

WOMEN TAKING UP SPACE: A CONCEPTUAL ANALYSIS OF THE GENDER-DIGITAL DIVIDE IN SOUTH AFRICA

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Abstract: The world has become progressively digital and visibility into the digital gender gap is becoming crucial. Each year, data demonstrates a persistent gender divide in access to information and resources that promote economic and social mobility. According to a study by Women in Digital Transformation, the COVID-19 pandemic exacerbated the gender digital divide. Sub-Saharan Africa appears to be following the continental trend of low digital connectedness among women with approximately 300 million unconnected women living in the region. In South Africa, the gender gap in digital technology access, use, and adoption remains persistent. Ultimately, gaps in digital skills, employment, and entrepreneurship in Information Communication Technology and other sectors result from this inequality in access. Utilizing a conceptual research design, this paper primarily sought to ascertain the gender discrepancies that still exist regarding access to digital resources and knowledge, despite women empowerment being one of the key sustainable development goals for 2030. A theoretical framework encompassing the theory of the digital divide, within the greater communication theory, was used to interrogate the identified phenomena in this study. The paper further offered a conceptual framework, identified by the authors as being the best practices for bridging the gaps on the subject. A further empirical enquiry is recommended to support the conceptual insights inferred in this study.

Keywords: gender digital divide, women, 4IR, sustainable development, South Africa

Introduction

Since the Fourth Industrial Revolution (4IR) is accelerating the rate of development in information and communication technologies (ICTs), it has been acknowledged that the gender digital divide (GDD) presents a hurdle to achieving gender equality for women (Kuroda et al., 2019). The GDD is defined as the gender disparities in digital connectivity (USAID, 2022). The increased dependence on digital technologies by society has the potential to further marginalize women, their communities, and national economies by blocking them from the possibility of full participation in digital markets. If the digital gender gap is not closed, instead of reducing gender inequality, digital technology may worsen it (Kuroda et al., 2019).

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Empirical research unequivocally demonstrates that women in developing countries participate in technology at considerably lower rates than males due to deeply ingrained sociocultural ideas regarding women's roles in society (Antonio & Tuffley, 2014). According to Alozie and Akpan-Obong (2017), the GDD manifests when there are fewer resources available to women or when they encounter more barriers to accessing and using ICTs. Mariscal et al. (2019) state that substantial socio-cultural restrictions, as well as affordability, limit access for women. Research findings, however, are now revealing the potential gains (personal, familial, and communal advantages) by these women when they can use internet technology (Antonio & Tuffley, 2014). The GDD is especially critical for development (USAID, 2022). Men are 21% more likely than women worldwide to have internet access. This probability increases to 52% in the least developed nations in the world. Women who experience intersectional discrimination and reside in less affluent communities have even less access to internet and digital devices, which has several adverse effects (Aoki, 2022).

In sub-Saharan Africa (SSA), the gender gap still exists, accounting for a 15% gender difference in mobile ownership and a 42% gender disparity in mobile internet usage; this is even though women's use of mobile phones and internet has significantly increased (Shanahan & Rowntree, 2019). The under-participation of women in the digital revolution can stifle economic progress and hinder the achievement of the United Nations' 2030 Sustainable Development Goals (SDGs) (Adeola, 2020). In South Africa, the GDD seems to continue to prevail despite government endeavours to promote the advancement and usage of technology (Ojo & Segone, 2022). The COVID-19 pandemic has seemingly further widened the existing digital gender difference, pushing equality between men and women back a generation (Aoki, 2022). Moreover, lack of access to information on fostering resilience during the pandemic could cause women and girls to fall behind, escalating already-existing gender disparities (Aoki, 2022). COVID-19 also caused countries to become more reliant on digital services (USAID, n.d). On the other hand, the COVID-19 pandemic has exposed the financial and social consequences of digital exclusion in general, including the results of gender disparities (DAKA Advisory AB and Women in Digital Transformation (WinDT), 2022).

Despite the obvious gender digital difference in South Africa, there is a paucity of studies for South Africa to address the GDD difficulties that hinder access for women. This study adopted a conceptual research approach, and the primary goal of this paper was to determine the gender disparities in access to digital resources and knowledge in the South African setting. In this study, a theoretical framework including the theory of the digital divide within the larger communication theory is employed to investigate the identified phenomena. In general, the study adds to the corpus of literature on the GDD by identifying the differences between men and women's use of technology and proposes potential remedies to close this gap in South Africa. Moreover, the study offers insight into the contributions of the COVID-19 pandemic to digital exclusion and suggests inclusive solutions to secure equal technological access for both men and women.

