



Gender, Technology and Development

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Gender, technology and development: reflections on the past, and provocations for the future

In our call for this 25th anniversary special issue we stated that “a reasonable, and epistemological, basis to begin with would be to question the central tenets of the journal, namely the separate and combined meanings of gender, technology and development.” This questioning is partly about understanding the emancipatory potential of development and technology, or of their interlinkages. However, as important as these connections are the editors never assumed a symbiotic and positive relationship, i.e., one in which development and technological changes would necessarily lead to greater gender equality and empowerment for women and sexual/gender minorities, or one in which techno-positivist assumptions were made about the relationship between technology and development.

As Govind Kelkar wrote in the editorial to the first issue of GTD in 1997, the creation of GTD assumed “added significance in an era that predominantly views liberalization, market economy, technology and technological sophistication as engineering development” and that editors and contributors to the journal “face the challenge of locating and interpreting hidden transcripts of gender difference in the fields of tradition, knowledge systems, technology and development” (Kelkar, 1997). Those connections have always been fraught with tensions, often because the influence and momentum behind changes induced in development and/or through technologies are interwoven with various relations of power that are still deeply marked by inequalities, of which gender inequalities are most persistent and broadly embedded in everyday life.

Dyadic relations between gender and development, and gender and technology are inherently paradoxical in that their emancipatory potential are countered by a process of patriarchal modernization that can be exclusionary and disempowering. That development can lead to gender equality and/or women’s empowerment has been both a premise of different development paradigms in the last several decades, including more recently with the Sustainable Development Goals (SDGs), and demonstrated in some contexts, and to some extent, through countless studies, including some in GTD since its launch in 1997. However, the fact that development itself is often a gendered process will not be new to any of our readers. Development is the product of both political processes taking place in institutions that are to this day mostly male-dominated, and, in most regions, economic processes that have not only been destructive of indigenous and gender knowledge systems but, also, undermined the agency and sources of livelihoods (especially in developing countries) for women and indigenous people. This critique of patriarchal structures can also be lodged against schools that focus on human-centered development (Truong, 1997) and the more recent focus on sustainability (Leach, 2016), and we can see this in increased submissions, in both this special issue and regular issues, that critically engage with pro-poor sustainable development approaches. Feminist political ecology, for instance, has not only helped us reframe environment/development linkages but has shown how even progressive agendas such as sustainability can reflect masculinist views of development/environment. Whether it is climate change mitigation or adaptation, agricultural research or poverty alleviation, such focus often starts with a completely gender-blind approach, and

this is also true of positive historical assessments of change in income, education and health (Alemany et al., 2019).

Yet the gender gap found in the context of technology is both particularly stubborn and wide. Technologies have always offered a challenging paradox, on the one side being key to making strides in health, education, agriculture and well-being, yet being fundamentally suffused with patriarchal power, especially in terms of how masculinity itself is defined by men's relations with and control over technologies (Wajzman, 1991). That paradox makes the use of technologies as a development tool highly contentious, as Sweetman (1988) noted almost 35 years ago, since they have the potential to significantly empower men and increase their control of gender power relations, undermining development goals of greater well-being for all, especially for women. This remark is still valid today with sustainable development advancing techno-environmental solutions (Nightingale et al., 2020), at the expense of a social nature approach that would address gender at its core (MacGregor, 2017; Resurrección & Elmhirst, 2008) and inequalities in political power that undermine progress toward sustainability (Doneys & Resurrección, 2022; Homsy & Lambright, 2021). The Covid-19 pandemic brought this dilemma in stark relief as technological solutions were unable to address inequalities that engender vulnerability, both in terms of health status and the socio-economic impacts of the pandemic (Ryan & Nanda, 2022).

