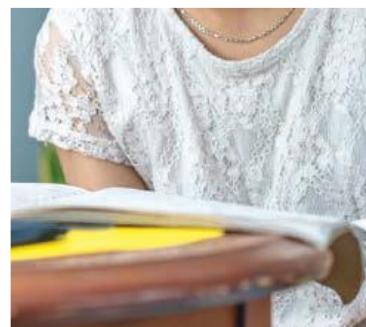
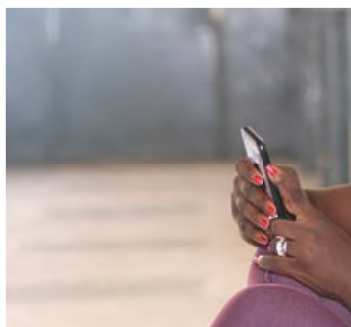
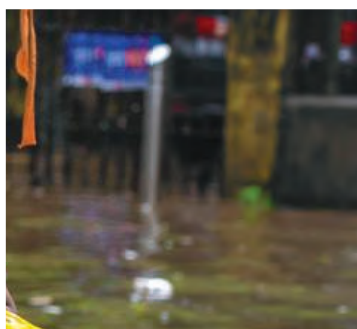


# Women, ICT and emergency telecommunications: opportunities and constraints



In partnership with:





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## Foreword

In the wake of a disaster, women are more vulnerable and more likely to die than men. Yet how often are their needs specifically addressed in work to prepare for, respond to and recover from disasters, even though doing so could unlock many opportunities and unblock many constraints?

In the 1991 cyclones that hit Bangladesh, 90 per cent of the 140 000 victims were women. In the deadly heat waves that hit France in 2003, most fatalities were elderly women. During the 2005 Hurricane Katrina emergency in New Orleans, most of the victims were Afro-American women and their children. And yet again, with the COVID-19 pandemic, women are bearing the brunt; not only because they represent an estimated 70 per cent of frontline healthcare workers and undertake most of the care work in the home, but because their over-representation in the informal economy and lower pay rates mean they are significantly harder hit by the economic downturn.

In such times of crises, access to accurate information is life-saving and life-changing for women, their families and their communities. Their perspectives and experiences, as well as their ability to organize, lobby and inform, can dramatically improve disaster risk management. That is why we need more innovative and culturally sensitive approaches to empowering women and girls through digital networks, platforms and technologies.

With many years of experience in delivering communications in times of disasters, ITU and the other partners of the Emergency Telecommunications Cluster (ETC) can attest to the importance and impact of such empowerment. That is why we are working to involve more women in the development of national disaster management strategies and strategic consultations on disaster preparedness and response, including for early warning systems.

We hope this joint paper will go a long way towards integrating women's needs into national disaster risk reduction frameworks, as well as in ensuring they get access to the digital tools that can play such an important role in their own safety and security, and that of their families and communities.



Doreen Bogdan-Martin  
Director  
Telecommunication Development Bureau, ITU



Enrica Porcari  
Chief Information Officer and Director  
Technology Division,  
World Food Programme (WFP) and  
Chair, Emergency Telecommunications Cluster (ETC)

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# Acronyms

AAP	Accountability to Affected Population
BMZ	Federal Ministry for Economic Cooperation and Development of the Federal Republic of Germany
BRAC	Building Resources Across Communities
C4D	Communication for Development
CAR	Central African Republic
CFM	Common Feedback Mechanism
CIMA	Centre for International Media Assistance
Cinterfor	ILO Inter-American Centre for Knowledge Development in Vocational Training
CRED	Centre for Research on the Epidemiology of Disasters
CwC	Communications with Communities
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ENSO	El Niño-Southern Oscillation
ETC	Emergency Telecommunications Cluster
ETS	Emergency Telecommunications Sector
FORCOM	National Forum of Community Radios in Mozambique
GBV	Gender Based Violence
GDN	Gender and Disaster Network
GFDRR	Global Facility for Disaster Reduction and Recovery
GMMP	Global Media Monitoring Project
GSM	Global System for Mobile Communications
GSMA	GSM Association
HF	High Frequency
HFA	Hyogo Framework for Action
HCO	Humanitarian Calling Operations
IADB	Inter-American Development Bank
IAM	Identity and Access Management
IASC	Interagency Standing Committee
ICT	Information and Communication Technology
IDPs	Internally Displaced Persons
IDRC	International Development Research Centre
IFRC	International Federation of Red Cross and Red Crescent Societies
IGF	United Nations Internet Governance Forum
ILO	United Nations International Labour Organization
INGO	International Non-governmental Organization

IOM	International Organization for Migration
IoT	Internet of Things
ISO	International Organization for Standardization
ISOC	Internet Society
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
LDCs	Least Developed Countries
LDRI	Local Development Research Institute
LMICs	Low- and Middle-Income Countries
NCWIT	National Center for Women and Information Technology
NETP	National Emergency Telecommunication Plan
FORCOM	National Forum of Community Radios, Mozambique
NGOs	Non-governmental Organizations
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
RAG	ITU Radiocommunication Advisory Group
SADD	Sex-disaggregated data
SDGs	Sustainable Development Goals
SIDA	Swedish International Development Cooperation Agency
TSF	Télécoms Sans Frontières
UCL	University College London
UHF	Ultra High Frequency
UN APCICT-ESCAP	United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VHF	Very High Frequency
VoV	Voice of Viet Nam
WHO	World Health Organization
WFP	World Food Programme
WOUGNET	Women of Uganda Network

<i>Amateur (ham) radio</i>	A non-commercial radio service used by licensed operators for experimentation, self-training, recreation and emergency communication
<i>Apps</i>	ICT applications, typically which run on mobile phones
<i>Artificial intelligence (AI)</i>	Machine-based techniques and systems that are able to recommend, predict or make decisions in response to specified objectives
<i>Big data</i>	Techniques used to combine and analyse massive sets of diversely-sourced data to guide decision making
<i>Biometrics</i>	The automated recognition of individuals based on their biological and behavioural characteristics
<i>Blockchain, (distributed ledger technology)</i>	A digital technology which utilizes a public distributed database to store records
<i>Call-in radio</i>	A programme format in which listeners are invited to share their live comments by telephone
<i>Digital platform</i>	A technology that facilitates interaction and that can scale massively, with value proportional to the size of its user base
<i>Disaster</i>	An event that overwhelms local response capacity and impacts social and economic development
<i>Disaster risk</i>	The probability of vulnerable conditions and the impact of disasters on lives, property, livelihoods, economic activity and the environment
<i>Disaster Risk Management (DRM) cycle</i>	The four phases of concern to the management of disaster risks before, during and after the actual event: mitigation, preparedness, response and recovery
<i>Disaster Risk Reduction (DRR)</i>	A systematic approach to identifying, assessing and reducing the risks of disaster, which aims to reduce socio-economic vulnerabilities to disaster and treat with the environmental and other hazards that trigger them
<i>Drones</i>	Small mobile units, such as Unmanned Aerial Vehicles (UAVs), that are remotely controlled or that can operate autonomously
<i>Free-to-air (FTA)</i>	Telecommunications service broadcast wirelessly to the public for no fee
<i>Gender digital divide (digital gender divide or digital gender gap)</i>	Gender-based gaps in the access to, and usage of, ICT and to the corresponding digital opportunities to live the life one values
<i>Gendered disaster vulnerability</i>	Women's higher risk at all stages of the disaster risk management cycle due to geographic, economic, social, educational, political power and other imbalances
<i>Gender Inequality Index (GII)</i>	A measure of gender inequality computed on the basis of reproductive health, empowerment and economic status.

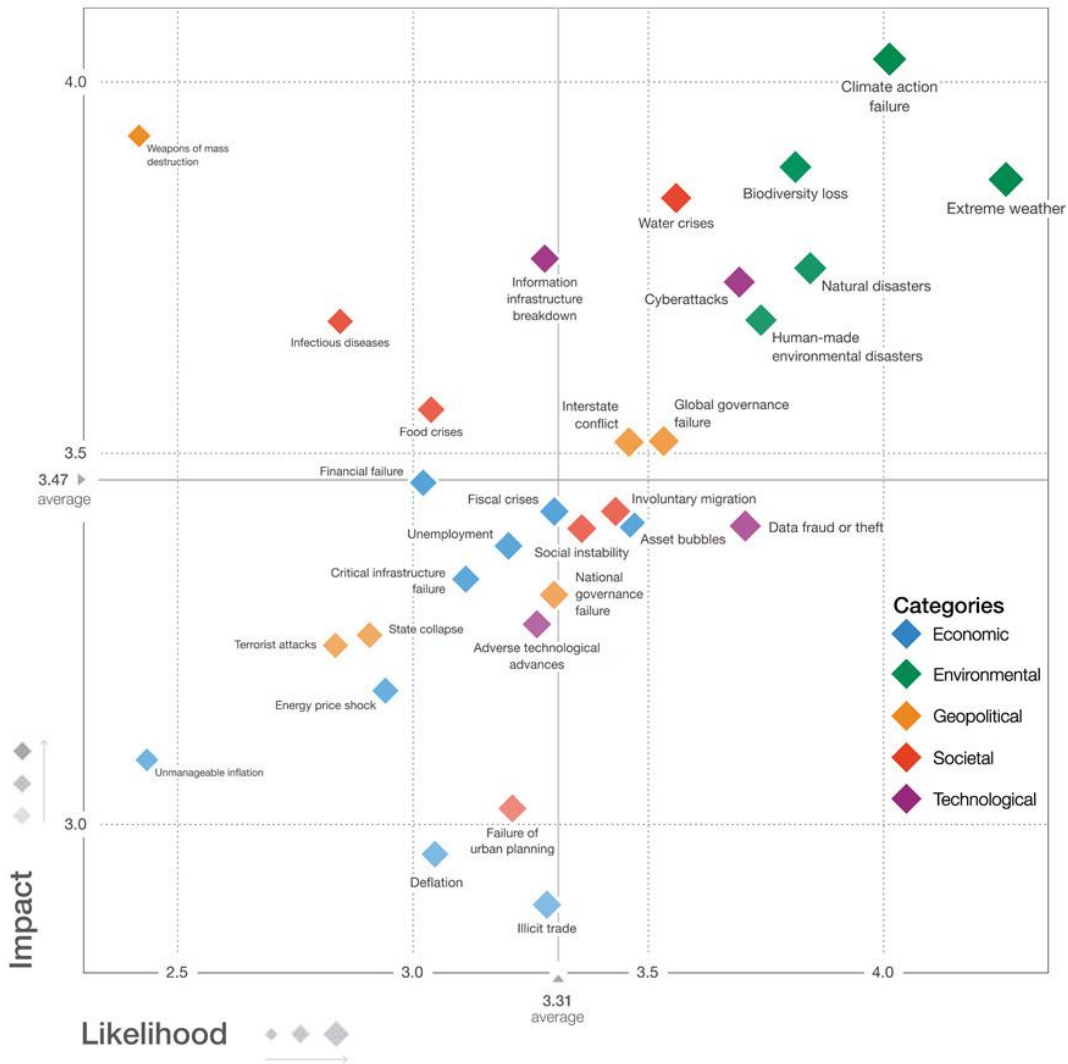
<i>Hotline</i>	A direct telephone line, typically toll-free, available to the public to reach emergencies or for communication between heads of government
<i>Information and Communication Technology (ICT)</i>	Electronically mediated forms of communication, storage and manipulation including devices, networks, services, and applications.
<i>ICT product life cycle</i>	All processes involved in the design, development, deployment, support and marketing of information and communications products
<i>Interactive Voice Response (IVR)</i>	A technology which enables human interaction with computers using voice communications through various devices, particularly phones
<i>Internet of Things (IoT)</i>	A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies
<i>Internet penetration rate</i>	The percentage of the total population of a given country or region that uses the Internet
<i>Land mobile radio</i>	A radio service used by private and public safety organizations and other first responder agencies, for critical and emergency communications
<i>Mobile money</i>	A scheme through which payments can be made and received through a mobile phone to a mobile money account, a mobile voucher for arbitrary purchases, or a mobile voucher specific purchases
<i>Resilience</i>	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management
<i>Telecommunications</i>	The transmission of signs, signals, messages, words, writings, images and sounds or information of any nature by wire, radio, optical or other electromagnetic systems
<i>World Risk Index (WRI)</i>	A measure of risk assessed on the basis of exposure, susceptibility, coping capacities and adaptive capacities

# 1 Introduction

Disasters are the result of events that overwhelm local response capacity and impact social and economic development. Humanitarian response sets out to save lives and alleviate suffering caused by environmental disasters, including those arising from natural hazards and pandemics; and human-made disasters, including those arising from armed conflict. Disaster risk takes account of the probability of vulnerable conditions and the impact of disasters on lives, property, livelihoods, economic activity and the environment (UNDP, 2010). Risk is therefore highest for disaster prone communities which are otherwise particularly vulnerable.

The World Economic Forum (WEF) Global Risks Landscape for 2020, assessed prior to the COVID-19 global pandemic, is depicted in Figure 1. It shows that environmental risks (climate action failure, extreme weather, biodiversity loss, disasters caused by natural hazards and human-made environmental disasters) feature among those with the highest combined rankings in likelihood and impact. Disasters caused by natural hazards, a keen focus of humanitarian work, claimed in excess of 1 330 000 lives and accounted for more than USD 2 900 billion in losses worldwide over the 20-year period from 1998 (CREC, 2018).

Figure 1: Global Risks Landscape 2020



Source: World Economic Forum, 2020

The Bündnis Entwicklung Hilft 2019 World Risk Report computes the World Risk Index (WRI) in terms of exposure (to earthquakes, cyclones, floods, drought, and sea-level rise), susceptibility (which depends on available infrastructure, food supply, and economic framework conditions), coping capacities (based on governance, healthcare, social and material security) and adaptive capacities (related to natural hazards, climate change and other challenges). Among other things, the report finds that island states are at particularly high risk on account of high levels of exposure and in many cases susceptibility, alongside poor coping and adaptive capacities. High exposure does not necessarily equate to high risk as some islands, and other countries, have very high exposure profiles but feature low levels of susceptibility along with high coping capacities. Japan, with its high exposure to earthquakes, is a case in point.

Disaster risks are strongly linked to aspects of poverty and inequality (IFHV, 2019) (UNDRR, 2015) (UN, 2020). Within countries, then, disaster risk is differentiated by a variety of pre-existing socio-economic conditions and cultural norms. Social vulnerability, the limited capacity to prepare for, respond to and recover from the impact of future disasters based on prevailing social and cultural norms (Llorente-Marrón, Díaz-Fernández, Méndez-Rodríguez, & González Arias, 2020), heightens the impact of disasters.

There is convincing evidence that gender is one of the determinants of social vulnerability (Oxfam, 2005) (Giovene di Girasole & Cannatella, 2017) (Bahadur & Simonet, 2015). One measure of gender inequality is the Gender Inequality Index (GII) (Gaye, Klugman, Kovacevic, Twigg, & Zambrano, 2010) which is computed on the basis of reproductive health, empowerment and economic status. Reproductive health is measured in terms of maternal mortality ratio and adolescent birth rates; empowerment is measured on the basis of the proportion of parliamentary seats occupied by females and the proportion of adults 25 years and older with at least some secondary education; and economic status is measured in terms of the labour force participation rate of female and male populations aged 15 years and older. GII values range from 0 to 1, with higher values indicating higher levels of inequality between women and men. The most recent data on GII are available for the year 2018. Table 1 shows available GIIs for the 10 countries with the highest World Risk Index in that year (UNDP, 2020).