The rest of the study is organized as follows: the literature review, including the theoretical framework of the study; the synthesis of the existing literature; the research methodology; the findings and discussion, including the conceptual framework of the study; the limitations and recommendations of the study; and finally, the conclusion.

Research Aim and Question

The aim of this research was to ascertain the gender discrepancies that still exist regarding access to digital resources and knowledge in South Africa. The research therefore sought to answer the following question: what are the best practices/strategies towards the effective narrowing of the GDD in South Africa?

Literature Review

The theoretical groundings for this research are presented in this section, alongside the empirical literature obtained from academic online search engines and databases. In partial fulfilment of the adopted research methodology, the selected scholarly outputs consulted in this study were published between the years 2002 and 2022 (however, not specifically applicable to the theoretical framework). This was done to provide a more accurate picture of the progression of efforts to bridge the GDD over the last two decades, including the period leading up to the COVID-19 pandemic, during the height of the pandemic (that is, during the years 2020 and 2021 when national lockdowns and related restrictions were substantial), and currently during the recovery period of the pandemic (that is, throughout 2022 during which the lockdowns and related restrictions were minimal and eventually fell away completely).

Theoretical framework

The feminist standpoint theory

Unlike the spontaneous thinking of a person or group of people, a standpoint is the collection of information available within a specific setting from which an understanding might be developed (Sprague, 2005). Most standpoint theory variations present certain social stances from which deeper comprehensions might be formed (Sprague, 2005). Standpoint theory forms the basis for the agent's social stance because the subject has preferential access to truth (Stoetzler & Yuval-Davis, 2002). According to standpoint theorists, these positions are beneficial because individuals on the periphery of society gain a greater perspective on the center than those in the center (van der Tuin, 2016).

Similarly, feminist standpoint theory involves thinking from the position of the marginalized, including women (van der Tuin, 2016). In support of the standpoint of women, feminist standpoint theory asserts an epistemological advantage over the nature of gender politics as well as social and psychological phenomena that involve gender (Anderson, 2000). Women's standpoints frequently enjoy epistemic privilege despite their own diversity in the systems governing race, class, nation, and other important relationships of social dominance (Sprague, 2005). Cipriani (2020) further adds that the feminist standpoint theory is also a form of critical theory intended to enable disadvantaged minorities to ameliorate their life situations. Harding (2015) characterized a feminist standpoint as the ownership of a community that has participated in critical conversations aimed at determining ways of obtaining knowledge that will be valuable to specific groups of women in their various disadvantaged situations in global gender, race, class, and colonial interactions.

Several scholars have utilized the theory to examine the GDD. For instance, Nsibirano (2009) examined whether gender symbolism contributes to a positive comprehension of disparities in ICT use in university education by drawing on ideas established in feminist standpoint theory and gender symbolism. Goh (2013) examined the use of Third World feminist epistemology as both methodological and theoretical frameworks in GDD studies. The aim was to identify the understanding of disadvantaged Appalachian women in the digital age, to empower them and to determine whether they could use information and communication technology in their efforts to change their conditions. Gurung (2018) explored the various standpoints of feminist scholars from the west and the east that are redefining ways in which gender interacts with technology.

In addition to being an important foundation of gender and information technology (IT), standpoint theory has historical significance since it has had positive effects on gender theory (Trauth, 2006). Therefore, the feminist standpoint theory is important to this study because it highlights the gender disparities in the digital era and seeks to identify alternatives to advancing the status of women in accessing and using technology.

Structuration theory

Structuration theory is based on sociology and provides insights on human psychology. The theory acknowledges the interrelationship of meaning, beliefs and norms, and force, and suggests a complicated interrelationship between some of these various elements of society, as opposed to portraying the potential of human activity as being constrained by a strong, steady social construct (Gibbs, 2017). Structuration theory acknowledges the role of social institutions in establishing rules within which people should function, and that only by functioning compliantly can these institutions be strengthened. This is because social systems are socially produced and lack inherent stability independent of human action (Gibbs, 2017).

Giddens's (1984) structuration theory aids in directing the analysis of the factors that contribute to connectivity deficits being generated and maintained in the broader economic and political areas (Straubhaar, 2012). Giddens's (1984) theory does not specifically concentrate on technology (Kishor, 2011), but it is frequently applied in information systems research as a meta-theory for analyzing the interplay between technology and organizations (Ransome, 2010). Additionally, the structuration theory tends to concentrate on how social systems and social institutions are reproduced, as opposed to the Critical IS theory, which emphasizes transformation (Ransome, 2010). However, the theory applies in this study to elucidate on the differences in social constructs between men and women in South Africa when it comes to technology use and the problems that result from those differences.