This journal would not have been created if based on fear or rejection of technologies alone. GTD editors believed from the beginning that technologies present real opportunities for change, that they can in fact help women and more powerless or disenfranchised groups jumpstart processes of emancipation by lowering barriers to education or health in terms of remoteness, mobility, and expand the capacity to tap into the benefits that can be derived from a rapidly changing knowledge economy (Hostettler et al., 2015). That this emancipatory potential of technologies is there has been noted by feminist technology studies and in many of the articles GTD has published over the years (see for instance, in recent years, Alhayek, 2016; Abubakar & Dasuki, 2018; Gaybor, 2019; Kim & Standal, 2019; Lechman & Popowska, 2020; see also Oyosoro et al., in this special issue, in particular). Additionally, in some respects, low-income countries have fared better than their high-income counterparts. Stoet and Geary (2018) noted the gender equality paradox where high-income countries with higher gender equality score performed poorly on indicators of women in Science, Technology, Engineering and Mathematics (STEM) (though debates on the extent of this paradox are still raging, see Richardson et al., 2020). More generally the earlier paradox mentioned above (technologies meant to empower women but advantaging men) suggests that the introduction of technologies for better development outcomes would require a clear, comprehensive and well-funded gender strategy.

This tension between gender, technology and development is really what we aimed to examine in this special issue, both because of the anniversary, asking us again to "look forward and look back" (Kusakabe et al., 2017), but also because the development of technologies (especially digital technologies) in the last 25 years has been unprecedented in history. Some of these changes have been positive, for instance in the way social media, through #MeToo especially, generated a bottom-up momentum toward accountability and justice for the widespread sexual harassment and sexual violence taking place that often went unpunished (Chandra & Erlingsdóttir, 2021). Social media have also been one type of technology where women have been early or primary users. Yet, the last 5–10 years have also been marked by technology-induced socio-political crises, especially the use of ICTs and social media in ways that promote mis/dis-information (Zimdars & Mcleod, 2020), undermine social cohesion and reinforce authoritarian propaganda and surveillance. This raises serious ethical issues with gender as a key area of concern. More recent

developments in AI and robotics take these concerns to a greater level (Søraa, 2017), with risks of vicious cycles being triggered as biased design and datasets not only reproduce gender in time (a pattern obvious in robot hardware), but actually amplify the more extremist forms, both in their discriminatory intent and their ability to widen gaps between those who control and use these technologies and those who are kept out. Although these power dynamics overlap between gender, ethnicity, race, religion, and other forms of social differentiations, gender remains a key structuring force of technological change.

Tensions between gender and development on the one side, and gender and technology on the other, have often been the basis of studies published in GTD. That separated focus was often the results of a gap between Feminist Science and Technology Studies, often focused on technology-reliant high-income countries, and more development-environment focused studies of gender inequalities in the so-called Global South. This is reflected in Donna Haraway's contrast between Cyborg and Goddess, as Nina Lykke noted in the first issue of GTD, with a North American feminist biologist clearly welcoming the cyborg as "fit to articulate quite different stories, critical stories, and to subvert and undermine hegemonic power structures of the present-day world" on the one side, and Indian physicist and ecofeminist Vandana Shiva's "critique of global power structures and the destructive logic of technoscience" to be resisted through women's spiritual connection with and knowledge of nature, on the other (Lykke, 1997). One view subverts fixed gender/sex while the other redefines it on more equal footing. Lykke proposed back then a bridge between these as representing a "feminist desire to finally discard the Cartesian split between human (= masculine) subject and stupid subjectless matter in favor of dialogues between human and non-human actors, embodied and localized in radically subjectified, multiple and diverse matter." Lykke's suggestion that these contrasting approaches can serve as "feminist points of departure for the disruption of the current social relations of science and technology" has indeed been the case for many articles published in GTD over the years. More recently articles have increasingly tackled relations between gender, on the one side, and technology and development combined on the other. This is in part explained by how digital and mobile technologies have become pervasive in different parts of the world, including in the most remote and low-income areas, forcing development research to tackle the role of technology in both empowerment and disempowerment processes.

It is between this renewed hope that technologies can provide entry points to empowerment and justice and continuing concerns (in some areas mounting concerns) with the risks that technology entails in terms of generating gaps and undermining equal development, that this special issue begins to question the central tenets of this journal. This tension is clear throughout the special issue, in both perspectives/commentaries and empirical papers.

