxeni, & Hustad, Eli	2021	*Information Systems Frontiers*	N/A	qualitative	secondary	digital divide; digitalization; digital inequalities; information systems research; sustainability; new research agenda

Source: Author's collection, 2022

Step two also involved thoroughly examining and organizing the chosen publications, including classifying them into categories and sub-categories, and creating a table to keep track of acquired information. The author read the abstract and skimmed through each paper to garner an understanding of the specified research topic and findings. While doing so, she extracted and noted the author, year of publication, journal/book/chapter, context (i.e., focused country or region), methodology used, data source (e.g., primary, secondary, or both), and theories/concepts covered. After analyzing this last point and searching for patterns and repeated themes, she then determined the three categories, namely,

1. Determinants of the gender digital divide,
2. Impacts of ICTs and bridging the gender digital divide, and
3. The regional perspective.

A deeper dive into the writings again shed a clearer view of the sub-categories based on the more detailed study subjects of each article. The first category contains mobile phone ownership, socioeconomic factors, stereotypes, root causes, availability and participation in ICTs and the Internet, and e-government. The second includes positive effects on sustainability, gender equality, empowerment of women, economy, education, and politics. Finally, the third consists of case studies on specific regions and countries such as Latin America, the European Union, Sub-Saharan Africa, and India. The explicit results and analyses are displayed in the following "Findings" section.

Step three was writing the review. Each category's research findings were summarized. Then, paragraphs followed that comprised of reasons for the findings and a critique from a feminist perspective, answering what the research covered (pros) and failed to address (cons). Furthermore, Table 1, which is a summary of the 42 selected papers, was created, organized, and formatted.

Discussion of Research Findings

This section exhibits key findings of this literature review based on Table 1. This review covers 42 pieces of literature with the year of publication ranging from 2010 to 2022. The literature consists of articles from journals–such as *Future Internet*, *World Development*, *Global Academic Journal of Humanities and Social Sciences*, *International Journal of Social Science & Interdisciplinary Research,* and more–as well as books, book chapters, and a report from an international organization. With seventeen of the studies using only the quantitative research method and nine of them applying a mix of both qualitative and quantitative, a majority analyzed data. Sixteen of the studies used the qualitative research method. The reviewed research (i.e., 29 of the articles) mainly used secondary data. Nine studies used only primary data and four used both primary and secondary data.

Categorizing the literature by their common features, the first main category is the determinants of the gender digital divide, namely mobile phone ownership, socioeconomic factors, stereotypes and other root causes, availability and participation in ICTs and the Internet, and e-government. Second, the impacts of information communication technologies (ICTs) and bridging the gender digital divide such as positive effects on sustainability, gender equality, and empowerment of women, the economy, education, and politics. Third, the regional perspective of the gender digital

divide, which consists of case studies on specific regions like Latin America, the European Union, Sub-Saharan Africa, and India. In the sections below, a critique from the feminist perspective of each category and its subcategories will be provided.

Determinants: Causes and/or contributing factors of the GDD

As Table 1 indicated, there are 32 distinct studies on the determinants of the gender digital divide, which can be classified into five groups. These five categories are mobile phone ownership, availability and participation in ICTs and the Internet, socioeconomic factors, stereotypes, and e-government. Please note that some studies have multiple themes, so they are found in multiple categories. The literature on these determinants used mainly quantitative methodology. Nineteen studies covered the availability and participation in the Internet and ICTs. Hence, this factor of the gender digital divide is the most discussed.