The critical information systems theory

The critical theory dictates that the mind should adapt to emerging challenges and emancipation opportunities created by evolving contemporary conditions (Bronner, 2017). Soft systems theory serves as the foundation for critical systems theory. It discusses conceptual, moral, and practical challenges in systems practice including and emphasises on balance and equality (Bausch, 2001). By

addressing social oppression as well as its origins, critical research actively works to change the hostile circumstances whereby individuals are compelled to participate (Myers, 1997).

Critical information systems (IS) research seeks to highlight current inconsistencies and discrepancies as well as the interests and goals of privileged groups. It also aims to prevent the exploitation of IS and advance the creation and usage of IS that is enabling (Cecez-Kecmanovic, 2011). The critical IS theory describes gender inequalities and explores why there is a disparity (Brown & Czerniewicz, 2017). Additionally, it searches for the underlying causes (Öngün, 2022). Kvasny and Trauth (2002) and Adam and Kreps (2006) emphasized the goal of critical research on gender and IT, which is to examine the prevalence of gender disparities and issues pertaining to women and IT. Trauth and Howcroft (2006) employed the critical approach in an exploratory study about the diversity in career narratives of women in the American IT labor force. Similarly, the critical theory is used in this study to explore South African women's experiences on utilizing technology.

The development of literature on the gender digital divide

The following literature is categorized into the pre-COVID-19 pandemic era, during the pandemic, and the pandemic recovery era, to assess the state and transition of the GDD through these various periods.

The gender digital divide in the pre-COVID-19 pandemic era

A study by Nicholson (2002), less than a decade after independence, found that of the 44 million population in South Africa at the time, only about 2 million had access to the internet, the majority of those with access being male. Another study by Singh (2004) revealed that females had less access to the internet than males in some South African organizations. This was recorded a mere decade after the end of the apartheid regime from which the country was still towards the very beginning of its recovery (Singh, 2004). Cooper (2006) examined literature published in earlier periods to investigate evidence of the GDD. According to the findings, women were less likely than men to learn about computers or other subjects using computer-based skills. Enoch and Soker (2006) demonstrated that socio-structural elements such as age, ethnicity, and gender had a substantial influence in the persistence of the usage gap in a study on university students' utilization of internet for learning. according to the previous study, socio-economic status is a key indicator of both access to and usage of ICT. Blignaut (2009) proposed raising the socio-economic level of the broader community as a protracted remedy for the digital gap in a South African study. This could be especially useful to women, who are frequently socio-economically disadvantaged.

Garcia (2011) researched the GDD in cellular phone usage by Latino immigrant farm workers in Southeast Ohio. The findings revealed that cellphones were not intrinsically empowering to women in the context of immigration (especially illegal immigration), but they could act as dominance and subordination-enhancing-mechanisms in the relations between men and women. Brännström (2012) used government statistics to illustrate ICT advancements in two low-income Sub-Saharan African nations, Kenya and Somalia, from 2000 to 2008. This article demonstrated that essentially, no official

statistics were available on gender disparities in access to, usage of, and advantages of telecommunications.

Antonio and Tuffley (2014) showed that established socio-cultural ideas regarding the place of women in society have contributed to the low engagement of women in technology in developing countries. They also stated that increased technological participation among women leads to improved education and activities that improve them, their families and communities. They will subsequently be more inclined to pursue a form of training that raises living standards and offers several additional benefits. Abu-Shanab and Al-Jamal (2015) conducted an empirical study of the GDD on university students in Jordan. The research determined the interactions of e-government and the GDD in developing countries. The findings showed evidence of the GDD, with educated males finding it unpleasant for women to have equal access to the internet and computers. Despite commendably high computer literacy rates, the GDD was reinforced by cultural norms and academic institutions.

Bornman (2016) examined the digital divide in South Africa's information society using samples from 2008 and 2011. The findings reveal that personal internet use and mobile internet access were less common than predicted by the literature. Moreover, differences between the sexes, in addition to significant gaps between population groupings and educational status, were discovered in computer and internet consumption, mobile ownership and accessibility to mobile internet, and accessibility to news through the internet. Potnis (2016) explored the variables preventing 245 female slum-dwellers in India earning less than \$2 per day from owning a cell phone. He proposed that socioeconomic imbalances be resolved to reduce the GDD, particularly in underdeveloped nations.

Singh (2017) wrote a commentary linking gender-based digital inequality to the restrictive atmosphere frequently experienced by women. Singh (2017) also highlighted the need for gender-sensitive curricula to increase women's ability to comprehend and develop the subject matter in both official and informal education. Further, the gender-based digital inequality necessitates the promotion of sharing of best practices and lessons learned among countries. Consequently, the cultural practices, socioeconomic conditions and constraints based on gender and class that prevent females from using and accessing ICT must be considered. Alozie and Akpan-Obong (2017) explored gender differences in ICT access and use in Sub-Saharan Africa. The findings of the study revealed a higher probability of men owning and utilizing technology. The study also attributed the gender gap to the disproportionate distribution of ICT resources among men and women, which favors men.