**Table 1: 2018 Top 10 countries at highest risk of disasters and their gender inequality indices**

Country	Region	2018 World Risk Index Rank (Value) <sup>1</sup>	2018 Gender Inequality Index <sup>2</sup>
Vanuatu	South Pacific	1 (50.28)	<i>Not available</i>
Tonga	South Pacific	2 (29.42)	<b>0.418</b>
Philippines	Southeast Asia	3 (25.14)	<b>0.425</b>
Solomon Islands	Oceania	5 (23.29)	<i>Not available</i>
Guyana	South America	4 (23.23)	<b>0.492</b>
Papua New Guinea	Southwest Pacific	6 (20.88)	<b>0.740</b>
Guatemala	Central America	7 (20.60)	<b>0.492</b>
Brunei Darussalam	Southeast Asia	8 (18.82)	<b>0.234</b>
Bangladesh	South Asia	9 (17.38)	<b>0.536</b>
Fiji	South Pacific	10 (16.58)	<b>0.357</b>

<sup>1</sup> Source: (IFHV, 2019)

<sup>2</sup> Source: (UNDP, 2020)

Women in countries that are at high risk for disasters and for which there exist high levels of gender inequality represent a particularly vulnerable population. Table 1 shows that eight of the ten countries at most risk in the sample year, 2018, are island nations in Asia and the Pacific. It also shows that nine of the ten feature GII values above the average (0.350) computed over 169 countries for which data are available (UNDP, 2019a). The region with the highest 2018 GII was South Asia (0.510). Though rankings and indices vary somewhat from year to year, Asia has been the most exposed to disasters, accounting for 39 per cent of the world's climate-related disasters and 62 per cent of its geophysical disasters over the 20-year period from 1998 (CREED, 2018).

Disaster impacts include loss of life and the destruction and damage to property, other assets and the environment, both natural and built. Disruption to essential services is in many cases debilitating. Disaster impacts also include injury, disease and other negative effects on physical, mental, social and economic well-being. The displacement of persons from their homes is another debilitating impact of disasters, with women and children accounting for more than 75 per cent of refugees and displaced persons at risk from war, famine, persecution and disasters (UNFPA, n.d.). In Indonesia alone, three earthquakes, two tsunamis and a volcanic eruption between 2004 and 2010 left 1 035 000 persons displaced (World Bank, 2012). Many of the vulnerabilities of affected persons, particularly women, derive from pre-existing social, cultural, economic and other conditions that prevail pre- and post-disaster. Disasters amplify these vulnerabilities (Llorente-Marrón, Díaz-Fernández, Méndez-Rodríguez, & González Arias, 2020).

Risk management has been widely adopted by organizations, communities and countries to reduce the impact of disasters. The disaster risk management (DRM) cycle comprises four phases: mitigation, preparedness, response and recovery. Disaster resilience is correspondingly built through measures and capacities employed before, during and after the event. This report adopts the United Nations Office for Disaster Risk Reduction (UNDRR<sup>3</sup>) definition of resilience as “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management” (UNDRR, n.d.).

Information and communication technologies (ICTs) have come to play a central role in managing disaster risks (Williams & Phillips, 2014) (UN-APCICT/ESCAP, 2016) (ITU-D Study Group 2, 2017). However, women are on average less able to access ICTs than are men: globally, they use the Internet 17 per cent less, with a wider gap in Least Developed Countries (LDCs) (ITU, 2019a). Women in low- and middle-income countries are also 10 per cent less likely than men to own a mobile phone. The gender gap in mobile ownership is widest in South Asia (ITU, 2019a) and is not closing (GSMA, 2019a).

### Purpose and approach

This report sets out to assess whether ICTs used to reduce disaster risk are benefiting women and men equally. It does so by considering vulnerability alone as it examines women's circumstances in relation to men's in the same geographies and with the same ICT infrastructure. It examines gendered disaster vulnerability as well as the gendered digital divide. In each case, vulnerability is considered from the lens of affected persons' capacity to mitigate and prepare for (before), respond to (during) and recover from (after) disasters. These examinations and a range of ICT initiatives currently used to reduce gendered asymmetries, inform recommendations for ICT-enabled disaster risk reduction (DRR) for the most vulnerable. DRR refers to the systematic approach to identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as to treat with the environmental and other hazards that trigger them.

<sup>3</sup> Formerly United Nations Office for Disaster Risk Reduction, UNISDR

## 2 Gendered disaster and digital asymmetries

### 2.1 Gendered disaster vulnerability

Disasters have caused significant human losses. A study of 141 countries, though, found that more women than men perished in disasters over the period between 1981 and 2002 (Neumayer & Plümper, 2007). A number of assessments of subsequent disasters also show higher mortality rates for women. For example women accounted for 60 per cent of deaths in the 1995 Kobe earthquake (Bahadur & Simonet, 2015) and it is estimated that women accounted for 91 per cent of deaths from the 1991 cyclone in Bangladesh, 70–80 per cent of deaths from the 2004 Indian Ocean tsunami, and 61 per cent from Cyclone Nargis in Myanmar in 2008 (UNDP, 2013). The mortality rate for women was 75 per cent higher than for men from the 2003 European heatwave (Fouillet, et al., 2006).

Some studies have found negligible differences between male and female death rates resulting from disasters arising from natural hazards. For example, 47 per cent of the victims of Hurricane Katrina in 2005 were female (Brunkard, Namulanda, & Ratard, 2008). Women accounted for 55 per cent of the deaths in two Japanese prefectures and 53 per cent of the deaths in a third as a result of the 2011 tsunami (Nakahara & Ichikawa, 2013). A study of 2017 Hurricane Maria in Puerto Rico found a death rate of 48 per cent for women (Cruz-Cano & Mead, 2019). Context and underlying social and economic conditions appear to be determinants of gender-based mortality profiles. For example, a study of flood events over the period 1980 to 2009 found higher mortality for males in developed countries and for females in less developed countries (Doocy, Daniels, Murray, & Kirsch, 2013).

Gender disaggregated mortality data on the COVID-19 global pandemic are not available for all countries. Data have, however, been collected for 43 countries by Global Health 50/50, an independent initiative dedicated to gender equality in global health. The team's online tracker (Global Health 5050, 2020a) shows data based on the total deaths recorded by countries' government agency websites and official reports. Figure 2 displays an overall mortality rate of 42 per cent for women (across all 43 countries with sex disaggregated data), based on Tracker results up to 3 June 2020. The results are quite different from those of Neumayer and Plümper (2007) who found that mortality rates of women decrease with increasing socio-economic status in the 141 countries studied over a 21-year period.

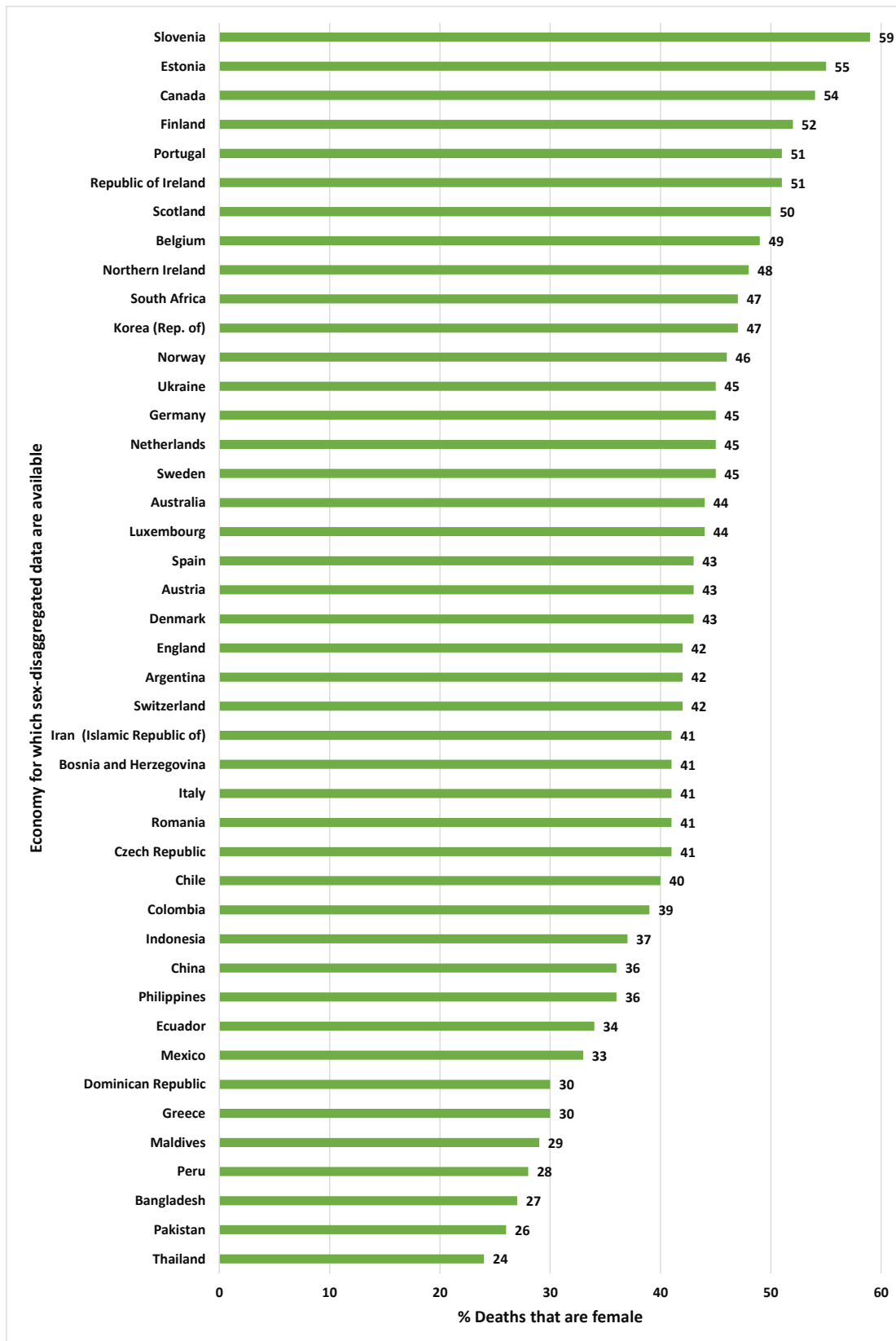
Victims of pandemics are subject to several predisposition factors that do not necessarily bare on other disasters. These include exposure to unhealthy environments and products, response to disease, access to health services including testing, and the quality of health care. In the case of COVID-19, men have higher incidences of a number of pre-existing risk factors than women. These include roughly five times higher alcohol consumption than women and in excess of four times more tobacco smoking, both by global average. Other existing COVID-19 co-morbidities include hypertension, cardiovascular disease and some chronic lung diseases including chronic obstructive pulmonary disease (Global Health 5050, 2020b).

Disaster vulnerability does not manifest itself purely in mortality during the event. Cyclone Idai in 2019, for example, affected more than 75 000 pregnant women of which an estimated 7 000 were at risk of life-threatening complications due to the effects of the cyclone (UN News, 2019). Indeed, United Nations Population Fund (UNFPA) found that their main humanitarian challenge there was to provide women and adolescent girls with lifesaving sexual and reproductive health services. Notwithstanding this, reports indicate that in addition to pregnant and lactating women, people with disabilities, the elderly, and boys and girls were hit particularly hard (COSACA, 2019).

Women, particularly poor women, are generally at disproportionately higher risk in all phases of the disaster risk management cycle than men on account of gender inequalities, caregiving roles and responsibilities, a lack of mobility and limited access to resources (Fothergill, 1996). This differentially inhibits their wherewithal to mitigate the impacts of, prepare for, respond to, and recover from, disasters. Women have also traditionally been excluded from the DRM cycle (Enarson & Morrow, 1998) but their role as key agents of positive change; and the corresponding need to ensure their full participation throughout the cycle is increasingly being recognized (UNDRR, 2005) (UNDP, 2013) (UNDRR, 2015) (UN, 2020).



Figure 2: Mortality rates of women from economies that report sex-disaggregated data



Source: Plotted using data from (Global Health 5050, 2020a) to 9 June 2020

## Disaster mitigation and preparation

Girls and women are often discouraged from learning lifesaving skills which places them at a disadvantage over men, who are encouraged to do so, when disasters strike (UN Women, 2016). In the 2004 Indian Ocean Tsunami, for example, Sri Lankan men had the survival advantage that they had been taught to climb trees and swim at a young age. Oxfam also confirmed that among the reasons for high relative mortality rates among women for the 2004 Tsunami is their low comparative ability to swim and climb trees (Oxfam, 2005). Teaching women and girls to swim has been found to save lives in flood-prone areas (IFRC, 2012).

Patriarchal control of information severely limits women's ability to plan and prepare for disasters. In Peru, for example, fishermen (all male) had been warned about a strong El Niño-Southern Oscillation (ENSO) event which causes extreme weather, often inducing disasters such as droughts and floods. Consistent with socio-cultural traditions, the fishermen did not pass on the warnings to the women in the village. The women, who manage household budgets and could have ensured provisions were in place prior to a disaster, were inadequately prepared to do so (Fordham, 2001). Among the reasons that women were more adversely impacted by the 2014 floods in the Tsholotsho district of Zimbabwe was their relative paucity of knowledge of disasters, their limited access to flood risk information, and the lack of early warning systems to alert them (Dube & Mhembwe, 2019).

Women's economic status can directly impact disaster vulnerabilities (Austin & McKinney, 2016). When they experience economic security and control over economic resources as a matter of course prior to disaster events, they can respond more effectively when disasters strike (Neumayer & Plümpner, 2007). Moreover, when women have control over the household finances and have increased capacity to make decisions about how money is spent, they can prepare for disasters more effectively. For example, they can invest in and employ irrigation systems in accordance with drought cycles, or structural home improvements that can withstand heavy weather (Enarson, 2000). A growing body of research highlights that when women possess greater financial wherewithal, they are also more likely to invest in education and healthcare provisions, both of which strengthen resilience to disasters (Austin & McKinney, 2016).

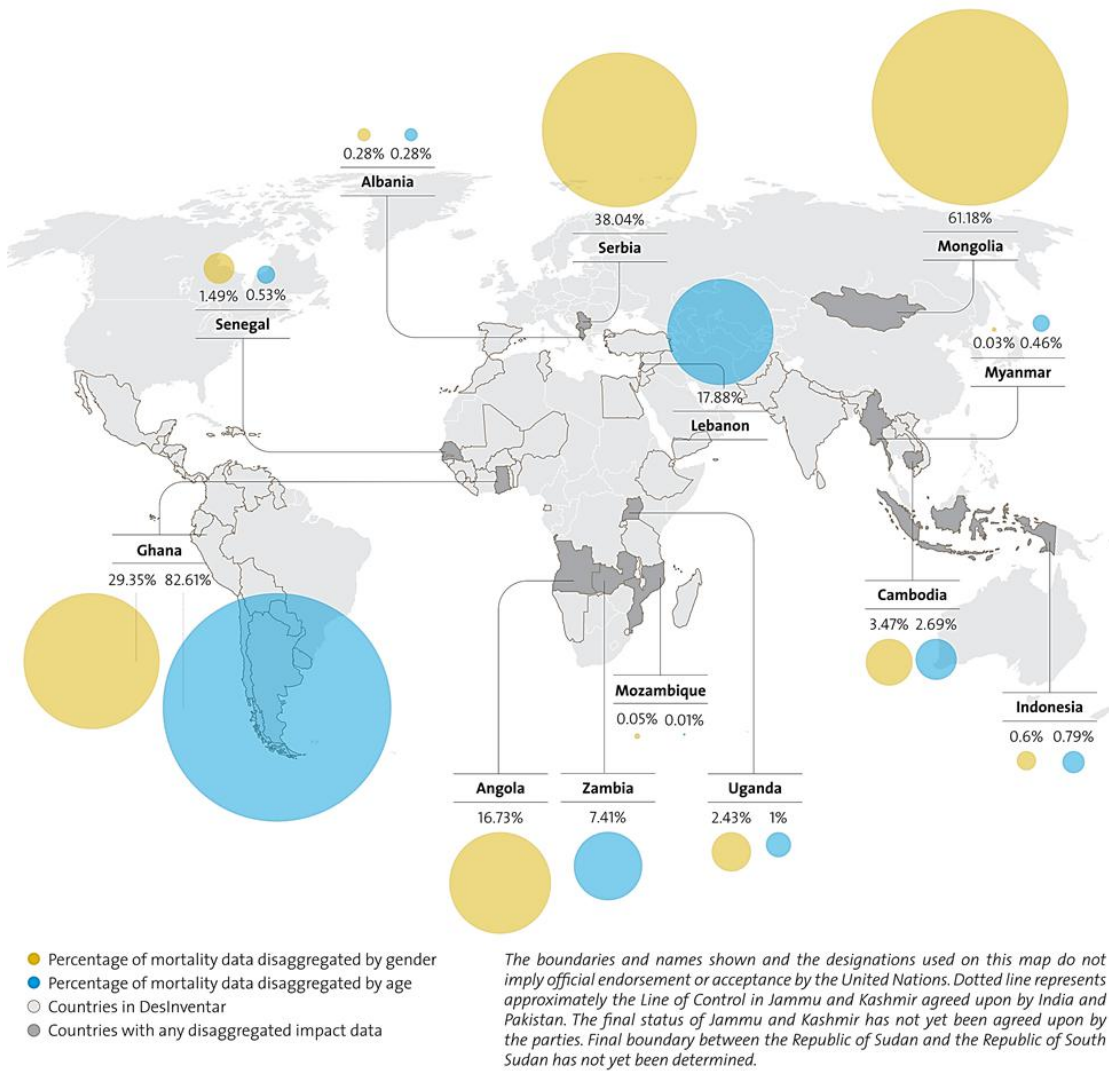
National disaster management authorities often do not consider the need for women's engagement in DRM despite findings that they play an essential role in decision making, community planning and prioritization of need (World Bank, 2012). Women are also key stakeholders in international strategies and frameworks but their roles in disaster risk governance is limited due socio-cultural, socio-economic, legal and institutional factors (Hemachandra, Amaratunga, & Haigh, 2018). Women were found to be particularly affected by the major Siberian flood in 2014 on account of their poor representation in the flood-planning response and overall decision-making processes (Cvetković, Roder, Öcal, Tarolli, & Dragičević, 2018). The exclusion of women from decision making outside of the home reflects the domestic situation in patriarchal cultures, such as in South Asia, where *korta* (in which family decisions are made by men) is practiced (Ear, 2017).