There are many noteworthy findings from the studies reviewed. One study on the correlation between the gender digital divide and mobile phone ownership found that men own around 70 percent of mobile phones in India (Potnis, 2016) [52]. According to Joshi *et al.* (2020) [35], in the urban slums of New Delhi, India, compared to males, females were half as likely to own mobile phones. Interestingly, it is more likely that women report having Internet access than men (Campos-Castillo, 2015) [12]. On the other hand, according to Acilar (2020) [3], there is a considerable gender gap in internet use. In general, it is less likely for married women to use the Internet to search for job opportunities (Omotoso *et al.* 2020) [48]. A lack of economic resources, awareness, literacy, education, and ICT training are also significant determinants of the gender digital divide (OECD, 2018) [49]. Additionally, education can be important in both helping to bridge and supporting the gender digital divide (Antonio and Tuffley, 2014) [8]. When women are at a disadvantage in accessing or using ICTs due to socioeconomic status and traditions, the gender digital divide is also apparent (Alozie and Akpan-Obong, 2017) [6]. Gender stereotypes can also explain women's underrepresentation in a Maker community (Maric, 2018) [41]. On another note, if e-government officials provide women with equal access to ICTs, it can have a positive effect on lessening the gender digital divide (Abu-Shanab and Al-Jamal, 2015) [1]. All in all, these various findings indicate that, when trying to lessen the gender digital divide, many factors and determinants–such as mobile phone ownership, socioeconomic factors, stereotypes and social norms, access to and use of ICTs and the Internet, and the e-government–should be considered.

The above existing literature indicates that there are several major reasons behind these determinants. For example, household education is a predictor for females in terms of mobile phone ownership, internet access, and text messaging (Joshi *et al.* 2020) [35]. Another example is how a major barrier for women in accessing and participating in ICTs is the English language (Saha and Zaman, 2017) [55]. Social norms and values are also key reasons behind the access and use of ICTs by women (Mushtaq and Riyaz, 2020) [46]. In Latin America, employment pattern differences between men and women contribute to the gender gap in Internet use (Galperin and Arcidiacono, 2021) [23]. Reasons for the gender gap in access and use of ICTs are also found

in socio-cultural and economic factors, especially in developing countries (Acilar, 2020) [3]. Strangely, there is a lack of research on the causes of socioeconomic factors. This may be a substantial gap in research since, as established above, these socioeconomic factors contribute to other gender digital divide determinants, which highlights its importance. In countries such as Rwanda, girls are pressured to get married or find a job rather than pursue their education, which can create technophobia for women (Mumporeze and Prieler, 2017) [45]. The importance of the e-government factor is due to how the government, based on research findings and implications, can bridge the gender digital divide through gender-neutralizing the educational system and advocating gender equality (Abu-Shanab and Al-Jamal, 2015) [1].

From the feminist perspective, the literature generally used the principle of working towards gender equality, which is a basic principle used by feminists. In the studies addressing mobile phone ownership as a factor of the gender digital divide, most (e.g., Fatehkia *et al.* 2018) [20] were "descriptive" in finding or tracking the gender digital divide. Most studies (e.g., Joshi *et al.* 2020) [35] conclude their research by stating that mechanisms need to be further studied or that further research is needed. There is a similar situation in research related to access and use of technology. Many studies (e.g., Mushtaq and Riyaz, 2020) [46] recognized the need for integrating policies, such as ICT policies, that fit women. But even a study (Eneh, 2010) [19] that specified recommendations didn't include anything directly related to feminist theories or concepts other than that girls should be encouraged to use Cyber cafes. None of the literature suggested making radical changes in society, so the radical feminism theory was virtually neglected. Clearly, there is a lack of definite future implications. However, this is an essential objective of feminist theories. In fact, many feminist theories aim for gender equality by seeking change, whether it's through legislation or eliminating concepts. So, where are the studies that seek reform? Where the research that has clear future is plans to make progress in bridging the digital gender gap? Most studies may be related to the concept of gender equality, but oftentimes the correlation is vague. It is ambiguous whether the research is leaning towards alleviating social, economic, or political gender inequality.

Impacts: ICTs and bridging the GDD
Table 1 demonstrates that 18 pieces of literature are related to or focus on the impacts of ICTs and bridging the gender digital divide. Unlike the previous category, it is found that the impacts are difficult to categorize. This is due to how aspects of certain impacts, such as a positive impact on sustainable development (Kerras *et al.* 2020) [37] and gender equality, are interconnected. Another example is how gender equality and women's empowerment are different concepts but have overlapping areas. For the most part, the studies used the qualitative method of research.