Gray et al. (2017) investigated the existence of a regional GDD in internet use by comparing the usage of the internet in Latin American countries between men and women. Countries with different levels of digital freedom were examined for the size, severity, and effects of this GDD. The 2010 Latin Barometer individual-level data were combined with country-level data from the United Nations (U.N.) Gender Inequality Index using a variety of random- and fixed-effects models. The findings indicated that Latin American men utilized the internet more than Latin American women. Additionally, men were found to utilize social media more regularly in gathering political information.

The gender digital divide during the COVID-19 pandemic era

Orkoh and Viviers (2021) examined the factors affecting firm acquisition and usage of digitalization in 48 African countries. To address the gender digital disparity, the study concentrated on the gender composition of ownership and control inside enterprises. The study found women to be disproportionately underrepresented in African business ownership and control. Acilar and Sæbø (2021) studied the GDD in terms of its characteristics and causes in both developing and developed countries. The paper investigated the properties of the studies and identified the variables causing the GDD in addition to conducting a comprehensive evaluation of the literature addressing the issue. According to the findings of the study, sociocultural variables have a significant factor in understanding the GDD. Despite the increased better direct access to ICT, women possess a lesser chance of acquiring access than men, particularly in developing nations (Acilar & Sæbø, 2021).

Perifanou and Economides (2020) explored measures aimed at bridging the GDD in Europe. The study suggests a framework for implementing comprehensive gender equity measures into practice across twenty-four areas. The study also recommends creating a system to monitor the development of gender equality. Kerras et al. (2020) evaluated the innovation and gender indexes of France, Spain, Morocco, and Algeria. They further examined the associations of these indexes with the GDD and the attainment of the SDGs. The GDD and ICT had an impact on seven SDGs, and none of these countries have attained them.

Acilar (2020) examined the GDD in Turkish e-government usage. Despite the evident increase in internet over time, there is still a consistent and significant discrepancy between males and females in using e-government services. A substantial number of females do not gain from the positive benefits of this service. Ancheta-Arrabal et al. (2021) used a gender perspective to analyze the connection between education and GDD in Latin American nations. The findings highlighted the importance of conducting research from educational and gendered approaches in Latin America, as they are underrepresented.

The gender digital divide in the COVID-19 pandemic recovery era

According to Liu and Fan (2022), women did not completely benefit from the efficiencies of technology amidst the COVID-19 pandemic. They further advocate for governments and ICT sectors to reduce the GDD. The Ukrainian government advocated for a digitally inclusive recovery centered on the introduction of inclusive eServices to empower women (Klyuchar et al., 2022). Based on women's experiences with telework during the pandemic, European Union member states are pursuing equitable economic opportunities for women through their policies, following the pandemic (Lopez and Schonard, 2022).

Overall, the previous literature throughout the pre-pandemic, during pandemic and pandemic recovery eras, show a broad agreement among scholars regarding the underrepresentation of women in the use of technology. Despite notable milestones in technological advancements, the gender digital gap persists, particularly in developing nations like South Africa. This places a responsibility on authoritative institutions to pursue avenues that will close the digital gender gap and maximize women's engagement in technology and consequently, the economy.

The implementation of telecommunication policies in African countries

ICT policy in African countries is frequently beset by a paradox, notably divergent national ICT policy and sectoral reform agendas, which results in policymakers' conflicting objectives and an impasse in the implementation of policies (Information Resources Management Association, 2010).

Generally, African countries have a dismal track record of putting their telecommunication policies into practice. This is supported by a variety of factors, including the unsatisfactory performance of mobile number portability (MNP) in most countries except for Ghana (Mothobi, 2022). South Africa, for example, attained a 5% porting rate 7 years after the MNP was implemented. MNP refers to the ability of phone subscribers to change service providers whilst retaining their number, and it is meant to promote competition between service providers and enhance the quality of services offered (Medudula, Sagar & Gandhi, 2016). Additional factors include mobile termination rates, which are costs that providers charge their customers for making calls (Mothobi, 2022); costly mobile data and smart devices; and poor broadband availability (Ahmed, 2020).