Disaster data are an essential foundation for risk management and for the design and implementation of effective policies and programmes. However, the specification of, as well as the reporting and interpreting of disaster mortality data are not a trivial task (Green, et al., 2019). Assessment and interventions into gender-based inequalities require gendered data yet there is a dearth of sex disaggregated data for disasters, as recognized by Oxfam in relation to more than 220 000 deaths from the 2004 tsunami in 12 countries across South-East Asia, South Asia, and East Africa (Oxfam, 2005).

The Local Development Research Institute (LDRI), a non-profit think tank established to assist African governments to, among other things, reduce inequalities, found a considerable gap in sex disaggregated data collected by national statistical institutes across Africa. They found that only 27 per cent of data requiring disaggregation by the Sustainable Development Goals (SDG) indicator framework is actually disaggregated (Juma, Mutuku, Salim, Nyaggah, & Muchiri, 2018).

UN Women, the United Nations entity dedicated to gender equality and the empowerment of women, and UNICEF, the United Nations Children's Fund, lament the gaps in disaggregated quantitative data at a global level as such data are essential to better understand differential impact and address gender inequalities in disaster. The organizations emphasize the need to strengthen systems for acquisition of disaggregated quantitative data citing the results of a study of global databases which revealed that DesInventar was the only one with disaggregated data on disaster impacts (UN Women / UNICEF, 2019). Figure 3 shows the data from all countries for which disaggregated data on mortality was available to the time of the review: 15 per cent of the countries in DesInventar disaggregate data by gender or age; and of the total deaths recorded in these countries, 0.46 per cent are disaggregated by sex.

Figure 3: Disaggregation in global databases



Source: UN Women / UNICEF, 2019

## Disaster response

Many social and cultural norms and practices render women more vulnerable than men during disasters. For example, the practice of Purdah (involving the seclusion of women) is a cultural-religious practice of “gendering” space and the built environment (Juran & Trivedi, 2015). This spatial segregation delineates women’s spheres as private and men’s as public, restricting female mobility so they are more likely to be at home when disaster strikes. The practice also limits women’s spatial awareness, social power, autonomy, and access to both economic opportunity and basic rights. These gender-specific vulnerabilities faced by Bangladeshi women is thought to account, in large part, for their higher mortality rates in the 1991 cyclone (Ikeda, 1995) (Neumayer & Plümper, 2007). Though the practice of purdah is decreasing, households that continue this practice are reluctant to send women to shelters during a disaster (Paul, 2011).

In many regions where gender-based segregation of space is not practiced, women’s mobility is also controlled by male family members. In such cases, they are generally not permitted to evacuate their homes without consent from their husbands or male elders (Nellemann, Vermaal, & Hislop, 2011).

Other spatial phenomena, which vary across regions and times of day, incidentally contribute to higher risk. For example, women in Aceh were at home cooking on the Sunday morning that the 2004 Indian Ocean Tsunami struck while men were out on errands away from the seafront. In the Sri Lankan district of Batticaloa on the east coast, the tsunami struck at a time when women usually take their sea baths. In India, women perished while waiting on the shore for fishermen at sea. The men survived as the waves were mild far out at sea, only gathering height and strength as they approached the coast, where the impact was greatest (Oxfam, 2005).

Yet another spatial phenomenon that has been found to contribute to higher vulnerability is the substantial proportion of women engaged in unpaid household work, including caregiving. Men, on the other hand, are more likely to find employment elsewhere, and sometimes spend long stretches of time away from home. In some regions, women also traditionally sleep inside houses, while men tend to sleep outside or on rooftops. During the Maharashtra earthquake (India) in 1993, women experienced a higher mortality rate than men because they slept inside the houses which are poorly constructed (Byrne & Baden, 1995).

Figure 4: The aftermath of the 2010 magnitude 7.0 earthquake in Haiti



Source: Derek Gay

The caregiving predisposition of women often hampers their personal safety in almost any type of disaster (Oxfam, 2005) (Ikeda, 1995). Women often stay behind to take care of homes and assets as opposed to seeking shelter and assistance during disasters. In the case of the high differential mortality rates from the 2004 Indian Ocean Tsunami, determined from surveys conducted in some affected villages, Oxfam assessed that some common factors across affected regions were that many women perished as they remained to look for their children and other relatives. UNFPA assessed that women bore the brunt of 2019 Cyclone Idai across southern Africa as they tried to save their households (UN News, 2019).

Gendered dress codes, expected of women for social, religious and cultural reasons, may also inhibit women's mobility during crises, putting them at greater risk of injury and increasing mortality rates. Survivors of the 1991 cyclone in Bangladesh, indicated that the 91 per cent female mortality rate (UNDP, 2013) was due to mobility impediments caused by their saris. Also, their long hair was caught on trees and floating debris (Ikeda, 1995). Saris and long hair have been recognized by Bangladeshi women themselves as culturally imposed hazards, leading them to wear salwar kameez, loose fitting shirts and pants, and to put up or braid their hair as precautionary measures when disasters approach (Alam & Rahman, 2014). Similar findings were reported for Sri Lanka, where it is customary for women to cover their mouths with scarves. In an emergency situation, they automatically reach for their scarves, slowing their response times (Tanesia, 2007). During and after the 1993 earthquake in the North West Frontier Province in Pakistan, many women took a long time to evacuate their homes in order to dress in an acceptable manner, which put them at greater risk (Raju, 2019).

### Disaster recovery

Existing gendered vulnerabilities are further exacerbated in post-disaster environments where women and girls often suffer a number of secondary impacts. These include increased risk of gender-based violence (GBV) and sexual harassment, both physically and online. This has been noted in a number of cases including Haiti after the 2010 earthquake (Horton, 2012) and around the world during the COVID-19 pandemic (UN Women, 2020). During the 2004 Tsunami in Sri Lanka, there were allegations of police harassing women, watching them bathe, and in one case raping a young woman who had sought their assistance (Fisher, 2010). In the 2015 Nepal earthquake, displaced women and girls reported feeling unsafe when they were forced to sleep in insecure homes and makeshift tents that could not be locked, with insecure washing facilities (UN Women, 2016). During the weekend of the Canterbury earthquake in April 2010 in New Zealand, police reported a 53 per cent increase in calls for domestic violence (CARE, 2018).

Access to financial resources in disaster situations is greatly hindered by lack of identification documents. In low-income countries, there is a large gender gap in national registration, with over 45 per cent of women lacking identification compared to 30 per cent of men (Desai, Diofasi, & Lu, 2018). In countries affected by humanitarian crises, women are also 30 per cent less likely than men to have an individual financial account (El-Zoghbi, Chehade, McConaghy, & Sourourian, 2017). The lack of direct access to cash and financial systems as well as the inability to transfer assets, limit women's economic activities, particularly in crisis situations (Thylin & Duarte, 2019).

## 2.2 Gendered digital divide

Access to ICTs is essential for disaster resilience (ETC, 2020a) but the prevailing digital divide is a crippling barrier for many. The digital divide is often thought of in terms of the gap in access to, and usage of, ICT by various populations (OECD, 2001). The estimated digital gender gap in Internet penetration is largest in Arab states at 14.3 per cent, followed by Asia and the Pacific at 13.3 per cent and developing countries at 12 per cent (ITU, 2019a), all in favour of men. While this gap has decreased over the period 2013 – 2019 in developed countries, it has increased by 7 per cent in developing countries and by 12.9 per cent in LDCs over the same period. Most countries with a large gender gap in Internet also have a large gender gap in smart phone ownership, as smart phones are the most frequently used means of accessing the Internet (ITU, 2019b). The mobile phone gender gap

is 23 per cent in India, 33 per cent in Bangladesh and 45 per cent in Pakistan (GSMA, 2018). In Africa, the mobile gender gap ranges from 12 per cent in South Africa to 60 per cent in Rwanda (Research ICT Africa, 2019) The gender gaps for smartphone *ownership* are even greater. Yet, nine out of ten women report feeling “safer” and “more independent” because of their mobile phone (GSMA, 2009).

Gender differences in access to, and usage of, ICTs have been variously referred to as the gender digital divide (UNHCR, 2017); the digital gender divide (OECD, 2018), (Broadband Commission Working Group on the Digital Gender Divide, 2017); and the digital gender gap (World Wide Web Foundation, 2019). Either way, the fundamental divide derives from the lack of access to digital opportunities to live the life one values (UNESCAP, 2019), a concept central to Sen’s capabilities approach (Sen, 1999). This interpretation of the digital divide motivates a holistic perspective to narrowing the gap: one that goes beyond the mechanical aspects of access and use, to consider the strategic aspects of self-actualization and agency.

EQUALS, the global partnership for gender equality in the digital age, has found that the barriers to women’s adoption of ICT generally include some mix of financial constraints, availability of infrastructure, ICT skills and aptitude, interest in and perceived relevance of ICTs, concerns about safety and security, and socio-cultural and institutional contexts (EQUALS, 2019). Gender-based asymmetries in all aspects of engagement with ICTs, and their origins, profoundly limit women’s ability to reap the considerable resilience gains offered by the technologies to mitigate the impacts of, prepare for, respond to, and recover from, disasters.

### Disaster mitigation and preparation

The cost of ICT is one of the greatest barriers to women’s Internet and mobile phone access in low and middle-income countries (OECD, 2018) (GSMA, 2018). The high cost of technology is particularly prohibitive for women who on average earn less than men and are more likely to engage in unpaid work. Factors such as job segregation, gender wage gaps, lack of decision-making power over finances, childcare and unpaid domestic work as well as exclusion from the formal economy, seriously limit the ability of many women to access ICTs. As the sophistication and functionality of technology grows, so does the cost of ownership, further limiting access for potential users and limiting the capabilities available to existing users (Intel and Dalberg, 2012). Therefore, the digital gender divide can widen with technological advancement and associated increased cost of ownership (BMZ, 2017).

Studies have found that women, particularly older women, are less likely than men to be aware of the existence or benefits of the Internet and as a result are more likely to think they “do not need it” or they “do not want it” (Fallows, 2005). Low levels of education often lead to a lack of trust in digital devices and lack of awareness of the benefits ICTs may bring. A study utilizing interviews and surveys of 2 200 women and girls in urban and peri-urban areas of Egypt, India, Mexico, and Uganda found that 25 per cent of women who do not have access to the Internet are not interested in using it, and almost all of these feel that it would not bring them any benefit (Intel and Dalberg, 2012). Women from Africa and Asia are found to be less aware of the Internet than men, with gaps of 21 per cent and 26 per cent in Nigeria and India, respectively (GSMA, 2019a).

The dynamics of traditional social networks have been found to influence persons’ perceptions of the value of the Internet. A GSMA study, for example, found that a fifth of women without mobile phones cited “no need – everyone is local” as a reason for not owning a device (GSMA, 2010). Approximately one fifth of Indian and Egyptian women have reported that they have not used the Internet because it is not appropriate for them – either because of negative social perceptions or lack of acceptance by family members (Intel and Dalberg, 2012).

Traditional illiteracy generally translates into digital illiteracy which is a major barrier to the use of technology. Educational barriers continue to disproportionately affect girls in the developing world because of increased domestic responsibilities and gender bias. Amongst the 40 per cent of Nigerian women who do not own a mobile phone, for example, literacy was reported to be a key barrier to ownership, compared to 22 per cent in the case of men (GSMA, 2018). This is amplified in rural areas as

girls are twice as unlikely to be in school compared to urban counterparts (UN, 2012). Research shows that more than half of women with no formal education are not comfortable or familiar with using technology, but only 15 per cent of women with at least a high school education feel the same (Intel and Dalberg, 2012). According to the Gender and ICT e-Primer (FAO, 2018), women are most inclined to the radio and mobile phone as their literacy levels are generally lower than men's. Women who only speak local languages not supported by major Internet platforms are often unable to access ICTs.

Other digital divides, such as those between rural and urban areas, arising from geographic isolation and a lack of rural infrastructure, can further exacerbate gender differences in ICT uptake. Sparser populations in rural areas render telecommunications infrastructure investment less appealing to telecommunications operators. As more women in developing countries are located in rural areas, compared to men who often move to urban centres for work, they are disproportionately disadvantaged from accessing ICTs. A woman in an urban area is 23 per cent more likely to own a mobile phone than a woman in a rural area, even if they are the same age, have the same income, educational level and occupation; and the rural gender gap is wider in almost every country GSMA has surveyed (GSMA, 2019a). Many rural women therefore do not own ICTs so their capacities for disaster preparedness, response and recovery are severely limited though more than half of the poorest women have access to mobile phones on loan (GSMA, 2010).

Gender stereotypes play an influential role in learning and professional choices made by women; and these stereotypes are ingrained from early (Bian, Leslie, & Cimpian, 2017) in many cultures. Women and girls are 25 per cent less likely than men to know how to leverage digital technology for basic purposes, four times less likely to know how to programme computers and 13 times less likely to file for a technology patent (West, Kraut, & Chew, 2019). Much of gender inequality in ICTs is rooted in gender stereotypes. Gender gaps in ICT leadership (West, Kraut, & Chew, 2019) perpetuate traditional stereotypes.

Systemic and structural barriers in the form of cultural norms and discriminatory beliefs contribute to gender inequality in ICT. For example, perceptions that women are less likely to possess the skills and/or intelligence to use technology persists even in developed countries. These attitudes have contributed to 'technophobia' among women and have been a deterrent to knowledge and skills development to fully take advantage of ICT. A GSMA study found that more than a third of women with household incomes of less than USD 75 per month were concerned about having the skills to be able to use technology (GSMA, 2010).

Although women now outnumber men globally amongst those with tertiary education (World Economic Forum, 2019), their numbers are lowest in ICT-related professions, such as engineering and computer science (OECD, 2018). Across the globe, women make up roughly only a quarter of those studying and working in ICT and their representation in these fields is on the decline. In the United States, the proportion of women in computing jobs fell from a high of 36 per cent in 1991 to a plateau of around 25 per cent where it has hovered since 2007 (NCWIT, 2016) (NCWIT, 2020). On average, amongst countries in the Organisation for Economic Co-operation and Development (OECD), only 0.5 per cent of girls wish to become ICT professionals, compared to 5 per cent of boys (OECD, 2018). Gender inequality in ICTs is exacerbated by the low number of women and girls studying and working in ICT.