The reviewed research has a number of significant findings, including ones on the positive impact of bridging the gender digital divide on sustainability (e.g., Kerras *et al.* 2020) [37], women's empowerment (e.g., Treuthart, 2019) [65], economic growth (e.g., Ponge, 2016) [51], and more. To elaborate, sustainable digitized societies need to bridge digital divides. (Vassilakopoulou and Hustad, 2021) [73]. According to Kerras *et al.* (2020) [37], gender and ICTs are crucial in

achieving sustainable development. Additionally, the role of ICTs as a mechanism for women's empowerment is broadly acknowledged by scholars and development organizations (Fatehkia *et al.* 2018) [20]. Women can gain a copious number of benefits, such as ones that are personal, family-related, and community-related, when they can use Internet technologies (Antonio and Tuffley, 2014) [8]. Other benefits affiliated with ICTs entail economic and educational empowerment, participation in politics, and the growth of voice and agency (Treuthart, 2019) [65]. Expanding upon the possible economic benefits of bridging the digital gender gap, technology has a profound impact on the gender gap in labor market results (Omotoso *et al.* 2020) [48]. It is proved that enhancing women's access to technology can advance economic activity, which, in turn, creates favorable welfare and economic outcomes for children, families, and societies (Ponge, 2016) [51]. In essence, it is crystal clear that bridging the gender digital divide and improving access to ICTs for women has a myriad of positive effects.

These impacts have many key reasons why they are noteworthy. Please note that some reasons may be interlinked with multiple impacts. One example is how the impact of better access to and use of ICTs on women's empowerment is a cause of enhanced economic growth (Treuthart, 2019) [65]. Integrating women into the technology sector brings more value to both the technology sector and sectors related to it (Kerras *et al.* 2020) [37]. It is imperative to empower women for reducing poverty, which is how reducing the gender digital divide can have a positive impact on economies (Ponge, 2016) [51]. Digital inequalities can also have serious consequences, especially now that daily activities and society have become more digital and electronic-based (Vassilakopoulou and Hustad, 2021) [73]. Gurung (2018) [28] states how women and men have an equal share on this earth, which ties back to all these important impacts and their reasons.

With a feminist point of view in mind, generally, the studies described what would happen if progress was made in achieving digital gender equality. Several pieces of literature (e.g., Ponge, 2016) [51] can be associated with the feminist concept of economic equality. However, like the previous category of studies, this research lacks attempts on making changes. This may be more logical since the focus is on what specific benefits digital gender equality can bring rather than how to achieve those benefits. This may be able to correlate to the "consciousness-raising and organizing approach" used by feminists, which is to advocate and organize events aiming to spread awareness (Liu, 2022) [39]. Despite this, the correlation is still considered weak. It is vague what types of implications can be made based on findings of the impacts. There is a need for more literature and studies on policy recommendations with appropriate proposals for change. Research could be improved by making suggestions on how organizations or governments can use these findings to spread awareness.

Regional perspective: GDD in specific regions
As displayed in Table 1, there are 36 studies regarding the regional perspective of the gender digital divide. The regional perspective can be coded into three sub-categories, which are the global/international, sub-region or region-specific, and country-specific perspectives. The studies, mainly consisting of the country-specific sub-categorical perspective, mostly employed the quantitative research

methodology.

The findings of the considered studies were thought-provoking. First, some studies that were researched with a global perspective had a particular focus on developing countries (e.g., Purushothaman and Zhou, 2014) [53]. An example of a finding is how women in developing countries have notably lower participation rates in technology when compared to men (Antonio and Tuffley, 2014) [8]. Second, the studies particularly focused on sub-regions or regions such as Latin America (e.g., Ancheta-Arrabal *et al.* 2021, Gray *et al.* 2016) [7, 27], Sub-Saharan Africa (e.g., Brännström, 2012) [11], Africa (e.g., Ikolo, 2011) [32], and the European Union and the Maghreb (e.g., Kerras *et al.* 2020) [37]. In Latin American countries, a quarter and a half of the observed gender gap in Internet use is due to men having higher employment rates (Galperin and Arcidiacono, 2021) [23]. Galperin and Arcidiacono (2020) also found that "equalizing the distribution of employment among women to that of men would reduce the gender digital gap by about 22% in Ecuador, about 32% in Guatemala and Mexico, and about 50% in Peru" (p. 10). Third, the country-specific studies, which is also most of the research done, included an abundance of information. Therefore, please note that not all findings from every individual country will be displayed here. Some considered countries comprise Jordan (e.g. Abu-Shanab and Al-Jamal, 2015), France (e.g. Maric, 2018) [41], Kenya (e.g. Ponge, 2016) [51], South Africa (e.g. Omotoso *et al.* 2020) [48], Nigeria (e.g. Eneh, 2010) [19], Rwanda (e.g. Mumporeze and Prieler, 2017) [45], Ghana (e.g. Miller and Shrum, 2011) [43], Spain (e.g. Hidalgo *et al.* 2020) [31], Germany (e.g. Heger and Hoffmann, 2021) [29], Bangladesh (e.g. Saha and Zaman, 2017) [55], Taiwan (e.g. Jiang and Luh, 2017) [33], Kashmir (e.g. Mushtaq and Riyaz, 2020) [46], Turkey (e.g. Acilar, 2020) [3], and India (e.g. Potnis, 2016 [52], Bala and Singhal, 2018 [9], Joshi *et al*. 2020) [35]. In addition, research on the United States consists of state-specific findings, such as ones from Texas (e.g., Dixon *et al.* 2014) [18] and Ohio (e.g. Garcia, 2011) [25]. The overall reports show that STI policies, programs, or legal instruments addressing the active participation of girls and women in STI are growing; however, there are important differences among countries (OECD, 2018) [49].