On the issue of gender, Gillian Marcelle highlighted in 2000 that several communications regulations in countries such as Mozambique, Uganda, and Senegal do not address gender issues (Olatokun, 2008). In contrast, the South African Communications Act of 1996 incorporated gender-specific terminology, in accordance with other gender legislation based on gender-equality principles. The Act emphasized the importance of fostering gender equality in areas including licensing, procurement, and training (Hafkin, 2006). In terms of gender impact, this implementation has underperformed. Regulators and operators have not integrated gender issues into their business operations. Policies have also failed to address economic difficulties since technical aspects of the network are assumed to be cost-neutral regardless of gender and because creative solutions to women's information requirements have not received enough attention (Olatokun, 2008).

The COVID-19 pandemic further exposed the GDD-related weaknesses of current telecommunications policies. The pandemic intensified prevalent inequalities and discriminatory systems, such as the GDD, prompting calls for a "feminist internet" (Power, n.d). South Africa responded to the pandemic by highlighting the necessity of sustained internet access, provision of temporary spectrum to main mobile networks, restricting any licensed businesses from imposing pricing increases or cutting data charges, and offering guidelines for a framework for zero-rating websites for education and health. However, like other African countries, South Africa has not explicitly addressed the GDD (Power, n.d). This consequently necessitates the inclusion of gender concerns in national ICT strategies in African countries for women to benefit from ICTs.

Materials and Methods

A research design encompasses the decisions about achieving research objectives and research questions and aligning theories to befitting resources and methods (Flick, 2018). The research design is fundamentally an outline for gathering and interpreting data to answer the primary and secondary research questions (Ragin, 1994). As with any design, the research design must be aimed at improving

usability; that is, a sound research design is an effective tool for tackling the research problem at hand, and it conveys the study's logic transparently (Ragin, 1994).

The authors used the conceptual research design to achieve the aim of this study. A conceptual study seeks to synthesize various empirical studies that meet the pre-determined inclusion criteria to answer a specific research question or achieve a particular research aim (Snyder, 2019). Despite its limitations, such as the lack of primary empirical results or findings offered, the conceptual research approach is praised for its ability to build and expand on existing theory and broaden researchers' scope of perception (Gilson & Goldberg, 2015).

The authors of this paper included various scholarly publications such as journal articles, conference proceedings, book chapters, and others, specifically produced between 2002 and 2022, in the outlining of the literature review. This was done to provide a holistic illustration of the progression of the subject of the GDD over the last two decades. In terms of the findings and discussion thereof, which encapsulated the conceptual framework of the study, the authors included scholarly and other pertinent and credible publications between 2018 and 2022. This was done with the aim of interrogating the subject knowledge from approximately two years before the COVID-19 pandemic (2018-2019), to during the two most hectic years of the pandemic (2020-2021), and ultimately, to the notable beginning of the recovery phase of the pandemic (2022 onwards).

The authors specifically adopted the following research methods in compiling this paper, as subsequently substantiated in Table 1 below (Jaakkola, 2020):

Table 1: A breakdown of the conceptual research design

Empirical research	Conceptual paper equivalent
Theoretical framing	Choice of theories and concepts used to generate novel insights
Data (source, sample, method of collection)	Choice of theories and concepts analyzed
Unit of analysis	Perspective; level(s) of analysis/aggregation
Variables studied (independent/dependent)	Key concepts to be analyzed/explained or used to analyse/explain
Operationalisation, scales, measures	Translation of target phenomenon in conceptual language; definitions of key concepts
Approach to data analysis	Approach to integrating concepts; quality of argumentation

Source: Designing conceptual articles: four approaches (Jaakkola, 2020).

Choice of theories and concepts analyzed: The Feminist Standpoint, the Structuration and the Critical IS theories delineated in the literature were adopted in the conceptual analysis of this study, within the context of the GDD. This theoretical framework assisted in understanding the implications and consequences of the GDD within the South African context, a country meant to be one of the

forefront drivers of the 4IR on the African continent. Further, the selected theories were discussed in terms of their relevance to the bridging of the GDD which has so far disfavored females as demonstrated in the literature.

Perspective; level(s) of analysis/aggregation: The paper aggregated the specific constructs identified as most pertinent towards bridging the GDD, namely, building partnerships between government, industry, and social communities; the revision of telecommunication policies; driving the women in STEM agenda from early education years; and training and supporting women in the IT sector.

Key concepts used to analyze/explain: The authors used the key constructs identified in this study, as outlined above, to analyze and explain the critical aspects to be considered in efforts to ameliorate the GDD in South Africa.

Translation of target phenomenon in conceptual language: In the absence of empirically collected data, the authors synthesized the main concepts derived from various sources of literature to provide a broader perspective of the research topic through the amalgamation of pertinent key constructs.