The participation of women in the full ICT product life cycle from design through development, deployment, support and marketing, is essential to ensure that products are gender-sensitive (Henwood, 1993) (O'Donnell & Sweetman, 2018), for example to counter bias and harassment as well as to provide solutions of particular interest to women. The omission of substantial female participation in the life cycle deepens gender gaps and exacerbates gender stereotyping. One study, for example, has found that Artificial Intelligence (AI) software using female voices perpetuates harmful gender biases in society (West, Kraut, & Chew, 2019). Yet women are often underrepresented in pivotal digital technology production jobs and core, creative technical roles; and overrepresented in auxiliary jobs such as data entry operators, call centre operators, etc. (Era Dabla-Norris and Kalpana Kochhar, 2018) (NCWIT, 2020).

There is a dearth of official reliable, transparent and comprehensive sex-disaggregated and gender data on how women and men engage with ICTs on which to base the design and implementation of policies for inclusive ICT development (EQUALS, 2019).

### Disaster response

The Emergency Telecommunications Cluster (ETC), a global network of organizations that work together to provide shared communications services in humanitarian emergencies, has examined the striking vulnerabilities of women under disaster conditions. They found for Hurricane Irma in Dominica (2017) and Cyclone Idai in Mozambique (2019) that these stemmed from the lack of digital literacy, specific cultural and gender norms and lack of affordability. These together resulted in the inability to receive sufficient relevant information before, during and after the disasters. Interviewers after Hurricane Irma found women disconnected for weeks and uninformed about the well-being of the family members in the other parts of the Island. Even though affordability was not a concern, a general notion was if a woman stays home, takes care of the children and helps in farming, she does not need a phone as “men go out and do important things, that’s why they should have phones”.

ETC response in the field has found that the timely receipt, understanding and acting on life saving information during disasters is proportional to the access to, and use of, voice and data connectivity. As women generally have less access to ICTs and lower levels of digital literacy than do men, they are less able to receive timely life-saving information, understand it and act on it.

It is often the case that information on disaster preparedness and recovery passes through male dominated channels such as government agencies of disaster management, meteorology and agriculture. In such cases, the composition and delivery of important disaster-related messages is generally not gender-sensitive and therefore less accessible or appealing to women. The 2015 Global Media Monitoring Project (GMMP) reported that over the period 2010 and 2015, women made up only 24 per cent of the persons heard, seen or read about in the news from radio, television and newspaper (GMMP, 2015).

### Disaster recovery

Gender stereotypes in relief activities prevail. This was evidenced, for example, after the 2004 Indian Ocean Tsunami when mobile phones were distributed to men’s self-help groups but not to women’s groups because technology was perceived as a man’s concern (UNDP, 2009). Without access to information and communications, women are less able to access opportunities for assistance, health, economic empowerment and capacity building.

Both men and women have the right to information on aid and services from, and interaction with, humanitarian workers at all phases of disasters and their management. Accountability to Affected Population, AAP (UNHCR, 2018) calls for a conscious mindset on the part of aid providers to ensure this. Among other things, AAP ensures safe and secure mechanisms to record, log and follow-up on complaints and feedback from affected populations. Aid organizations have found that women are often least likely to know of their rights and entitlements and depend on male family members to interact with aid workers. Digital illiteracy, patriarchal control and limited financial wherewithal, which limit access to information channels available through ICTs, contribute to women’s ignorance of rights and entitlements.

In the recovery phase of disasters, online harassment and other predatory behaviour create disincentives to Internet use. Women and girls using the Internet have a disproportionately higher risk of being exposed to gender-based online harassment, cyberstalking and sexual trafficking than men (Intel and Dalberg, 2012). The incidence of such behaviours is heightened in the aftermath of disasters. Outside of disaster situations, 40 per cent of Mexican women who do not own a mobile phone indicate they are concerned about strangers contacting them (GSMA, 2018).



### 3 Gisele's story

The report from (Wiest, Mocellin, & Motsisi, 1994) recommends the study of women in emergency construction project roles; and the facilitation of their access to the primary resources for building sustainable types of shelters. The multi-skilled, multi-talented IT technician, Gisele Benjamin, is a case in point. Gisele shares her experience as a volunteer labourer in an International Organization for Migration (IOM) recovery mission in Dominica following the devastation caused by Hurricane Maria in 2017. Prior to her six-week foreign assignment, she was uncertain about the intensity of the manual labour and the arrangements for accommodation, food and power. She had security concerns as she would be the only woman on the team; and was worried that she might be expected to work on the Sabbath which was not possible for religious reasons.

Despite her fears, she settled quickly as she was able to assist colleague labourers access Internet services through her resident ICT skills and personal networking equipment. She also helped them study for the prerequisite online UN Security exam and, on job sites, administered first aid services. She regularly assisted with technical matters including calculations, and fully participated in manual labour alongside the men.

Figure 5: Gisele Benjamin builds an HF radio for emergency communications



Source: Kim Mallalieu

Gisele travelled with her amateur radio equipment in the high frequency (HF), ultra-high frequency (UHF) and very high frequency (VHF) bands. She acquired a Dominican operator licence and made physical as well as daily on-air contact with local amateur radio operators. They loaned her a power supply when hers failed and gave her the tools and assistance to make an alternate HF antenna, which she used to make daily on-air contacts throughout the Caribbean. She was not only prepared for recovery from one hurricane season but to assist with mitigation, preparation and response activities for the next one.

Gisele encourages all volunteers to have at least a handheld radio, if not a full HF setup, to assist with immediate relief whenever regular communications services are largely or entirely inaccessible. Quite apart from the direct use of ICT in recovery activities, she emphasizes the importance that ICT plays in rallying personnel to assist with recovery. In particular, she notes the use of popular social media channels to disseminate calls for participation in volunteer missions.

Gisele has also volunteered in recovery missions in Antigua and Barbuda in 2019 following Hurricane Maria; and the Bahamas in 2020 following Hurricane Dorian. In all three countries, prevailing gender biases impacted the recovery missions through, among other things, asymmetries in the allocation of duties and resources. Yet she reflects that “from my experience in volunteering, work crews are always better with women on the team. They provide a calming influence to tense situations and are usually better equipped to talk and relay information to women affected by the disaster.” Indeed, she has found that most of the beneficiary households have been headed by women; and has noted the deep appreciation they have expressed for the female presence of, and interactivity with, female volunteers.

Gisele is grateful to have had these life changing experiences and, despite prevailing gender inequalities to which she is regularly a victim, will continue to serve vulnerable communities through the use of ICT in all phases of the disaster risk management cycle.

## 4 ICTs reduce gender-based disaster vulnerabilities

Telecommunication infrastructure, technology, services and standards are critical to all phases of disaster risk management. ITU Guidelines for national emergency telecommunication plans (NETPs) (ITU, 2019c) recognizes the need for a wide range of technologies and services to support disaster communications response. It numbers among these: emergency dispatch services; amateur radio; first responder systems, including radio and public safety broadband; television and radio broadcasting; terrestrial mobile networks; wireline voice networks; broadband networks; satellite networks; and social media.

The focus of this work is the set of ICTs with which women affected by disasters can directly interact to reduce gendered disaster and digital asymmetries thereby increasing their resilience and agency. These technologies facilitate access to key information about disasters and strategies for mitigation, preparation, response and recovery; and facilitate payments that enable affected women to receive assistance under disaster conditions. Priority technologies also connect affected persons with authorities and aid agencies; and give a voice to affected survivors, enabling them to express their needs, concerns and experiences.

The predominant ICTs used in low resource communities have typically been free-to-air (FTA) radio and television (TV) but mobile phones have more recently taken over in most countries. Adoption is not homogeneous within countries as shown in Figure 6 for a sample of LDCs. The Figure shows that for the sampled countries, the household adoption of radio ranges from 3.5 per cent to 48.9 per cent; for TV from 17.1 per cent to 79.3 per cent; and for mobile from 34.9 per cent to 90.1 per cent (ITU, 2019d). There are some differences between rural and urban adoption rates, with the highest featured in Haiti for TV with 19.2 per cent higher adoption overall (urban and rural) compared to rural areas.

Figure 6: Radio, television and mobile phone (% of households), selected LDCs

Country	Year	Total national (urban and rural)			Rural		
		Radio	Television	Mobile	Radio	Television	Mobile
Bangladesh	2014	3.5	43.5	88.5	3.6	33.0	86.7
Haiti	2016-17	48.0	30.7	75.9	37.3	11.5	66.5
Lao P.D.R.	2017	...	79.3	90.1	...	72.2	86.6
Madagascar	2016	48.9	17.1	34.0	46.6	12.1	29.1
Timor-Leste	2016	24.5	40.2	84.3	21.6	27.8	80.5
Yemen	2013	39.9	66.8	80.0	39.4	54.5	74.0

Source: ITU, 2019d

The estimated global average subscription rate of mobile cellular subscriptions for 2019 is 108 per cent, and the estimated global average subscription of active mobile broadband subscriptions for the same year is 83 per cent (ITU, 2019a). Averaged across all advanced economies, mobile phone ownership estimated in 2019 was 94 per cent and smart phone ownership was estimated at 76 per cent; while averaged across all emerging economies, mobile phone ownership was estimated at 76 per cent and smart phone ownership at 45 per cent (Silver, 2019). These gross figures do not necessarily capture the profiles of ownership within communities that bare a high disaster risk, nor do they reveal the gender disparities within such communities. As both gender and economic wherewithal number among disaster risk factors, we recognize that these figures for mobile phone subscription and ownership are upper bounds for the most vulnerable in disaster prone areas.

ICTs to reduce gender-based vulnerabilities to disasters are not limited to FTA radio, TV and mobile, but also include a range of Internet-based technologies. The next sections explore how all of these technologies are being used in ways that reduce gender-based disaster vulnerabilities, as well as

exploring a number of supporting ICT tools that are increasingly important to reducing gender-based disaster risk.

## 4.1 Radio

Radiocommunication refers to telecommunication by means of radio waves. It includes satellite communications, radio astronomy and other space applications, as well as terrestrial services such as traditional sound and television broadcasting. Some radiocommunication services used in point-to-point microwave links in telecommunication networks are fixed, while others, such as land, cellular and marine radio, are mobile. Other types of radiocommunications such as amateur radio, remote sensing, and meteorology, are available for use in different or combined modes: fixed or mobile, and terrestrial or satellite. In the review of radiocommunication technologies to directly strengthen the disaster resilience of women, radio comprises free-to-air, call-in, amateur and mobile. Television and mobile telephony are treated separately.

### Free-to-air radio

Traditional free-to-air (FTA) radio is broadcast wirelessly to the public for no fee. Community radio provides free-to-air service to specific, generally localized, geographic communities of interest. Where high levels of illiteracy and poverty prevail and where local languages are not served by general FTA radio stations, community radio is often the only viable means to disseminate information to women. In the case of Mozambique where 56 per cent of women in urban areas and up to 70 per cent of women in rural areas are illiterate (USAID, 2019), community radio plays an essential role as amplifiers of public service information. Local women rely on it to stay up-to-date on local events while they attend to their daily responsibilities.

Following damage assessments conducted in the wake of Cyclone Idai in Mozambique, ETC partnered with the National Forum of Community Radios (FORCOM), the governing body of 51 community radio stations, to rehabilitate six community radio stations. More than 1.9 million listeners in affected districts were able to receive information following the catastrophic damage that left more than 600 dead and an estimated 1.85 million in need. Feroza Zacarias, Executive Director of FORCOM, expressed gratitude to the sponsors indicating that “...when a community radio disappears the community’s ability to access information is in jeopardy. In most of the rural areas of Mozambique, populations rely entirely on community radios to stay informed and to actively participate in local development” (ETC, 2019a).

In other regions radio has also been found to be an important information channel for women who work in the home as it enables them to listen while they multi-task (UN-APCICT/ESCAP, 2009). It is a critical support channel before, during and after disasters. Since 2000, the Women of Uganda Network, WOUGNET, has been reaching women farmers through a variety of channels including broadcast radio. The network shares information on best practice and promotes the use of ICT by women and women’s organizations. This traditional means of communication is highly accessible and WOUGNET potentially draws more women listeners than other radio channels. The sharing of weather forecasts and early warning information by the network is of keen value in the mitigation and preparation phases of the disaster risk management cycle.

### Call-in radio

FTA radio has been applied in a variety of ways to increase its potency. In Thua Thien Hue and Quang Binh provinces of Viet Nam, for example, a radio soap opera was created to introduce its audience to problems that may occur before, during and after disasters, focusing on floods and storms, consequences of insufficient preparation, and how to minimize adverse impacts of disasters. The show was broadcast through community loudspeakers before and during the storm season on the Women’s Programme of the Voice of Viet Nam (VoV). The messages conveyed through this electronic channel were reinforced through booklets that showed ways to deal with local disaster situations in clear pictures.

One radio station in Indonesia collaborated with the female-headed household empowerment programme, PEKKA, to run an interactive talk show. The programme was developed, and is managed and hosted, by women-headed household groups. It not only provides listeners with valuable information on available assistance but is a forum for them to share knowledge on topics such as reproductive health and education in support of restoration of women's livelihoods for example on animal husbandry and home industries. The community radios also assist with the coordination of aid distribution (Tanesia, 2007).

### Mobile radio

Land mobile radio is used by private organizations as well as public safety organizations such as the police, fire and ambulance services, and other first responder agencies, for critical and emergency communications. Unlike amateur radio, land mobile radio does not require a licence to operate. Among the first responder agencies that use this technology is Radio Emergency Associated Communication Teams International, Inc. (REACT), a non-profit organization of volunteers who provide a wide range of radio related services to the public in times of disaster or other emergencies. REACT has teams across the entire United States of America and its territories including Hawaii and Puerto Rico as well as in Canada, the United Kingdom, Germany, Thailand, Philippines, Nepal, and Trinidad and Tobago. Of note, though, is that none of the officers, Board directors or assistant directors are women. Thirty per cent its global membership are women.

REACT routinely engages in exercises and actual incident response alongside national agencies such as local disaster management units and national emergency authorities. The duties of radio operators in message handling and liaising with served agencies, require a skilful and professional approach. Competencies, attitudes and attributes such as firm and flexible leadership, remaining calm in a crisis, effective and efficient time management, complex scenario handling, sensitivity, compassion, succinct and clear communications, are among critical skills. Interviewed for this report, the Vice Chairman of the Board of REACT International, Ravindranath Goswami, indicated that women play an important role in ensuring diversity and balance across the spectrum of communications responsibilities: planning, command, liaison, crafting and dissemination of public information, managing of control stations and assessments. He indicated that after-action reviews regularly reveal the important contributions of women, their exemplary performance often recognized and complimented for, among other things, enhanced order, care, attention to detail, smoothness of operations and composure.

When interviewed for this report, Lisa Henzell, an officer from one of the REACT teams in Trinidad and Tobago, shared that her inputs are often "looked at as complaints or rants, lacking substance" and that many women in the field feel obliged to work twice as hard to be recognized or included. This experience accords with the findings of a number of authors such as (Jolanda Jetten, 2019), that stricter performance standards have been found to apply to women than men in the same jobs. Lisa also shared that traditional perceptions that radio technology and ICT are masculine, continue to deter women's participation as radio operators. Nevertheless, as a professional and volunteer emergency communications technician she takes pride in her role in emergency information sharing. One day she hopes to be recognized in the fields of ICT and emergency communications with true and equal respect by the technocrats.

The barriers to entry have lowered with the availability of free online learning and certification by REACT International and other emergency response agencies. These efforts are important to ensure gender balance in the strategic acquisition, appreciation and application of information; and to provide appropriate and sensitive support to emergency and disaster victims while helping to save lives and property.