The article by Ardra Manasi, Subadra Panchanadeswaran, Emily Sours and Seung Ju Lee on the potential for AI to mirror gender bias is both timely and relevant to our special issue, as it takes on the fundamental paradox offered by AI as both a tool for change and an instrument of inequality. Bias can be unintentional (yet have negative outcomes), for instance when the data is biased through selection or preparation, or through a biased algorithm using that data, but it can also be intentional in stereotypical understanding of gender orders with a gender division of AI labor that assigns "affective labor" to "feminine" AI (represented through voices, attitudes and behavior) while "instructing or lecturing" labor is attributed to "masculine" AI. This gender order becomes particularly problematic when this AI is integrated in robots that are themselves gendered materially or physically, since stereotypes are then visually replicated. As the authors suggest, overcoming this bias will require more than just addressing bias in current applications but also using AI-powered tools to address bias and inequality.

A similar argument is found in a broader examination of gaps in technology-related fields in Sophia Huyer and Eugenia Nunez's article about "breaking through the silicon wall." As the authors note, these persistent gaps are a particular concern considering how the latest development in digital technologies, including AI, "may reverse momentum in gender equality and empowerment" as the economy is increasingly driven by these technologies. They underline promising opportunities that these technologies can provide in some contexts, such as the way ICTs can promote economic independence or be used toward gender justice, yet the slow pace of change demands real concerted efforts. They also proposed that taking "a solid analysis of intersectionality could be a new pathway to break the impasse" to reduce gaps in representation that spans different forms of social differentiations.

Yet as these technologies are rapidly developing, the ability of societies to reduce gender gaps is lacking. Ewa Lechman and Magdalena Popowska's article on overcoming gender bias in the digital economy shows, using World Economic Forum reports, Eurostat, and UNESCO databases, that gender gaps in STEM fields are a real concern in Europe. Gender gaps in STEM education enrollment are still important, although there has been limited progress in some countries. However, gender gaps in STEM graduate representation are persistent and any progress has been negligible, with women representing only around one-third of graduates in Europe. When it comes to STEM related employment the gaps are both large (women represent half men's number) and actually increasing in many countries. The authors also conclude that progress in female STEM graduates does not translate into greater employability. The ICT sector fare among the worse fields, which is particularly worrying considering the pace of technological change with regards to digital technologies and robotics, but also because ICTs are at the core of knowledge economies and support the growing importance of information as a driver of economic growth. The article also shows, as many increasing submissions to GTD demonstrate, that development challenges are not limited to low-income contexts. Their findings support the gender equality paradox since the number of female STEM graduates and employees in Europe, as found in this article, remains well below those found in many low and middle income countries such as Thailand, Philippines and Kazakhstan in Asia where more than 50% of their STEM researchers are women (though the gap is pronounced in all contexts with regards to engineering) (UNESCO, 2017).

Still, as the article by Claire Babirye, Chisenga Muyoya, Suvodeep Mazumdar, Andrea Jimenez, Ciira Maina, Jabhera Matogoro, Margaret Nyambura Ndungu and Dorothea Kleine on data science training for women and girls in Africa shows, there are concerns about breaking a cycle between education and work in technology-related fields that tend to exclude women and girls. The article suggests ways forward that are presented, for instance by addressing representation in training material, the use of unequal language and imagery, or the lack of participation in the policy process, combined with proven methods such as greater accessibility to mentors, dedicated scholarships (easier to implement in some contexts, we would argue, than affirmative action measures), and collaborative methods such as peer-to-peer support. As the authors suggest, this would help identify "causal pathways that link ICT and data science and women's empowerment," especially as ICT4D projects often use empowerment as a goal without adopting a more critical approach that would simultaneously address barriers while identify what works.

Similarly, Becky Faith notes in her paper how technologies proposed to empower often end up doing the opposite, particularly as they refer to ICT4D. Applications of ICT for development have often been implemented with a goal of empowerment without an understanding of power dynamics that is at the root of social and gender inequality. This not only undermines the emancipatory potential of these technologies but in fact