Approach to integrating concepts; quality of argumentation: In line with the previous point, the authors used the existing literature and theory as a basis for their argument regarding the constructs identified as best practices towards the effective alleviation of the GDD in South Africa. The voice/argument of the authors, substantiating the literature, is also evidently positioned in the discussion of the findings.

Further to the above points, the authors used a conceptual framework approach in this paper. The purpose of such an approach is to propose a conceptual framework which highlights specific constructs thought by the researcher(s) to predict certain relationships within a particular topic (Cornelissen, 2017). In this study, the authors developed a conceptual framework showing selected best practices and strategies to be employed in efforts towards bridging the GDD in South Africa. A conceptual framework approach fundamentally uses a figure/framework to depict and summarize the key aspects considered in a study (Payne et al., 2017), which has been demonstrated in this study through Figure 1 in the subsequent section.

Results and Discussion

Conceptual framework

The theoretical framework, as earlier delineated by the authors, provides a sound basis for the discussion of the key findings of this research. Figure 1 below illustrates the selected strategies that have been identified by the authors as being most pertinent towards effectively eradicating the GDD in South Africa. Key aspects of each construct are outlined and discussed in the subsequent subsection, and associations of each to the theoretical underpinnings of the study are pertinently highlighted.

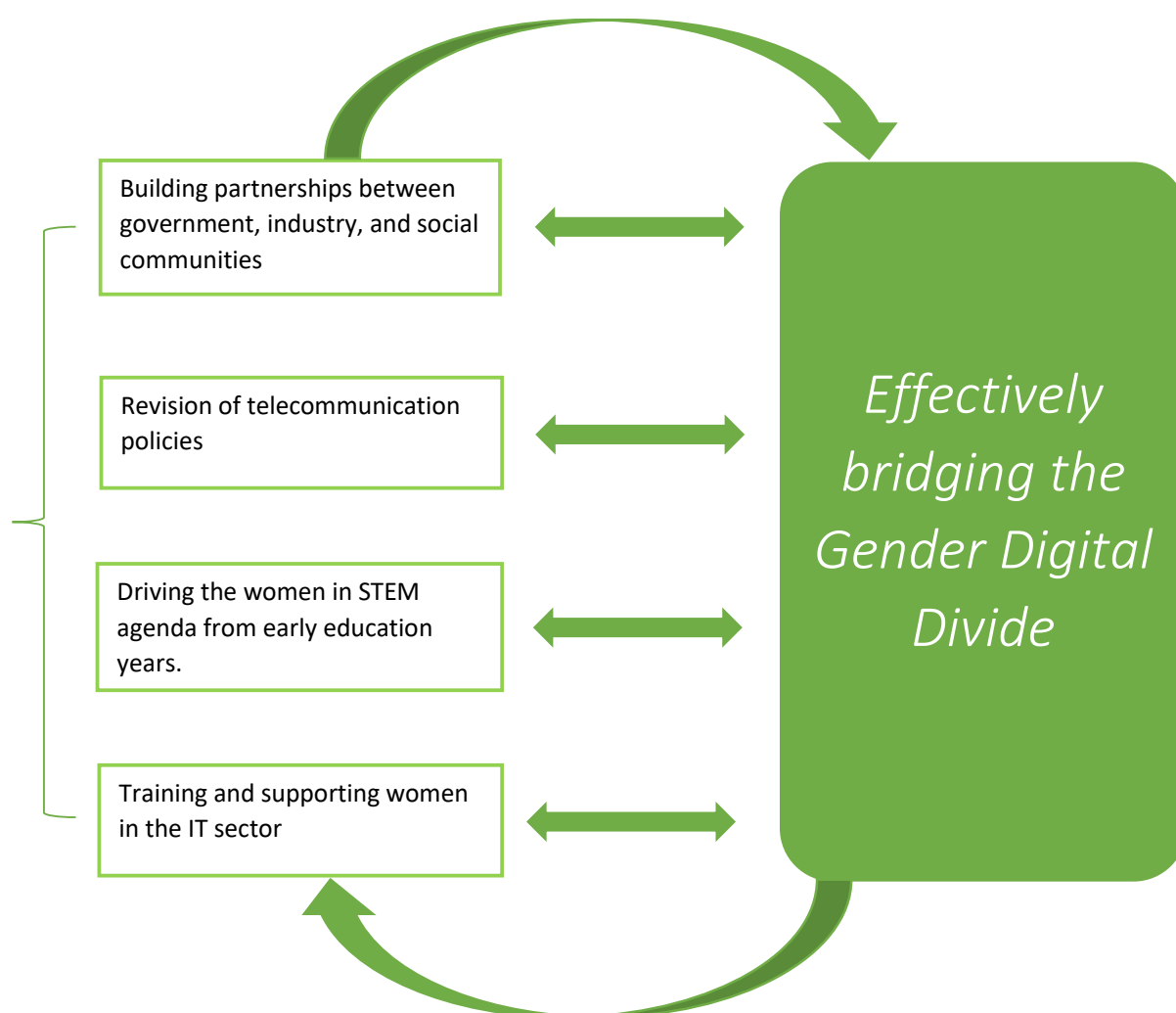


Figure 1: A conceptual framework on effectively bridging the GDD (source: authors' own compilation, 2022)