### Amateur radio

Amateur (ham) radio is a non-commercial radio service used by licensed operators for experimentation, self-training, recreation and emergency communication. Unlike radiocommunications such as FTA radio and cellular communications, amateur radio does not require infrastructure, such as towers and cell sites, to operate. It is therefore far less vulnerable to outages caused by disaster-inflicted damage

Figure 7: Radio operators in a disaster management office in Trinidad



Source: Ravindranath Goswami

to essential structures and facilitates. While communications range is extended through the use of repeaters on towers, amateur operators often leverage the long-distance capabilities of HF frequency bands and typically set up their HF antennas on elevated structures on their personal premises. These are generally built to be collapsed at a moment's notice and can be rapidly reassembled. To facilitate long distance emergency communications at disaster sites, simple home-made configurations of wires are used as HF antennas and strung up on trees to elevate them. Batteries are standard fare in a radio room (shack) as they are in amateur go-kits, at the ready to assist with emergency communications when the need arises.

Amateur radio is often the only form of communications available immediately after a major disaster that destroys both power and telecommunications infrastructure. Hurricane Maria which hit Puerto Rico in 2017 claiming nearly 3 000 lives, was a typical example of the role ham radio plays in the immediate aftermath of a devastating hurricane. The national power grid came down leaving the entire island without electricity, 98 per cent of commercial communications was down and the Internet and other radio systems were also non-functional (ARRL, 2018). Amateur radio was the only means of communication for many small villages and communities. In addition to supporting relief agencies, health facilities and other providers of essential services, amateur radio was used to relay patient information from one facility to another during patient transfers. The lack of resources including food, water, and shelter in the aftermath of a disaster adversely impacts pregnancy and pregnancy outcomes; and increases pregnancy-related morbidities (ACOG, 2010) so unbroken health communications is important for women.

There is no evidence of gender-sensitive policies or practice within the amateur community to increase the participation of women operators and leaders. Additionally, there is considerable gender asymmetry in the profile of licensed operators with, for example, in the United States of America, only 15 per cent of licences are held by women.

Figure 8: Personal amateur radio “shack” in Saint Kitts and Nevis



Source: Kim Mallalieu

## 4.2 Television

Free-to-air radio has been shown to be very effective in bringing information to women for all manner of disaster information, and that it is a very convenient channel for the many women who work in the home. Television, where it exists, is similarly situated, both standard ports of call for information of all types. Their role in dissemination of disaster mitigation, preparation, response and recovery messages to vulnerable communities is unmatched. Additionally, TV has been shown to have a causal effect on perceptions of social reality (Shrum, O'Guinn, & Wyer, 1998) and community radio is broadly recognized as having the power to empower, particularly for marginalized persons (CIMA, 2007). The mental persistence of messages, video and audio respectively, are powerful influencers of perceptions and, with systematic planning and reinforcement over time, have a potent role to play in modifying stereotypes.

Approximately 86 per cent of households have access to a television based on data from the six countries which have reported TV adoption rates to the International Telecommunication Union (ITU) for 2019. Data from the 39 countries which have reported TV adoption rates for 2018, show an average household adoption rate of 84 per cent (ITU, 2019d). ITU recognizes FTA (terrestrial) television broadcasts as an important channel to alert women to services that help them deal with sexual harassment and other protection issues. The Union also recognizes its importance in explaining how people can keep themselves safe from diseases and where they can access medical services (ITU, 2017).

Two national surveys conducted in 2010 and 2011 in Bangladesh suggest that TV is an important influencer of health behaviour for women on the basis of considerable improvements in key reproductive health attitudes. It is thought that TV programming is responsible for observational learning and ideational change. A study of viewing habits of rural women in the Tehri Garhwal

District of India also found it to be an influencer of women's attitudes, transforming their views and understanding as well as several of their behaviours (Bhatt & Singh, 2017). Notwithstanding the potential negative impacts and influences of television, it is an effective means of reaching women in low income groups and of low literacy.

### 4.3 Basic voice and SMS

In the aftermath of disasters, humanitarian calling operations, which facilitate voice communications between affected persons and their families, are very high priority and are a critical form of assistance provided by humanitarian organizations. Télécoms Sans Frontières (TSF), the world's first non-governmental organization (NGO) focusing on emergency-response technologies in support of humanitarian crises, has established humanitarian calling operations after many disasters including the 2019 Typhoon Kammuri, which affected 1 922 106 persons; and Cyclone Idai, which in the same year left an estimated 1.85 million people in need of humanitarian support (TSF, 2020).

ETC is another organization that assists with emergency communications and resilience building in disaster-prone areas. It is a network of humanitarian, government and private sector organizations that, among other things, focus on the provision of accessible, affordable and usable ICTs for persons in affected communities to communicate among themselves and with humanitarian agencies. Among other response actions in the Central African Republic, the Cluster partnered with the humanitarian organization, INTERSOS, to establish five female-operated fixed-line phone booths for internally displaced people in the Bria internally displaced persons camp. The Central African Republic has suffered decades of conflict which has resulted in large numbers of internally displaced people, totalling 697 337 to March 2020 (UNHCR, 2020a). Women and girls comprise the majority of displaced people in that country and are highly vulnerable to exploitation and abuse, and generally lack access to personal phones.

Traditions of voice communications lie in the fixed line service offered through the public switched telephone network (PSTN). Landlines per person peaked at 56.8 per cent in 2000 globally; and at 19.5 per cent in the developed world in 2005 (Wilson, Kellerman, & Coreey, 2013). Adoption rates have since fallen on account of mobile phone substitution. Voice communications, which has remained a critical aspect of all emergency communications, has evolved considerably over the years.

#### Humanitarian hotlines

Basic telephone hotlines have been used by women around the world as a key emergency communications channel for many years. The UN Women Global Database on Violence against Women (<https://evaw-global-database.unwomen.org/en>) features hotlines from 83 countries. The featured hotlines provide support for violence against women and girls in general, as well as specifically for trafficking, sexual violence, domestic and intimate partner violence, and stalking. Reports generated by hotline hosts provide keen insight. Many hotline agencies provide narrative and quantitative graphical accounts of the nature of call-ins by hour, month and day; and type of abuse (emotional, physical, verbal, sexual, incest, rape, financial, threats, neglect, isolation, infidelity, eviction and other); and document the nature of callers by parameters such as age, employment status, marital status, ethnicity, geographic origin and whether they are repeat or first-time callers.

Access to critical information in an emergency is essential to minimize impact. Modern, feature-rich hotlines for women are increasingly being used by humanitarian agencies as entry points for multi-agent support with crisis-related needs. The use of a single phone number for queries to multiple humanitarian agencies together with a coordinated mechanism to channel these queries to individual mandated organizations, is best practice. This single number within the international humanitarian architecture allows members of the affected population easier access to answers, speeds up the resolution of issues and allows greater access by NGOs to government and UN decision-makers, thereby improving aid delivery efficiency.



Figure 9: Women in an internally displaced people camp in Bangassou (Central African Republic) take part in a consultation about their access to information



Source: WFP / Phyza Jameel

ETC has set up a free humanitarian hotline for internally displaced people sites in Bria; as well as toll-free COVID-19 helplines in Libya and the Central African Republic (ETC, 2020b). The Central African Republic hotlines are supported by a common feedback mechanism comprising 25 NGOs and eight UN agencies. In turn, humanitarian organizations are able to work more efficiently to meet the needs of internally displaced people.

Since its onset in 2011, the Libyan crisis left 1.1 million people in need of humanitarian assistance and protection, of which 307 000 are women (UNFPA, 2018). While a number of humanitarian organizations in Libya already have their own individual hotlines, the affected communities are often not aware of the very many UN branches and specific international and local NGOs, which have distinct and specific mandates. Even those in affected populations that are well-acquainted with these organizations often cannot remember all of the phone numbers and procedures in place to register feedback and submit complaints. ETC is implementing a common feedback mechanism in Libya funded by the Government of Luxembourg. Designed in accordance with the recommendations of the Interagency Standing Committee (IASC), the common feedback mechanism offers a single, toll-free, country-wide hotline number for all affected populations in Libya: internally displaced people, returnees, conflict-affected people, host communities, refugees and migrant workers. As women constitute a particularly vulnerable component within each of these groups, 50 per cent of common feedback mechanism workers will be women to ensure that female callers are comfortable to seek assistance and get help.

Figure 10 shows the ETC Services for Communities (S4C) advisor, Phyza Jameel, conducts an impromptu focus group discussion to assess the information access needs of women in Buzi, Mozambique.

### Interactive Voice Response (IVR)

Interactive Voice Response (IVR) is a technology which enables human interaction with computers using voice communications through various devices, particularly phones. IVR systems are able to

Figure 10: ETC services for communities (S4C) impromptu focus group discussion



Source: WFP / Suzanne Fenton

provide rich options for information access and interactivity for illiterate communities so are often used to substitute for text messaging (Marchant, 2016). They have been widely used in humanitarian contexts (Knowledge, 2018).

Persons with limited access to ICT have correspondingly limited ability to access otherwise available information on weather and climate (Gumucio, Hansen, Huyer, & van Huysen, 2019). This has considerable impact on the many rural women involved in agriculture on account of its vulnerability to weather-related disasters and other effects. IVR has been introduced in a number of countries in Africa to enable women to seek information of interest to them and for their voices to be heard at no cost to them: their unanswered calls ('beeps') to a designated phone number are followed by IVR return call. Farmers leave voice messages or can access a variety of agriculture-related information and vote on weekly polls (Farm Radio International, 2015).

The Canada-based international non-profit organization, Farm Radio, has partnered with roughly six hundred radio broadcasters for a variety of radio programming interventions (Feruglio & Gilberts, 2017) in 38 countries in Africa. Listening groups have been established through which women generate and share information on topics including gender-based violence. Partner broadcasters have received training to ensure a gender component on their shows, and are using 'beep' technology to ensure women's voices are included in their broadcasts through a regular women-only call in phone line which attracts women and features their voices (Farm Radio, 2017).

Broadcasters have been trained to incorporate a gender-sensitive approach in their programming. With WFP funding, Farm Radio is collaborating with the Tanzanian Metrological Authority, the Ministry of Agriculture and three local radio stations to broadcast timely and gender-sensitive weather information, and guidance on what to do about it, to a quarter million farmers.

## SMS

According to the Research ICT Africa 2019 *State of ICT in Uganda* report (Research ICT Africa, 2019b), affordability of smartphones and computers for Internet connectivity remains one of the most significant challenges to access in Uganda. The price of the data bundles is also prohibitive for the most vulnerable. Feature phones are therefore the communications device of choice for many.

Quite apart from the voice capabilities of feature phones, their SMS capability has been used to advantage for women exposed to risk. Interviews conducted for this report reveal that WOUNET has been using its existing SMS platform to provide support to women who cannot afford smart phones through the COVID-19 pandemic. Mr Amuku Isaac, a WOUNET Program Officer for Information Sharing and Networking, explained that the network has been urging women, especially those who use social media, to only trust official information sources to avoid being misled by misinformation. Guidelines issued by the World Health Organisation (WHO) and Uganda Ministry of Health are translated into the local languages and shared with women who are registered on the WOUNET SMS platform. Registered users of the platform have used it to alert leaders of the need for clean water to regularly wash their hands as required by the Ministry of Health as an essential COVID-19 protection measure. Other alerts have been sent about the lack of medicine in the health centres and high domestic violence cases. Messages received on the platform are forwarded to the relevant authorities at the district level for resolution. Broken boreholes have been repaired and new ones drilled by the government and other NGOs in response to complaints lodged on the platform.

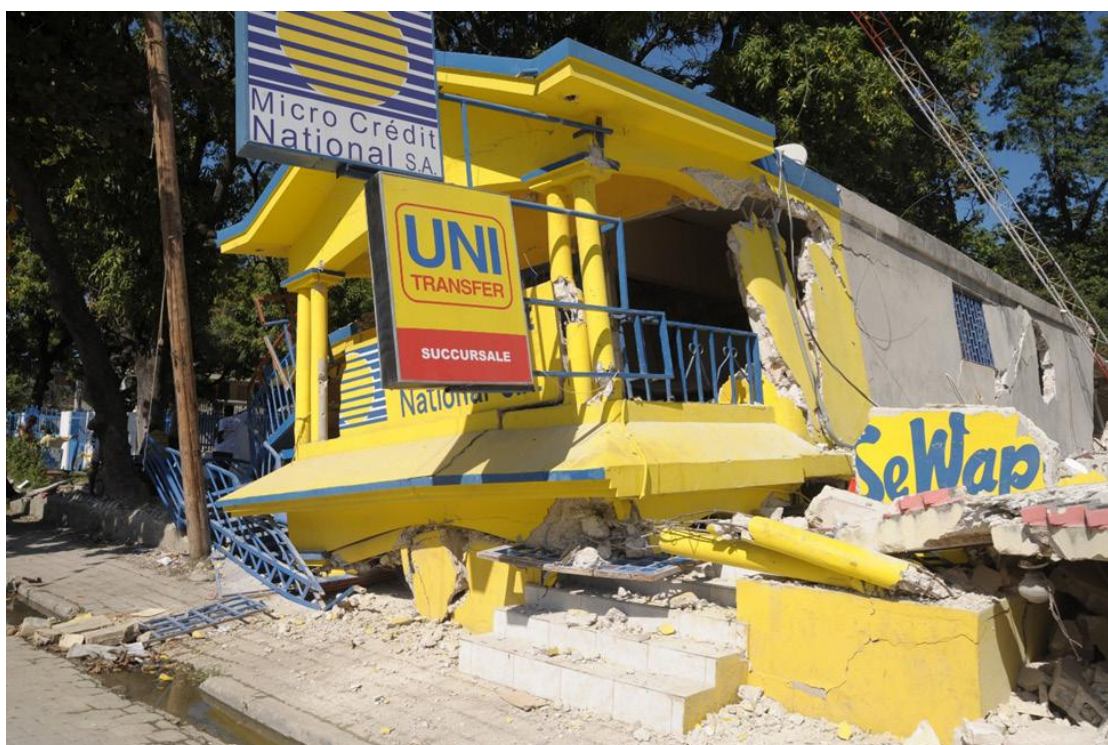
The WOUNET toll-free SMS platform has been used by rural women since 2000 to lodge complaints and to engage in a question and answer forum in their local languages or English. Messages are relayed to the responsible duty bearer and feedback conveyed back via SMS. The support of local languages is responsible for greater accessibility to local women. Regular use of the platform prior to 2020 enabled its seamless deployment as the communications channel to support rural women in Uganda on COVID-19 matters.

In many countries, SMS systems have been established specifically for women, not necessarily for use in disaster situations. As in the case of WOUNET, such systems can be immediately deployed as a ready and familiar information and communications channel prior to, during and after a disaster. One such has been implemented by SEWA Bank, a women's self-help organization for poverty alleviation in India. They facilitate the regular transmission of commodity prices via SMS to leaders of village-level producers' groups (FAO, 2012).

In Rwanda, an SMS-based system has been operational since 2010 to, among other things, monitor pregnancies and reduce communication bottlenecks associated with maternal and newborn deaths (Ngabo, et al., 2012). A comprehensive 2016 evaluation of the impact of the nationwide rollout of this, RapidSMS system, commissioned by UNICEF Rwanda (Ruton, et al., 2016) assessed that RapidSMS has contributed to the decrease in maternal mortality rates which have been estimated to have fallen by roughly 9.1 per cent annually from 1.2 per cent in 2000 to 0.2 per cent in 2017 (WHO, 2019). It was assessed that one of the mechanisms through which RapidSMS could have influenced maternal and child health was the RED Alert notification system that could have led to a decreased response time and earlier intervention in emergency situations. However, a number of practical matters such as the need to input long national ID numbers were a significant barrier to use. Experiences such as this provide important insights for future systems designed to address the emergency needs of low-income women. While RapidSMS was not designed specifically to provide support through natural disasters, its use under normal circumstances by both health care providers and women patients enables trouble-free use during all phases of a disaster.