contributes to making them tools for online gender-based violence (GBV). Reversing this would require a fundamental questioning of and resistance to the production of visible, hidden and invisible power in socio-technical systems and infrastructures, that are exclusionary, especially when it comes to women and minorities. It also requires moving sole responsibility for tackling online GBV away from individuals and toward companies and governments that act as support mechanisms to this GBV. In addition, this violence amplifies real world GBV, and so there is an urgent need to address it, especially as it has the potential to undermine recent progress made in terms of gender equality. The way “these mechanisms are embedded in the power relations and business models of the technology industry” suggests that solutions will require challenging what Faith describes as “the economic models which underpin social media platforms, the limited leverage of governments and international bodies, the technological architectures which promote and enable hate speech and gendered digital inequalities which pervade the technology industries and governing bodies.” Revealing these power dynamics is a part of the solution, but so is the promotion of different forms of transformative power, according to Faith, that can resist and weaken these forms of exclusionary power systems.

One article by Rok Smerdelj and Mojca Pajnik on online media reporting on same-sex partnerships in Slovenia is indicative of two developments within GTD, one is an increasing discussion of the power of media, especially through technological innovations in the digital age with a reflection of gender, at least for a gender and development journal, that addresses processes of exclusion and marginalization experienced by sexual and gender identity minorities. The article also contributes to the special issue discussion around the power of online media and technologies as both tools for empowerment and tools of exclusion. More specifically, the authors note the failure of online media to address the intersectional realities of same-sex relations, treating individuals in same-sex partnerships as a homogenous group devoid of intra-group differences, while at the same time being unable or unwilling to recognize “the different contexts of social exclusion of same-sex partnerships as a result of intersectional identity.” In the process, “the lack of specification of various contexts of social exclusion of same-sex couples in liberal discourse contributes to its weakening and the strengthening of discourses against it”, discourses which represent discriminatory and exclusionary forces that hijack a gender defense in the name of traditional and biased gender norms and roles.

Dev Nathan, Govind Kelkar and Pallavi Govindnathan take a different perspective to the debate on technology and development from all the above, focusing on the knowledge economy. They argue that women are excluded from certain areas of knowledge. Such exclusion is important to address since gendered knowledge inequality leads to other forms of inequality. They give a rich example of practices among indigenous groups and in Hindu caste system where women are prohibited to acquire knowledge that is transferred in the form of rituals for indigenous people and in Vedic texts for brahmins under Hindu caste. Women who try to access such knowledge are denounced as witches. Their argument can also be applied to the current situation of women in science and in STEM education. The exclusion of women from science and knowledge creation has become more subtle – women and girls have internalized the value that STEM is for men and boys, while in the earlier days, as described by Nathan, Kelkar and Govindnathan, such exclusion was done through violence.

Felix Idongesit Oyosoro, Chinaemelum I. Okafor, and Ruth Aigbe, in their article about Black Cyberfeminism and women’s influence on the #EndSARS protest against brutal police tactics in Nigeria, take a more positive view of technologies as enabling emancipation through information and awareness raising. In this case digital technologies amplified the

work of the Feminist Coalition (FemCo) by bringing attention to issues that were not getting discussed or noticed by traditional media and institutions. Another important contribution of this article is to highlight the contribution of women to both a protest movement and to the digital advocacy used to strengthen the impact of the movement. We often discuss the lack of women's access to science and technology, but research also needs to question that vacuum, since as researchers we may overlook women's contributions and, in the process, reinforce the invisibility of women when in fact women's actions and contributions are key (see for instance Dung et al., 2019, on the work of women programmers being important yet overlooked). In this case, the authors make a compelling case that the #endSARS movement owes its success in terms of advocacy and mobilization to women, and more specifically to the Black cyberfeminist movement.