Strategies for alleviating the gender digital divide in South Africa

Building partnerships between government, industry and social communities

Jamil (2021) attributes the global GDD to the uneven usage of the internet. To achieve improved and inclusive digitalization outcomes at public and private cross-sectoral levels, Jamil (2021) highlights the necessity of cooperation amongst key stakeholders such as in e-government, the private sector, academia, civil society, and international organizations. Governments must recruit digital talent to streamline their systems and services (Karaboga et al., 2020). To thrive in the digital transition and acquire a competitive edge, businesses also need to recruit digital talent. Cooperation between such stakeholders would nurture and maintain a nation's pool of technologically competent individuals (male and female). To advance digital inclusion, the public sector should take the initiative in funding and building capacity in non-profit domains (Gong, 2020). Digital inclusion is synonymous with

social inclusion. Government initiatives and policies have been the main conduits for the discovery of the relationship between digital and social inclusion, and societal contexts and educational settings have steadily shaped it as well (Marshall et al., 2019). The provision of digital services to the underprivileged, women in this case, and the reduction of the GDD should be the ultimate goals. Literature reflects gendered relationships with technology within the social settings of technology use by applying the structuration theory. Though COVID-19 has resulted in an increase in digital services, this has not resulted into new economic prospects for women in South Africa because the GDD has not been adequately resolved. This study suggests gender inclusive recovery strategies to broaden women's access to digital services as a solution to this problem. Industry, governments, and social society must collaborate to intensify their efforts to bridge the digital gender gap, which includes investing more in enhancing digital skills for women, which is particularly in line with the feminist standpoint theory.

Revision of telecommunication policies

Telecommunications infrastructure development, along with national revenue and GDP, are the most important national-level determinants for resolving digital gender inequality. Investment in telecommunications by countries shows a higher level of ICT readiness (Bhandari, 2019). However, if existing gender gaps in digital participation are not addressed, investing in telecommunications infrastructure is ineffective. If not carried out effectively, this would probably result in gender inequalities in areas such as inequities in labor markets and lower financial inclusion for women (Mariscal et al., 2019).

Consequently, telecommunication policies should be designed to eliminate gender gaps in digital inclusion to empower women by preventing and eliminating gender inequalities in ICT use. While this is true, policy initiatives to close the digital gap should also place an emphasis on skills and confidence rather than just access or ability because the lack of use of ICTs is frequently due to a lack of desire to do so rather than physical or cognitive limitations (Grishchenko, 2020). An upscale grade of telecommunications infrastructure, for instance, would not help reduce GDD if women lacked the confidence to use it. Some studies show that policymakers should emphasize socio-demographic factors in defining digital inclusion policies in addition to the development of communications infrastructure (Afshar-Ali, Alam & Taylor, 2020). This necessitates the revision of such policies in South Africa and these policies should aim to improve social behaviors so that the deleterious results of societal and organizational operations are reduced, as supported by the critical information systems theory. South African authorities must gather data on access and usage of ICT that is segmented by gender and age. This will streamline the tracking and evaluation of progress and the development of communication plans and policies to empower women and girls to practice their digital rights, as is implied to be one of the benefits emanating from the application of the structuration theory.

Driving the women in STEM agenda from early education years

The feminist standpoint theory contests the belief of traditional scientific methods that excluded women from the inquiry and marginalized them in every element of knowledge benefits and

construction, making it pertinent to the STEM agenda (Gurung, 2020). Gender stereotype research has demonstrated that science is identified with men and manly characteristics (Makarova et al., 2019). While, based on various research, there has been a "leaking pipeline" in STEM education and jobs, with fewer women represented (Lykkegaard & Ulriksen, 2019). There are significant gender discrepancies in STEM in Africa because of economic, environmental, societal, and personal variables (Commodore-Mensah et al., 2020). Women continue to encounter less acceptability than men in STEM leadership, since organizational culture in numerous African countries still devalues women in leadership positions (Babalola et al., 2021).