One of the most impactful forms of assistance to persons affected by disasters is access to cash and the facilitation of financial transactions: receipts and payments. Refugees, internally displaced people, stateless persons and women are particularly vulnerable. Even for patriarchal societies, humanitarian organizations, such as Concern Worldwide, have concluded that cash should be disbursed to women in disaster situations, and that this should be the standard for social transfer programmes (Devereux,

Figure 11: Inaccessible Microcredit Agency in Haiti following the 2010 earthquake



Source: Derek Gay

Mthinda, Power, Sakala, & Suka, 2007). Cash transfers are increasingly being facilitated through feature phones with SMS.

### Mobile money

Mobile money, a scheme through which payments can be made and received through a mobile phone, is often utilized by humanitarian organizations to effect cash transfers. Methodologies include the transfer of cash to a mobile money account, to a mobile voucher of specific value to be used for any purchase, and to a mobile voucher for the purchase of specific goods or services. These schemes have been variously used in many countries including Haiti in the wake of the 7.0 magnitude earthquake of 2010 that left over 62 000 persons living in displaced camps for several years; Rwanda which hosts an estimated 150 000 refugees; and Pakistan which hosts roughly 1.6 million internally displaced people and approximately 1.3 million refugees (GSMA, 2017a). At the end of 2018, there were 272 mobile money services in 90 countries, compared to 116 services in 2011 (GSMA, 2019b) (Pénicaud & Katakam, 2014). At the same time, cash is increasingly being used as a form of humanitarian assistance, either as an alternative to, or in partnership with, the provision of food or other items.

Mobile money for humanitarian purposes is a strong proposition in many developing countries as these are the countries which most use the facility on a regular basis. Mobile money accounts exceed bank accounts in roughly 19 countries; and in 37 countries there are ten times more registered mobile money agents than there are bank branches (GSMA, 2017a). Mobile money for the well-established global hub of women's funds, Prospera, would have facilitated a ready channel to provide financial support to women in the event of crisis situations. Assessments indicated that it was likely to have been feasible to migrate the well-established in-person delivery system to a digital platform in Mexico where it had been the largest social assistance program (Mariscal, Mayne, Ruiz, & Rio, 2019). Nevertheless, there are a number of factors which contribute to the success of programmes and after 21 years of operation, it was announced in 2020 that Prospera operations in Mexico were coming to an end (Development Pathways, 2020).

## 4.4 Internet

The Internet is host to a rich variety of facilities including multi-featured messaging applications (apps), other types of mobile apps, very many different types of websites, social media platforms and distance learning platforms. A digital platform is a technology that facilitates interaction, often but not always commercial, between and within multiple communities. It can scale massively and its value is proportional to the size of its user base. Examples of digital platforms are Airbnb, Amazon, BlaBlaCar, Deliveroo, Facebook, Google, Reddit, Snapchat, TaskRabbit, Twitter, Uber, Xing and YouTube.

### Connectivity

The United Nations High Commissioner for Refugees (UNHCR) has found that connectivity can be a tool for self-reliance and positive change when affordable Internet access is available to all, including displaced and host communities (UNHCR, 2015). It has also found that a reliable and speedy Internet connection is a high priority for refugees, in some cases above food, water and shelter (UNHCR, 2016a); and that Facebook is a popular and trusted means of communicating with families in the aftermath of emergencies. The UNHCR vision of connectivity for refugees is “through creative partnerships and smart investments, to ensure that all refugees, and the communities that host them, have access to available, affordable and usable mobile and Internet connectivity in order to leverage these technologies for protection, communications, education, health, self-reliance, community empowerment, and durable solutions” (UNHCR, 2016b). The organization facilitates connectivity to affected areas through a variety of strategies and partnerships with local mobile network operators, private sector organizations, community-based organizations, host governments, donors and a network of ICT emergency standby partners.

There are many models for Internet connectivity. These include use of a personal device to access a data plan or free public Wi-Fi; or use of public facilities such as community-based centres. Free Wi-Fi hotspots provide a critical means of Internet access for many persons at risk, and the establishment of community-based Wi-Fi networks is an important resilience-building measure. With the support of USAID, AfChix, a network of African women in technology, is facilitating the development of four women-led community networks in Kenya, Morocco, Namibia, and Senegal where connectivity had previously been non-existent or too costly. The AfChix community networks reach thousands of households within a half to a one-mile radius and can be scaled. In each case, women’s collectives manage all aspects of the community networks, maintain the Internet infrastructure and liaise with regulators, sponsors and stakeholders as necessary.

The TSF creates ICT centres in collaboration with NGOs and women’s organizations. It adopts and adapts existing communications tools, as appropriate to the needs and contexts of affected persons. TSF has compared the contexts and scale required of its 2019 mission to establish Wi-Fi facilities for over 7 000 migrants and refugees in the Bira Centre of Bosnia-Herzegovina, with its 2015 missions in Serbia, Macedonia and Greece (TSF, 2019a). Despite the differences, TSF credits the lessons learnt from its 2015 experience for the success of its 2019 mission.

Like the TSF, ETC provides Internet connectivity to affected persons. For example, the Cluster provided affected communities in the Domiz camp in Iraq with connectivity for education and general communications in response to conflict that displaced nearly six million people between 2014 and 2017. When ETC officially closed its operations in Iraq, it gave the equipment to local partners (ETC, 2019b).

ITU is the United Nations specialized agency for ICTs. Among other things, ITU has been providing communications assistance within the first 24 to 48 hours of disasters to countries all around the world. Recent examples include the provision of satellite communications following category 5 Hurricane Dorian that hit the Bahamas in 2019, and Harold that hit Vanuatu in 2020 (ITU, 2020a).

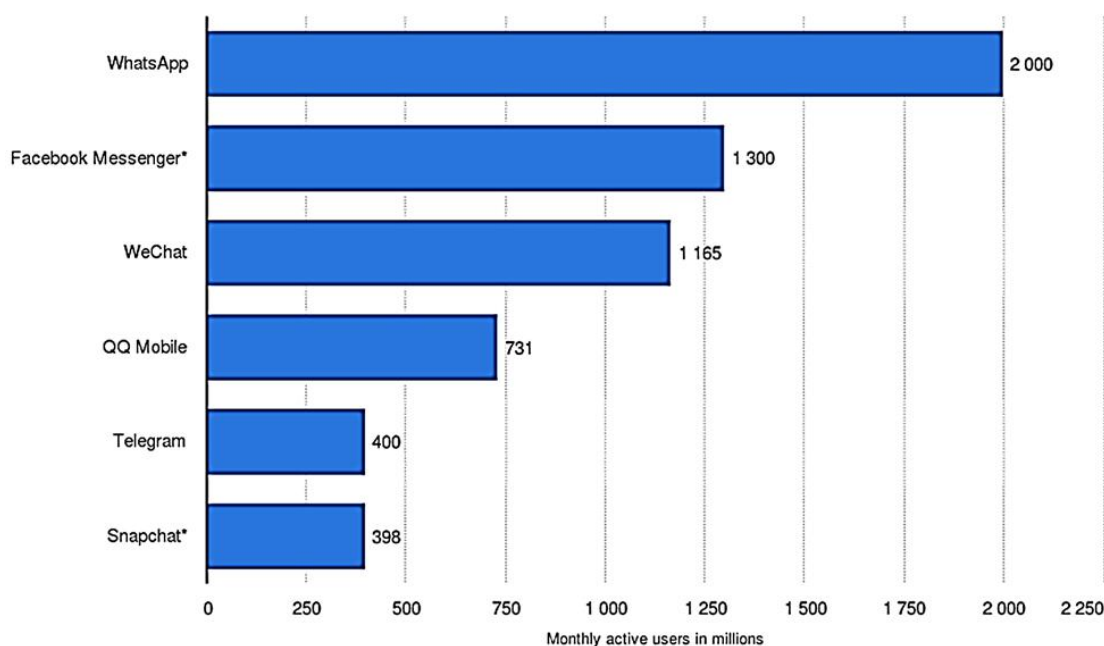
### Multi-featured messaging apps

Over the years the functionality of messaging apps has expanded considerably. In addition to the rich vocabulary of emoticons used to represent facial expressions and convey emotions, real time video

communication and messaging are now popular over messaging apps. Popular messaging apps are Whatsapp, Facebook Messenger, WeChat, QQ Mobile, Telegram and Snapchat. Figure 12 shows that the global number of active users of these apps, as at October 2019, was roughly 6 billion.

COVID-19 stimulated the launch of a number of services available through WhatsApp, the most prevalent of all messaging apps. These include the WHO Health Alert service which provides timely, reliable information about how to prevent the spread of the coronavirus as well as travel advice and coronavirus myths. To subscribe the message "hi" is sent to +41 79 893 18 92 on WhatsApp. In June 2020, the WhatsApp launch of an in-app electronic payment capability has secured its place in the digital platform space.

Figure 12: Most popular mobile messenger apps as at October 2019 (Global) – in millions



Source: Statista, 2020

### Mobile applications

Smart phones offer an impressive range of information acquisition, generation, presentation, and analysis tools; and an equally vast range of possibilities for communication and collaboration. There are several applications designed specifically for women, others designed specifically for disaster resilience, and some solutions designed for women at risk of disasters. Important focal points for mobile applications include gender-specific education for women on mitigation strategies for disaster risks and connecting women refugees with aid workers.

Recognizing the vulnerability of perinatal women and their newborns in earthquake-prone Nepal, researchers at University College London developed a mobile application, MANTRA. The app educates women about potential disasters and maternal health (UCL, 2017). The development of the app was triggered by the 2015, 7.8 magnitude earthquake that destroyed entire villages, killing some 9 000 individuals. Over half a million houses were destroyed and several health facilities damaged, leaving women without healthcare advice and services. Many victims, including pregnant and newly delivered women and their babies, lived unsheltered for periods of days to months with compromised health, nutrition, water, sanitation and hygiene (UCL, 2017).

The MANTRA application sets out to increase maternal and newborn health resilience before, during, and after disasters. It provides educational content through three gaming modules: maternal health, neonatal health, and geo-hazards. Target users are women with low or no education, who have never

used a smart phone nor played mobile games. It was tested by 50 women, aged 20 to 60, in different focus groups. Participants, including those who had never previously used a smartphone, reported that they enjoyed using the app and learned new and critical information from it. Many participants reported that they had previously been aware of geohazards and risks but did not know what to do if one, particularly of large magnitude, occurred. They also indicated that they were overwhelmed by confusing guidelines (UCL, 2017).

As of 2018, it has been reported that over 900 000 Rohingya refugees have been living in severely overcrowded camps in the Cox's Bazar area of Bangladesh having fled systematic discrimination and targeted violence in their home state of Rohingya (OCHA, 2018). The Kutupalong Balukhali expansion refugee camp is one of the largest and most overcrowded refugee camps in the world, with over a million Rohingya refugees, 10 square meters per person, and highly exposed to the monsoon elements. Women and girls are particularly vulnerable to exploitation and violence in the overcrowded camps. The IOM reports that women and girls lured into forced-labour account for two-thirds of those receiving IOM support in Cox's Bazar and another 10 per cent were victims of sexual exploitation (UN News, 2018). Further, among the refugees and host communities, more than 30 000 pregnant women urgently need maternal health care and three of every four babies in the camps are born in unsanitary shelters (UNFPA, 2019).

With support from partners, the Emergency Telecommunications Sector (ETS) developed a mobile application, ETC Connect, for refugees to lodge requests for information and receive confidential responses. The app was launched by the Building Resources Across Communities (BRAC) in 2018, an international non-government organization (INGO), under a project with UNICEF. Community mobilizers, mostly women, went door-to-door sharing lifesaving messages related to health, water sanitation, hygiene, nutrition, and protection and emergency preparedness (ETC, 2018). On average 800 feedback and information requests related to humanitarian services were received through ETC Connect each day. The information provided additional insights into humanitarian relief efforts aimed at improving women's lives in refugee camps (ETC, 2018). Training for the mobile application was also provided to staff from the WFP, MedAir, BBC Media, and Communications with Communities (CwC) Working Group.

AtmaGo is a free Android app designed to "improve women's resilience to disasters, promote economic development, increase female public safety and reduce the short and long term impact of disasters" (GSMA, n.d.). Among other things, emergency alerts about floods and other disasters are sent to users in select locations. A survey in Jakarta (CIPG, 2018) revealed that 30 per cent of users who receive its warnings take preventative action; 79 per cent find the app helpful or very helpful in connecting them with the community; 67 per cent find it helpful or very helpful in assisting them to prepare for disasters; 68 per cent share information from AtmaGo and 13 per cent of those who share information, share disaster reports. The assessment estimates that alerts can reduce property damage caused by disasters by USD 324 per household per year, assuming that effective action can reduce damages by about 50 per cent, that the potential reduction in healthcare costs is estimated at USD 14 per household per year for residents of Jakarta, and that AtmaGo can reduce morbidity and mortality caused by floods and other disasters by 643 years of healthy life lost per 100 000 population assuming that effective action can reduce impacts by about 50 per cent.

Many of the mobile money provisions available for feature phones are accompanied by companion facilities available through smart phones. On account of their richer capability and cost-free operation, messenger apps are a very popular substitution for the cellular network-based SMS. Many of these are, in turn, important communications channels for all phases of disasters when the necessary infrastructure is in working order.

Zello is an example of a VoIP-based "walkie-talkie" app that is useful for various phases of a disaster. It simulates two-way radio operations with push-to-talk capability, with support for transmission of text, pictures and GPS coordinates. The cross-platform app, requires Internet access to operate, works on all popular devices, smartphones, tablets, laptops and desktop computers for all common operating systems. It is well suited for broadcast communications across groups of people and was designed to

Figure 13: Personnel from ETC partner, BRAC, reaching out to Rohingya women



Source: BRAC / Munem Wasif

work with low-quality connections and low battery, as are typical of many disaster situations. It has been used, for example, to crowdsource locations of affected persons when Hurricane Harvey hit Texas in 2017 and had 6 million new users during Hurricane Irma that hit the United States of America and the Caribbean in 2017 (Varieras, 2019).

As for all disasters in which the app is used, Zello talk groups (channels) were created specifically for different communities for both Irma and Harvey. One such channel, Houston Midwives for Pregnant Mammams, served mothers in labour who were unable to make it to the hospital (Young, 2017). The women who acted as channel moderators for Irma agreed that, among other things, Zello is easy to learn (Varieras, 2019). This low barrier to entry provides an upgrade path to radio use, and there have been several instances of women starting with Zello, transitioning to land mobile for first response, and then becoming licensed amateur radio operators.

### Evolved websites

The World Wide Web has become the global port of call for information of all sorts. Originally a website was an informational resource on the Web used somewhat like an asynchronous broadcast channel from which public information consumers would access posted information whenever they wished. Though several websites exist in the old tradition today, many others additionally feature rich forms of engagement, crowd sourced content and interactivity. Figure 14, for example, shows a snapshot of the homepage of the *Take Back the Tech!* site (<https://www.takebackthetech.net/>) that features an engaging information resource in the left column leading to advice on how to provide assistance to victims of gender-based violence (GBV). The middle column is a digital solidarity quilt to which registered users can contribute a picture representing hope, strength or solidarity for the cause against GBV. The right column features an interactive component in which users can shuffle a deck of digital playing cards of women leaders in various aspects of ICT and women's rights around technology, freedom of expression, violence prevention and more. The *Take Back the Tech!* site is a collaborative campaign to take control of any ICT device and platform for activism against GBV.



Figure 14: Excerpt from Take Back the Tech! Site showing a variety of engagement strategies

The image displays three distinct engagement strategies from the 'Take Back the Tech!' website. Each strategy is presented with a visual header, a descriptive paragraph, and a call-to-action button.