There are some causes, as per the extant studies, of the findings stated above. For instance, women in developing countries have a lower technology participation rate than men due to rooted sociocultural beliefs about women's standing in society (Antonio and Tuffley, 2014) [8]. Since women usually work in sectors that are more ICT-intensive, such as education or health services, it explains how the relationship between Internet use and employment is more linked among women (Galperin and Arcidiacono, 2021) [23]. Besides this, in Jordan, the gender digital divide was widened by cultural norms (Abu-Shanab and Al-Jamal, 2015) [1].

Looking critically through a feminist lens at this research, the issues that were addressed were also generally descriptive. It is apparent that there is a general trend of the studies directly stating how the gender digital divide is a serious problem that needs solutions (e.g., Mushtaq and Riyaz, 2020) [46]. However, there is still an absence of research that actively looks for innovative and practical change-oriented ways to approach this subject. Such an approach is an important and common aspect of feminist theories. Many studies also seem to lack variables considered such as gender stereotypes (e.g., Dixon *et al.* 2014) [18]. Additionally, more comparative analyses on gender-related studies on the digital divide need to be done in terms of country-to-country or region-to-region juxtapositions.

Conclusions
From the feminist approach, a key finding of this review is that there is a lack of change-seeking and the "consciousness-raising and organizing approach" is inadequate. In essence, there is a fair amount of research on raising issues but insufficient numbers on concrete, reform-aiming policy recommendations and analyses of region-specific comparisons, which need to be addressed by future research. The findings of this literature review can aid future researchers in considering a fresh perspective when conducting studies. They contribute to the literature on digital inclusion, women's empowerment in technology, as well as gender and feminist studies altogether. This justifies how complicated this issue is, which is why a holistic approach needs to be used in tackling many questions, whether it's regarding researched information or methodology.

It should also be noted that, although the qualitative methodology has many limitations, such as focusing too much on experiences and meanings rather than considerations in contexts, the author admits that it has the advantage of having a flexible design and a broad range of viewpoints, methods, and techniques in grasping interpersonal experiences (Denzin and Lincoln, 2002, Silverman, 2010, Maxwell, 2012) [17, 59, 42]. The quantitative methodology has numerous weaknesses too. According to Schofield (2007) [58], it tends to measure variables at a specific time and disregard whether the information is at its best or disorganized. However, the quantitative methodology is suitable for generalizing whole populations with its large samples (Carr, 1994) [14]. Therefore, a mix of qualitative and quantitative methodology, aiming to benefit from the multitude of advantages of both, shall be used in future research.

Finally, despite the meticulous execution of this review, some research limitations should be noted. The limited number of 42 selected publications did not consider studies written in non-English languages, which misses out on extensive information. In addition, there can be potential criticism for the eliminated studies during the procedure. Articles may have been overlooked due to the use of keyword searching. The process of searching, downloading publications, and coding them was done manually. Hence, despite the thorough and precise double-checking for mistakes, it is subjective to errors.

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