Fundamentally, the STEM agenda ought to be centered on the idea of a thriving Africa built on equitable growth and sustainable development. Currently, the South African government recognizes that STEM education should begin in elementary school, as noted by Keane, Linden & Snead (2022). With the introduction of the Digital Skills for All Curriculum (DSfAC) for Grades R through 9, the South African Department of Basic Education (DBE) aims to increase STEM learning in the country's core curriculum (Bezuidenhout, 2021). Moreover, measures that bridge gender gaps in the classroom and encourage female STEM involvement must be implemented at a government and institutional level, as supported by the structuration theory. This will not only increase proficiency but will also pique and sustain girls' enthusiasm in the field, consequently enabling young girls and women to participate in the country's development as innovators in a labor market is increasingly focusing on innovation as South Africa transitions to 4IR.

Training and supporting women in the IT sector

Calitz et al. (2020) note how cultural and social dynamics contribute to mental, skills and usage encumbrances regarding the use of technology by women as compared to men. O'Donnell and Sweetman (2018) go on to more profoundly highlight that the GDD not only exists when it comes to access to technology, but even more so when it comes to the design and development of technological hardware and software, which consequently and inevitably creates an imbalance of power as men are more likely to control technological content. As supported by the critical information systems theory, it is imperative that women, particularly those in the IT field, receive the appropriate training and are empowered with a mindset shift which enhances their confidence in using and relating with technology. While encouraging the pursuit of IT careers among girls at an early age is critical to bridging the GDD, supporting women who ultimately pursue careers in IT is as imperative, especially in the South African context where social cultures and traditions may continue to prevail in a woman's adult life (Calitz et al., 2020). This necessitates that organizations and various relevant stakeholders perpetually and intentionally empower women within the sector to trust in their abilities and dexterity when it comes to creating and contributing to various aspects of technology (Naidoo, 2022), a strategy that is particularly aligned with the underpinnings of the structuration theory.

In line with O'Donnell and Sweetman's (2018) argument, for as long as men dominate IT professions and are better qualified or trained than their male counterparts in this regard, developing nations such as South Africa are less likely to leverage technology to remedy female inclined social challenges as the technological development would continue to assume a more male inclined narrative (Naidoo, 2022). For example, no matter how much progress has been made regarding technological

developments supporting the reduction of maternal fatalities during pregnancy and childbirth (Mlambo et al., 2022), as long as women are not the frontrunners in the development of such technology, the world will continue to miss out on the advances and progress that potentially could be made, as men are indirectly affected by this phenomenon and thus, less likely to prioritize it. This further highlights the possibility of a widened societal gap being created with regards to gender, if women in the IT sector are marginalized and left behind in the technologically driven future of our local and global communities (United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP), 2021), thus rendering the provisions of the feminist standpoint theory even more critical.

Limitations and Recommendations of the Study

As is inherently the case with conceptual and theoretical studies in general, this study lacked empirical substantiation. Further, the study focused on specific, rather than all-inclusive elements of the GDD, whereas other facets of the subject not included in this study may have resulted in alternative conclusions. Furthermore, although a global perspective was consulted when delineating the literature, the paper primarily tackled the research topic using theories more inclined towards a local perspective, that is, a South African perspective, which may have restricted the insights unravelled by the authors within the broader global context of the GDD.

The authors recommend further enquiry of the research topic using qualitative methods, quantitative methods, or a combination of both methods to empirically explore, investigate, substantiate and interrogate the conclusions reached in this research. The authors also recommend the conducting of further comparative studies which will explore and investigate the GDD across different global contexts, particularly scrutinizing the prevalent disparities between developed and developing countries and highlighting lessons and best practices that have been encountered by nations that have made more progress than others with regards to bridging the GDD.

Conclusion

While the literature suggests that the GDD is a global challenge, it is also evident that some countries, particularly those still developing, are worse off than others. South Africa, which was the focus of this study and is considered to supposedly be among the leading developing countries on the African continent, has also proven to fall short when it comes to encouraging equal access to technology as a cutting-edge resource for nation and economic building towards a more sustainable future. Although hindering aspects such as the improper apportionment of resources, systemic injustices resulting from the nation's history and cultural dynamics, and a further exacerbation by the COVID-19 pandemic, were some of the main contributors towards the unrelenting GDD in the country, other issues pointing towards a lack of proper planning, sound resource allocation and investment were uncovered. The study, therefore, suggests that the building of partnerships between government, industry, and social communities; the revision of telecommunication policies; the promulgation of the women in STEM agenda from early education years; and the training and supporting of women in the IT sector, are some best practices which can be adopted by South Africa in efforts to alleviate the currently prevailing GDD. While the conceptual approach adopted in the study allowed the authors to zone in

on key insights, further empirical enquiry is imperative to ensuring that the critical aspect of technology accessibility and design among all genders towards nation building and development is achieved, particularly in the post COVID-19 pandemic era.

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