Although GTD is receiving a growing share of submissions that examine recent digital technologies, the journal has also been a platform for studies of technologies at large, especially in the context of fisheries and agriculture. Meryl J. Williams and Victoria Syddall's paper in this issue sheds light on the linkages between gender, technology and development from the perspective of fisheries. It provides an overview of historical changes in how women/gender have been discussed in the context of fisheries technologies. The paper takes the wider definition of technology as not only the standard industrial or biological understanding of technology but also the social organization and networks that enable the productive process, as defined in GTD's 20th anniversary issue (Kusakabe et al., 2017). Williams and Syddall analyze the three characteristics that situate women in technology – the gender division of labor, the focus that fisheries sector has on capture fisheries where men dominate, and women's invisibility in fisheries. They further discuss how feminist technology studies examining the impact of technologies on women have challenged the invisibility of women. However, feminist technology studies are not enough to capture “the broad spectrum of interrelated society, economic, infrastructure, technology and political factors across different hierarchal levels of control.” In order to reflect the inter-relationships between different factors and aspects, Williams and Syddall argue that gendered approaches to sociotechnical systems and transitions research are needed. It is particularly important, as they emphasize, that “feminist research also commits, implicitly or explicitly, to social action. Feminist fisheries research is inherently political.” The importance of analyzing gender and technology with its link to the political economy cannot be highlighted enough to maintain a critical eye on technology development – how technology uses impact gender relations as well as how technology development is shaped by them, and not to treat women as a tool for technology dissemination.

The Issue carries two more papers on fisheries. One is by Nikita Gopal, Rakesh M. Raghavan, Sruthi P., Rejula K. and Ananthan P. S., and the other by Maria Pena, Patrick McConney, Leisa Perch and Terrence Phillips. Gopal et al. address women's contribution in capture fisheries in Kerala, India. They focus their analysis on the invisibility of women's contribution in fisheries which echoes Williams and Syddall's starting point of concern when discussing gender and fisheries. They show the wide spectrum of women's contribution to fisheries from gleaning to diving. They also highlight the precariousness of women fishers because they do not have legal access to fishing areas. Women depend on *kettus*, which is a private fishing ground, as a customary practice, but the owners of *kettus* are shifting their usage to aquaculture and other industrial use, squeezing women out of fisheries. Pena et al. study the organizational leadership of Caribbean fisherfolk organization. Women in fisherfolk organization is another area of invisibility for women in fisheries. They argue that changes toward greater attention given to women in fisherfolk organization leadership came about when women's role in decision making was highlighted in global

and regional guidelines such as the 2014 Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines).

Some of the papers that were submitted and published for this special issue reflect an important focus for GTD over the past 25 years – that is, rural livelihoods. Aside from fisheries, the special issue includes one article on agriculture (by Katie Tavenner, Todd A. Crane, Renee Bullock and Alessandra Galiè) and one on agriculture extension (Gloriose Nsengiyumva, Graham Clarkson, Tatiana Gumucio, Peter Dorward and Chantal Ingabire). Tavenner et al.'s paper introduces a step-by-step guide to intersectional approaches to agricultural research for development (AR4D). They argue that many studies using intersectional approaches take into consideration “single identity intersections or ‘snippet’ approaches to intersectionality,” so there is a need to go beyond piecemeal approaches. However, the deeper the intersectional approach gets, the more fragmented social identities can be. Although there is no denial that an intersectional approach is useful to understand how a person is affected by these different social identities, the authors caution that the approach face challenges “in ways that are politically useful in terms of developing interventions that address specific axes of social difference.” Finally, Nsengiyumva et al. analyze the outcome of the Participatory Integrated Climate Services for Agriculture (PISCA) training and found that even though both women and men are stimulated to make changes in their agricultural practices through training, poor women household heads have the most difficulty in making changes. They have attributed the disadvantage to women heads of households’ relations with other household members, their access to land and money, as well as social networks.

The special issue aimed to reflect on the past and provide provocations for the future. All the perspectives/commentaries and empirical papers in this special issue reflect the ways GTD has changed as a journal over 25 years, with an increasing focus on the gendered impact of technologies, especially recent advances in digital technologies and robotics. The gender and development challenges brought by these technologies are also transcending our understanding of development in various ways, for instance in the way development was primarily understood as relevant only in resource-poor contexts, or a view of gender and development focused on women, in part because of the sheer scale of inequalities between women and men around the world. The lack of focus on sexual and gender identity minorities however contributed to a view where issues of sexuality and gender identity did not matter in development, which effectively erased the gendered experience of these individuals and groups and prevented research and policy solutions conducted in or created for a development context. As a gender and development journal, many of our submissions tend to amplify the concept of gender as binary, or heterosexuality as the norm, and we hope going forward that the journal can contribute to research which questions this binarism and heteronormativity, including through iterations of queer thinking in specific development contexts (Mawdsley, 2020). Similarly, theorizing on gender-based marginalization of certain groups of men and subordinate masculinities can provide nuanced insights into the evolving conceptualizations of gender and development. Society has historically accepted the notion that men may face violence as combatants (a violence long made legal in the laws of war), but vulnerability is also an outcome of masculinist notions of men’s health or hegemonic masculinity both erasing and being abusive to other forms of masculinity, as Raewyn Connell (2005) argued, or an outcome of gender expectations in terms of provider or breadwinner roles that have become fractured or difficult to fulfill in a changing economy and/or climate. Men’s vulnerability can lead to further violence among and against themselves (in the form of suicide) as well as to others, particularly against women (domestic violence and other forms of GBV).