- Help A Friend:** The header features a purple background with cartoon illustrations of women and the text 'HEY! IS YOUR FRIEND BEING ATTACKED ONLINE?'. The description asks if a friend is being attacked online and provides a link for more information.
- Digital Solidarity Quilt:** The header shows a grid of various images including a hand cursor, a woman, a red female symbol, and a dog. The description explains that the digital quilt represents collective solidarity and recognition of women's human rights defenders. It includes a link to view and contribute.
- Digital Rights Activists:** The header features a pink background with a line-art illustration of a woman's face and the text 'take back the tech' and 'ADA LOVELACE Wrote the first algorithm for a machine'. The description describes a deck of playing cards reflecting women's contributions to technology and includes a link to shuffle and contribute.

Source: Take Back the Tech! (takebackthetech!, n.d.)

The Access Now Digital Security Helpline (<https://www.accessnow.org/protect-digital-rights-promote-public-health-towards-a-bettercoronavirus-response/>) provides 24-hour, 7-day rapid-response emergency assistance via email and advice on digital security practices in eight languages. During COVID-19 the interest in support and advocacy services for women such as these was heightened in response to the upsurge in online GBV. Many other online helplines were established to support women at that time.

The vulnerability of women is reduced through the building of their personal agency but many other agents within the ecosystems of perpetrators of violence also need to change. The COVID-19 Web resources happily target a robust cross section of these communities, for example, *#SheTransformsTech* (<https://www.worldpulse.com/she-transforms-tech>) is a crowdsourced campaign and global poll that synthesizes stories and inputs from grassroots women from over a hundred countries into recommendations for global policymakers and technology companies. Their tag line is “We believe women hold the power to create global change. We connect them.”

*Call to men* (<https://www.facebook.com/groups/healthymanhood>) operates an online group and call to action for men to stop the COVID-19 increase in online pornography and to practice positive masculinities. A strategies and resources manual for journalists that advocates how to address online abuse is available at <https://onlineharassmentfieldmanual.pen.org>. Internet Lab Law and Technology Research Centre (<https://www.internetlab.org.br/en/>) facilitates academic debates around issues involving law and technology, especially Internet policy. The website of CenderIT, a project of the Women's Rights Programme of the Association for Progressive Communications (<https://genderit.org/>), features a rich portfolio of gender and ICT analysis informed by feminists from 18 countries in Africa. The EQUALS Digital Skills Fund (<https://webfoundation.org/digitalskillsfund/>) is a grassroots programme which supports women and girls across the Africa, Asia-Pacific, and Americas regions to develop digital skills.

The responsive Web, which enables websites to be viewable from multiple devices including smart phones and tablets, has dramatically increased access to the Internet, particularly amongst vulnerable populations who at most possess a smart phone. When women and girls have access to the Internet,

though, they are the subjects of online violence more often than men, and the rate has risen sharply during the COVID-19 pandemic (UN Women, 2020).

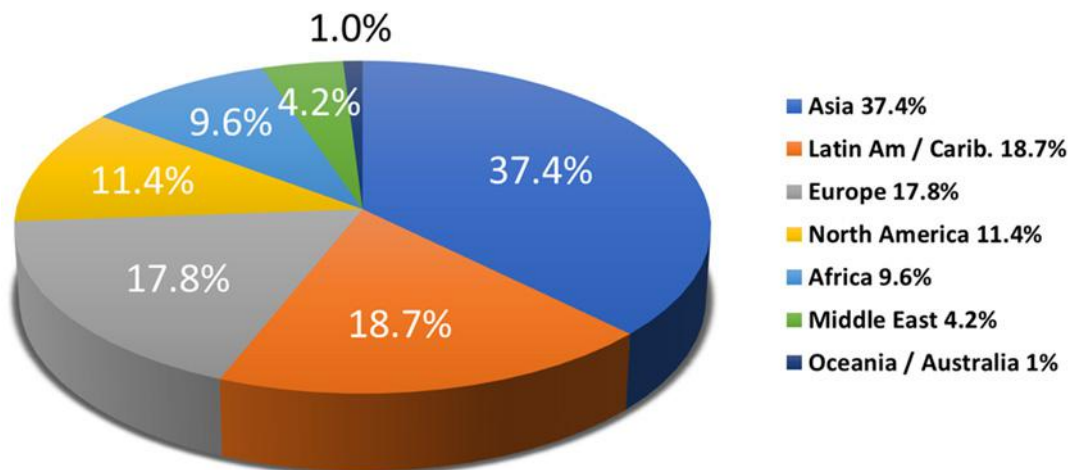
### Social media

The most popular full-featured digital platform globally is Facebook, with a global subscription of 2 224 726 721 as at March 31, 2020 (Internet World Stats, 2020). Data from Internet World Stats, 2020, in Figure 15 show that the majority of Facebook users are in Asia (37.4 per cent); users in Latin America and Europe follow at (18.7 per cent and 17.8 per cent respectively); users from Africa account for 9.6 per cent and those from the Middle East 4.2 per cent of global users. Oceania / Australia accounts for the lowest percentage of users at 1 per cent.

Facebook now offers a type of social learning group that enables administrators to organize and reorder posts into units, pose challenges for learners and receive notifications when learners have completed tasks. A curriculum on strategies to stay safe during the COVID-19 is available through this feature.

Facebook maintains a rich set of features over its portfolio of platforms (Facebook Messenger, Instagram, WhatsApp). Several pre-existing platforms provide direct support for disaster preparation, response and recovery. Some have been expanded in response to COVID-19 while others have been added on account of the pandemic. Informational resources include the expansion of the pre-existing blood donations feature, which indicates when there are shortages in local blood banks and arrangements for donating. Community Help, for example, is a tool to request or offer help to neighbours; a Messenger Coronavirus Community Hub provides tips and resources to keep people connected and to prevent the spread of misinformation. Instagram Search was extended to include a new way to browse with friends over video chat and educational resources were added. “Stay Home” stickers as well as stickers to promote accurate information and donations, were added. A shared story feature was added; and COVID-19 content and accounts were removed from recommendations, unless posted by a credible health organization.

Figure 15: Facebook subscribers in the world as at March 2020



Source: Internet World Stats, 2020

Facebook Local Alerts (🚨) enable local authorities to issue alerts for fixed time frames for missing persons, public safety, service interruption, transit and weather. The affected area, within the authority jurisdiction, can be specified on a map, centred on a pin. Only followers of the Facebook page who live in the area and have their location history setting turned on, receive the alert. The network effect results in rapid sharing of alerts. Figure 16 shows Sonoma County, California (United States of America) under flood waters, and a local mandatory alert issued by the authorities to evacuate. In minutes the

alert was shared to thousands of persons (Facebook, 2020a). Authorities that qualify to issue local alerts include city government, county government, fire / emergency services and law enforcement.

Figure 16: County of Sonoma, California flood and Facebook local alert



Source: ITU

Several steps have also been taken to combat COVID-19 misinformation on the platform including the support for fact-checkers. To promote the use of reliable information sources, COVID-19-related Facebook groups receive an educational pop-up directing them to credible information from health organizations; and group admins are advised to share broadcasts from national and international health authorities. Facebook local alerts is used by over 2 000 agencies to deliver timely information to their communities.

Quite apart from the informational and connection-based features that, with appropriate measures, have potential to provide direct benefits to women and other persons at risk in the context of disasters, many open data products are available for agencies to use in disaster mitigation, preparedness, response and recovery interventions. These include pre-existing gender disaggregated displacement maps (Facebook, 2020b) created under the Data for Good program. COVID-19 is featured strongly in Facebook Disease Prevention Maps and Symptom Map, which provide key inputs into disease forecasting as well as mitigation, response and recovery measures. Open COVID-19 datasets have also been made available for public use.

### Distance learning

Disasters are highly disruptive to education. Each year, the education of roughly 37 million children is disrupted due to the destruction of their schools or the use of these structures as disaster shelters (Watt, 2020). Pandemics are also highly disruptive to learning. In the case of COVID-19 in 2020, an estimated 62 per cent of learners ranging from pre-primary to tertiary level students were affected by closures (UNESCO, 2020c). COVID-19 stay at home orders and social distancing requirements imposed in countries around the world motivated remote learning to mitigate the impact of education losses (Li & Lalani, 2020). Internet-facilitated online and distance learning was widely adopted in response. Online and distance learning facilitates the distribution of learning resources and the conduct of learning activities using a variety of techniques that cover a broad spectrum of computer mediation. UNESCO provides information on a wide range of online and offline distance learning tools and resources to enable educators to carry on classes with their students while at home (UNESCO, 2020a). These include examples of digital learning management systems, systems built for use on basic mobile phones, systems with strong offline functionality, Massive Open Online Course platforms, repositories of self-directed learning content, mobile reading applications, collaboration platforms that support live-video communication, tools for teachers to create digital learning content, resources for psychosocial support, and other repositories of distance learning solutions.

UNHCR has compiled a list of distance learning solutions for refugees that they indicate may be considered as digital education resources and tools for all learners and teachers (UNHCR, 2020b). This list may be filtered according to several categories including level, thematic area and by language, including sign language. The list highlights resources that UNHCR has used in low-resource contexts.

Recent work recognizing the opportunities of online and distance learning and the need to build the disaster resilience of women and girls (Sattar, 2016) describes a model that combines traditional methods of teaching with an online delivery method to raise awareness of disaster risk mitigation. It comprises conventional print materials as well as audio and video material via an e-learning platform is accessible from mobile phones.

ICTs may be used to reduce women's vulnerability to disasters in many ways. These do not only include the use of ICTs by affected women but also number among the many who design, implement, deploy and advocate for the use of humanitarian ICTs. Learning and sensitization is therefore not only important for potential and existing victims of disasters but for a whole spectrum of persons involved in the many parallel life cycles of humanitarian ICTs. Electronic learning platforms and online learning technologies are key resources in this regard. The UN Women Training Centre eLearning Campus offers courses on a variety of topics relating to gender equality. In addition to face to face delivery, various ICT-enabled modalities are available: self-paced, moderated, blended, and customized.

Existing learning platforms for use on basic phones include Cell-Ed, a skills-based learning platform with offline options; Funzi, a mobile learning service that supports teaching and training for large groups; KaiOS, a tool that enables basic smartphone capabilities on inexpensive mobile phones; Ubongo, delivery localized learning through entertainment and mass media, in Kiswahili and English.

Existing tools for the creation of digital learning content include: Thinglink, to create interactive images, videos and other multimedia resources; Buncee, to create and share visual representations of learning content, including media-rich lessons, reports, newsletters and presentations; EdPuzzle, video lesson creation software; Kaltura, video management and creation tools with integration options for various learning management systems; Nearpod, to create lessons with informative and interactive assessment activities; Pear Deck, to design engaging instructional content; Squigl, to convert speech or text based content into animated videos; Trello, for visual collaboration for learning resource planning and organization.

## 4.5 Supporting ICT tools

### Biometrics and blockchain

Despite the convenience and potency of mobile money for disaster victims, it excludes those who do not possess phones and may be challenging for those with very low rates of literacy. Also, a lack of official proof of identity can exclude women from formal assistance during and following a disaster. In a number of countries, legal and cultural gender disparities make it more difficult for women to obtain a national identity card or apply for a passport (GSMA, 2017b). In the aftermath of 2010 flooding in Pakistan, for example, many women lacked national identity cards, which limited their ability to receive assistance from relief schemes that were predicated on the possession of an identity card (GFDRR, 2018).

WFP has implemented its Building Blocks programme using biometrics and blockchain to transfer cash directly to unbanked beneficiaries. Biometrics refers to the automated recognition of individuals based on their biological and behavioural characteristics. This is useful for beneficiaries who do not possess national identity cards. Blockchain, otherwise known as distributed ledger technology, is a digital technology that utilizes a public database to store records. Each record comprises information on the unique digital signatures of entities participating in a transaction, as well as other key information such as the date, time, and value of the transaction. Blockchain facilitates direct, secure, and fast financial transactions (Ko & Verity, 2016) without the need for a financial intermediary. This is particularly useful in situations in which banking infrastructure is underdeveloped or inconvenient; and, among other things, lowers transaction costs.

Beneficiaries of the Building Blocks programme, who previously received their monthly cash entitlement at centres on a set date, withdraw cash at their convenience at several supermarkets setup with biometric identity systems that scan irises at checkout. After testing the capability to

authenticate and register beneficiary transactions in Pakistan in 2017, WFP used the Building Blocks system to provide cash transfers to over 106 000 Syrian refugees in Jordan the following year (WFP, 2020). The platform is shared by UN Women to deliver benefits in its cash-for-work programme for Syrian refugee women (UN Women, 2018). Blockchain is increasingly being adopted by other large-scale humanitarian agencies (Coppi & Fast, 2019).

Building Blocks is of greater benefit to women than men as it does not require a mobile phone and fewer women own smartphones than do men. Also, the blockchain technology utilizes virtual bank account identities for every Building Blocks beneficiary verified through iris scans. This form of bank account is of greater benefit to women than men in low-income economies as they enjoy lower rates of national identification registration than men (Desai, Diofasi, & Lu, 2018), and therefore are less likely to qualify for traditional bank accounts. The access to cash through Building Blocks, enabled by blockchain technology, therefore removes two substantial barriers for women in the refugee camps.

A follow-on benefit of the Building Blocks programme is the acquisition of digital and financial literacy training. In particular, UN Women took a comprehensive approach to beneficiaries' economic empowerment through seminars in expense tracking and budgeting, and teaching them how to view their current account balances and history online. Another benefit of the programme to aid agencies is the secure monitoring possible as the virtual Building Blocks accounts are linked to the Office of the UNHCR biometric identity system.

Quite apart from use of blockchain by humanitarian organizations to disburse aid, it finds natural applicability in other contexts of financial inclusion including the receipt of remittances and land titling. Additional applications include tracking of support to beneficiaries from multiple sources, improving the transparency of donations, reducing fraud, grant management, organisational governance and management of crowdfunding and co-ordination of aid delivery. Its advantages include increased efficiency and improved information management, (Coppi & Fast, 2019) (Riani, 2018). Notwithstanding its considerable potential, blockchain technology is still relatively new and there are cautions to its widespread adoption. Deloitte calls for collective action on the part of both public and private sector to develop innovative solutions within a sustainable and supportive ecosystem (Deloitte, 2018).

### Standard data tools

Initiatives to address the paucity of gender-aware data include the UN Evidence and Data for Gender Equality (EDGE) project launched in 2013, the World Bank Gender Data Portal re-launched in 2016, GSMA (2018) Toolkit Researching Women's Internet Access and Use, and USAID Gender and ICT Survey Toolkit (2018). The UN has also developed four ICT access measures: proportion of adults with an account at a bank or other financial institution or with a mobile-money service provider; proportion of individuals using the Internet; proportion of individuals who own a mobile telephone; proportion of households with access to mass media. These are included in its Minimum Set of Gender Indicators (UNSD, 2019).

ITU has created a gender dashboard that tracks indicators in areas of women in ITU meetings, women in ICTs and connectivity (global Internet gender gaps and women in tech data) and women in ITU (staff demographics). Increasing transparency of data on gender and leadership can help raise awareness of current imbalances and strengthen efforts to accelerate progress. For example, one of the dashboard indicators tracks the percentage of female delegate speaking time in ITU meetings. At the ITU 2018 Plenipotentiary Conference, women spoke on average 24.9 per cent of the time, and as little as 17.5 per cent of the time in some sessions. Interestingly, when there was a female chair this increased to 33.8 per cent, which may indicate that female leadership can facilitate more opportunities for women's voices to be heard in ITU decision-making. Monitoring not only reveals inequality but enables the setting of targets to rectify it. This applies to advancing equal representation in all areas and at all levels, including women studying STEM, working in the technology industry, media, etc., environmental protection and risk prevention, during disasters.

An EQUALS report finds that most indicators are “conceptually unclear, lack an agreed methodology, and are not regularly collected by most countries in any region or development category (less than 50 per cent of countries, for most indicators)” (EQUALS, 2019). The report identifies the following barriers to the collection of sex-disaggregated data: low data collection and analysis capacity of national statistics offices, diversity of potential issues and indicators, and lack of conceptual and definitional clarity.