This of course does not detract us from continuing to examine and research aspects of development and/or technology that have emancipatory potential, or that remain deeply exclusionary to women. However, as most development processes or activities are male dominated or controlled, for instance in fisheries and agriculture, or climate change mitigation and adaptation, where women contribute significantly yet are invisible or unrecognized, women are often left out of decision-making and therefore remain unsupported and disadvantaged. As several papers in this special issue suggest, feminist scholarship remains a key contributor to critically rethinking development and development studies, and their linkages to technology.

A thread of “provocation” found in submissions covering more recent digital technologies, however, underlines a worrying trend where technologies are being created at such a fast pace, with increased sophistication and complexity, that society remains behind in understanding their impact and therefore late or unable to form a new social contract that would promote opportunities created by technologies while eliminating the bias and conflict they can generate. When it comes to gender, this concern is particularly valid considering the bias against women in technology development, use and derived benefits. We can see that in the combination of AI and robotics where a gender order becomes “fossilized” socially and culturally in software, and physically in hardware; potentially being less flexible or unchanging than a socially constructed gender order, therefore both “mirroring the gender bias” in society and serving as its model, and consequently creating a vicious cycle between technological representations of gender and social constructions (including how technology may re-inscribe binary and stereotypical gender roles and norms). This should underline the urgency of addressing the gender bias found in technology. Yet, as many articles have shown – particularly by Huyer and Nunez, and Lechman and Popowska – we have made little progress in addressing gaps with regards to women in STEM (in some cases the gaps have increased).

As with the #endSARS article, GTD has carried over the years examples of success in technology development and application that help reduce the drudgery of women’s everyday lives and/or make gender relations more equal, and these successes need to be highlighted and amplified. It is in fact a general assumption in this special issue that technology has great emancipatory potential if we recognize the gendered construction of technology and address it through gender transformative change toward gender justice and within a broader application of ethical principles with respect to technology and development. There is an urgency in highlighting the gendered effect of use and creation of technologies to minimize the negative effects that marginalize women and other vulnerable groups of people and maximize the emancipatory potentials. The effect of technologies differs and changes in time and space. Understanding such temporal and spatial perspectives is what drives GTD to continue carrying out insights from around the world, from both high-income and low-income contexts and from different cultures and belief systems.

Finally, in the spirit of questioning the central tenets of our work for this 25th anniversary special issue, and as a journal hosted by an academic institution in Thailand, GTD remains committed to exploring development in broader anticolonial contexts by supporting scholarship from the Global South (for lack of a better term), and especially indigenous and minority perspectives (Icaza & Vázquez, 2016; Mohanty, 1984). The publishing process in academic journals can contribute to exclusionary processes turning knowledge production into a reflection of who holds power (a patriarchal pattern noted in Nathan, Kelkar and Govindnathan’s paper in this special issue) while gatekeeping out good research from less known, or acknowledged, academic institutions in the Global South. This process can also be observed with regards to gender research, as feminist studies from the Global

South struggle to be heard or accepted in Western centric and/or neoliberal feminist journals. An anticolonial approach should also highlight that development is not an issue that only concerns or happens in the Global South, as gender-based and other forms of vulnerability, inequality and marginalization processes in the Global North are both common and, with respect to specific groups, also growing. While both reflecting on the past, and outlining potential provocations for the future, it is important that we ensure, as gender and development scholars, to avoid repeating harm caused by elitist and masculinist scholarship that should be antithetical to gender and development research.

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