A number of tools are available to complement large scale data collection. These include Interactive voice response data gathering using Magpi (Magpi, 2020) or more inexpensive text based data gathering tools such as GroupMe (GroupMe, 2020), CallFire (CallFire, 2020) and TextIt (TextIt, 2020). TextIt facilitates the creation and transmission of relatively complex question flows using a mobile phone. Text and SMS based surveys enable rapid, concise data for programmatic decision making when other options are not available (Berman, Figueroa, & Storey, 2017).

Not only are data required for alerting, analysis, research and planning but it is necessary to provide compelling evidence for policy change and perception change and other forms of change. Key to this is the set of presentation tools and strategies used to raise awareness. There are many tools and resources including the ITU Gender Dashboard (ITU, 2020b), which features women in ICTs and connectivity and the Humanitarian Data Exchange (HDX), which features gender data for several countries.

### **Artificial intelligence and big data**

Definitions of artificial intelligence (AI) are varied. As the basis of its recommendation for ten steps to protect human rights, the Council of Europe Commissioner for Human Rights considers it to be “an umbrella term to refer generally to a set of sciences, theories and techniques dedicated to improving the ability of machines to do things requiring intelligence” (Council of Europe, 2019). The recommendation recognizes AI systems as machine-based system that are able to recommend, predict or make decisions in response to specified objectives.

Among other things, AI is used to process data in ways that are of benefit to women. For example, the need for gender-disaggregated data is accompanied by a corresponding need for data anonymization to preserve privacy. AI based tools for this purpose include Amnesia, which removes identifying information from data sets (Amnesia, 2019). Data anonymization may also play a role in reducing gender bias (Saunders, Kitzinger, & Kitzinger, 2015). Aylien (Aylien, 2020) is a tool that analyses text using artificial intelligence, natural language processing, and machine learning. Lexalytics (Lexalytics, 2020) is a modular platform solution that hosts three text analysis tools to extract meaningful insights out of text data. MeaningCloud (MeaningCloud, 2020) is a text analytics tool that automates the process of extracting insights from unstructured data.

AI can be used in countless ways to assist in all phases of disaster risk management, learning from massive data sets (big data) gathered and curated over years of incidents and consequences. It could have a tremendous impact for disaster management by accelerating recovery and response times. Humanitarian groups are hoping to speed up map creation by using machine learning to extract objects such as buildings and roads from aerial images. Considerable research is currently being devoted to the use of AI for detecting and possibly one day predicting earthquakes (ITU, 2019d). During the COVID-19 global pandemic it has been used in efforts to search for a cure, to share knowledge, observe and predict the evolution of the pandemic, assist healthcare personnel, control population and much more (Council of Europe, 2020).

The International Development Research Centre (IDRC) and the Swedish International Development Cooperation Agency (SIDA) have issued a joint call for research proposals “The COVID-19 Global South AI and Data Innovation Program: Leveraging AI and data science to improve responses to COVID and future pandemics in Low and Middle-Income countries”. IDRC and SIDA will sponsor multidisciplinary research on strategies to develop and scale responsible (inclusive, rights-based, ethical, and sustainable) evidence-based artificial intelligence (AI) and data science approaches that support COVID-19 response and recovery in low- and middle-income countries (LMICs). Research

themes of interest include: forecasting transmissions and reducing spread through policy and public health interventions; optimizing public health system responses for patient diagnosis, care, and management; mobilizing AI and data science to understand and support gender inclusive COVID-19 action; building trust and combatting mis- and dis-information around COVID-19; strengthening data systems and information sharing about COVID-19; and supporting transparent and responsible AI, data, and digital rights governance around COVID-19 and pandemic responses (IDRC, 2020).

AI may also be applied to tackle some of the factors that compound gendered disaster vulnerability and the gender digital divide. These include but are not limited to: online harassment, gender bias and stereotypes, and digital illiteracy. One of the strategic and potent approaches to the application of AI that has emerged within the technical (tech) community is rich, flat (non-hierarchical, in fact somewhat anarchical) collaboration. COVID-19 has activated a number of initiatives. For example in response to the alarming rise of domestic violence and online harassment, the Red Dot Foundation and Omdena have partnered in a call for other collaborators to join them to create an AI solution to understand trends (Omdena, 2020). The Red Dot Foundation is a nonprofit organization dedicated to ending violence against women and girls using crowdsourced data, community engagement and institutional accountability; and Omdena is a collaborative innovation platform for AI engineers and domain experts.

AI also finds application in support of efforts to address gender bias and stereotypes. For example, with proper application, it may detect socially undesirable patterns in text, which can then be used as the basis for controlling gender-bias expressed in documents. Dinan *et al* (2020) report on a multi-dimensional gender bias classification framework based on machine learning models trained to find patterns of bias. Several other researchers have explored methods for removing gender bias from text (Bolukbasi, Chang, Zou, Saligrama, & Kalai, 2016).

AI is capable of transforming digital literacy and all thematic areas for teaching and learning at all levels. UNESCO recognizes this and is lead host in Mobile Learning Week 2020 under the theme “Artificial Intelligence and Inclusion”. Though the 5-day event has been postponed due to COVID-19, its themes are: How to solidify international cooperation to promote inclusive access to AI and digital innovations? How to leverage AI to advance inclusion in access to quality learning opportunities? How to foster AI innovations to enhance learning outcomes across learning settings? How to ensure non-discriminatory and gender-equitable use of AI for lifelong learning? (UNESCO, 2020b).

UNESCO identifies several applications of AI technologies for digital inclusion, such as: the use of educational data to track and support learners in crises and emergencies; machine translation and image recognition technologies to support access to global learning resources; personalized, AI-aided mentoring based on individual learning pattern recognition; and diagnostic technologies for learning difficulties (UNESCO, 2020c).

Another transformational impact of AI and big data is the support of the global digital humanitarian network of volunteers. Digital humanitarians, people “bound by a humanitarian calling and access to the Internet and Twitter” (Meier, 2015), programmatically interpret massive amounts of messages shared on social media. Among the many tools used by digital humanitarians is the free and open source Artificial Intelligence for Disaster Response (AIDR) platform that automatically collects and classifies tweets posted during humanitarian crises.

Even without AI, big data has a considerable role to play before, during and after disasters. For example, it may be combined with map data to guide decisions on where to plan housing developments to avoid disaster sensitive areas (Salah, Pentland, Lepri, & Letouzé, 2019).

### Internet of Things

In the case of major weather events, such as hurricanes, tornadoes, floods and wildfires, physical and technical roadblocks can prevent response teams from obtaining critical data to track damages, prioritize response needs, and keep the public informed (Tremaine & Tuberson, 2017). Poor communication

channels, overburdened response systems, satellite disruptions, and Internet blackouts can all stand in the way of rescue efforts. This is where disruptive technologies, such as Internet of Things (IoT), can be utilized in disaster response strategies and methods. IoT sensors can collect environmental data such as temperature, water quality, pressure, level, smoke and humidity (Tremaine & Tuberson, 2017) and systematically broadcast it from emergency areas. They can also detect the propagation of disaster phenomena such as fire and flood waters. IoT can be critical for urgent decisions such as whether to evacuate an area at risk of flooding, or how to guide residents to the safest exit routes ahead of an emergency.

While there do not appear to be any IoT solutions at this time that have been specifically designed to provide support for women before, during and after disaster situations, it represents an opportunity for wearable versions of applications such as AtmaGo. There already exist IoT solutions for theft monitoring, such as Charm Alarm, specifically for women. This device comprises a bracelet worn on the wrist and linked to a sensor in the woman's purse or wallet. When the separation between the two exceeds a threshold, vibration and beeping provide an alarm. The flexibility and consumerization of IoT components such as sensors, actuators, communications transceivers, microprocessors and digital signal processors, provide rich opportunity for IoT solutions tailored to women's resilience in all phases of the disaster risk management cycle.

### Drones

Drones, such as Unmanned Aerial Vehicles (UAVs), are small mobile units that are remotely controlled or that can operate autonomously. In the face of the 2020 COVID-19 pandemic, public health and safety officials employed drones to monitor public spaces and enforce social distancing rules (MarketplaceTech, 2020). In at least one case they were used to broadcast, via loudspeakers, messages such as "This is the Anti-COVID-19 Volunteer Drone Task Force. Please maintain a social distance of at least six feet. Again, please maintain social distancing. Please help stop the spread of this virus, reduce the death toll and save lives. For your own safety and your family's safety, please maintain social distancing. Thank you for your cooperation. We are all in this together" (CBS, 2020).

Quite apart from their role in visual data acquisition, drones are able to assist in risk reduction in many ways. They are increasingly being used to deliver health supplies including blood. The Rwanda Government is collaborating with a United States of America startup company, Zipline, to deliver blood supplies by drone. A key motive is to arrest the possible consequences of postpartum haemorrhaging, a leading cause of death for pregnant women. Zipline, is also delivering vaccines by drones in Rwanda. The mountainous profile of the country makes drones an ideal means of delivery. In Ghana cities, drones are operating around the clock with the expectation of ultimately reaching 2 000 clinics in the country. Zipline is experimenting with drone delivery of vaccines and other medical supplies in several other countries in Africa over quite different terrain profiles (Financial Times, 2019).

Like amateur and mobile radio, drones are used by first responders, officials and other agents to provide direct or indirect support to women and other at-risk persons within disaster contexts. Drone operators are expected to have the wherewithal to purchase, operate and maintain the devices.



## 5 Unintended consequences

This report has focused on the opportunities for, and use of, ICT to improve women's resilience to disasters. In addition to the intentioned benefits, there are happily some positive unintentional benefits. A follow-on benefit of the Building Blocks programme, for example, has been the acquisition of digital and financial literacy training for disaster victims. In particular, UN Women took a comprehensive approach to beneficiaries' economic empowerment through seminars in expense tracking and budgeting, and teaching them how to view their current account balances and history online.

Indirect impacts of digital competence include increased levels of self-confidence and independence, and the potential increase in social status, mobilization, and access to new opportunities as well as to channels to exercise oppositional voice (Cummings & O'Neil, 2015).

Yet there are a host of negative unintentional consequences that are cause for concern, and that direct recommendations for mitigation strategies. In relation to traditional TV and radio, for example, a meta-analysis of 64 primary studies found that stereotyping, predominantly around occupational status, is prevalent in advertising (Eisend, 2010). A study of 1755 advertisements from 13 countries in Asia, the Americas and Europe in May 2014 found that the phenomenon is global (Matthes, Prieler, & Adam, 2016) and observed that there is evidence that gender stereotypes in advertising can influence gender-role stereotypes in society. This further perpetuates gender roles and gender inequality (MacKay, 1997); (Oppliger, 2007). Outside of advertising, women are disproportionately portrayed in traditional media as less authoritative, capable, and serious than men, and typically cast in auxiliary roles (McCracken, FitzSimons, Priest, Girstmair, & Murphy, 2018).

The potential harmful effects of social media are numerous. The UN Internet Governance Forum (IGF) Dynamic Coalition on Platform Responsibility (DCPR), a multi-stakeholder action group concerned with online platform responsibility to respect human rights, has facilitated a participatory, multi-stakeholder exploration of the human rights dimension of digital platforms. The 2017 report, "Platform Regulations: How Platforms are Regulated and How They Regulate Us" (UN IGF Dynamic Coalition on Platform Responsibility, 2017), explores the moral, social and human rights responsibility of Internet intermediaries and the thorny issue of their liability. It makes no specific mention of women but recognizes among the harms of platforms, gender based harassment and bullying. Other harms cited include: video posts; fake and junk news; promotion of terrorism and extremism; misogyny; hate speech in the form of inter alia racism, Islamophobia, anti-Semitism, homophobia; religious discrimination; reputational damage related to such doctrines as the right to be forgotten. Indeed, platforms are rampant with mis-information, which is not only often defamatory, but it can influence vulnerable persons to make life threatening decisions. This is particularly tragic under disaster circumstances.

As far back as 2015, the UN IGF articulated recommendations for online platform responsibility to respect human rights in accordance with the UN Guiding Principles on Business and Human Rights (UN Working Group on Business and Human Rights, 2011). The terms of reference for platform responsibility call for corporations to (1) make a policy commitment to the respect of human rights (2) adopt a human rights due-diligence process to identify, prevent, mitigate and account for how they address their impacts on human rights; and (3) have in place processes to enable the remediation of any adverse human rights impacts they cause or to which they contribute (UN IGF, 2015).

The Internet of Things (IoT) is also associated with a number of potential security concerns: physical, regulatory, legal, financial and reputational risks. This has spawned the need for strategies and mechanisms that address trust, identity, privacy, protection, safety and security (TIPPSS) for all IoT applications, devices, processes and services. The Institute for Electrical and Electronic Engineers (IEEE) P2733 Standard for Clinical Internet of Things (IoT) Data and Device Interoperability with TIPPSS establishes the framework for clinical IoT data and device validation and interoperability. A priority area is healthcare including wearables that provide critical data to electronic health and medical record systems during emergencies.

The development of TIPPSS calls for inputs from all segments of society as we are all vulnerable to attack. Florence D. Hudson Ed. (Hudson, 2019) tells the stories of several women who are playing an active role in driving the TIPPSS agenda and working to ensure its development. These women include technologists, astrophysicists, aerospace engineers, computer scientists, biochemists, cybersecurity professionals, experts in identity and access management (IAM), policy experts, lawyers, judges, students, and venture capitalists, with experience in industry, academia, and government.

As for IoT, drones used for disaster mitigation, preparation, response and recovery may be accompanied by unintended consequences. Of most concern to vulnerable persons for whom they provide support, is the adherence to the UN principles on personal data protection and privacy, that is to say: fair and legitimate processing, purpose specification, proportionality and necessity, retention, accuracy, confidentiality, security, transparency, transfers and accountability (UN, 2018).

Despite the powerful application of biometrics as a convenient, efficient and robust form of identification for the most vulnerable of disaster victims, unconstrained use may be offensive and a legal offence. The Handbook on Data Protection in Humanitarian Action (Kuner & Massimo, 2020) elaborates on the need for humanitarian organizations to ensure protection of individuals' personal data. This is essential to protect their lives, integrity and dignity. The Handbook provides cautionary notes on potential violations of these principles for biometrics as well as other new and emerging technologies of utility in humanitarian work: data analytics, drones, cash transfer programming, cloud-based computing and messaging apps.

A 2015 analysis of branchless banking applications in the developing world (Reaves, Scaife, Bates, & Traynor, 2015) has found an alarming set of vulnerabilities. The range covers different avenues for information leakage, fraud and errors in certification validation. At the time of the research, the authors assessed that the majority of apps did not provide adequate protections for financial services and that the liability rests with the customer. A more recent assessment of blockchain by KPMG cautions that the technology is still relatively new and a number of potential vulnerabilities remain (KPMG, 2018).

Table 2 provides sample unintended consequences for some ICTs used for disaster resilience building.

**Table 2: Sample unintended consequences of ICTs used for disaster resilience building**

Example ICT	Sample Unintended Consequences
Broadcast media including FTA TV and radio	<ul style="list-style-type: none"> <li>• Gender stereotypes in advertising can influence gender-role stereotypes in society, perpetuating gender inequality (MacKay, 1997); (Oppliger, 2007).</li> <li>• There is considerable latitude to express opinions, that may be shrouded in gender bias. The elimination of the United States of America Fairness Doctrine provides even greater latitude (University of Minnesota Libraries Publishing, 2010)</li> </ul>
Mobile Banking/Cash Transfer	<ul style="list-style-type: none"> <li>• Pervasive and systemic vulnerabilities including erroneous certification validation, poor cryptography, and information leakage that enable impersonation and financial record theft (Reaves, Scaife, Bates, &amp; Traynor, 2015)</li> <li>• In the case of biometrics: ethical issues such as affected persons' concerns about surveillance and use of data for purposes other than those for which the affected persons' are aware (Kuner &amp; Massimo, 2020)</li> </ul>
Internet	Women tend to restrict their access online because of violence committed online (UN Women, 2020)

Example ICT	Sample Unintended Consequences
Websites	<ul style="list-style-type: none"> <li>• Depression, loneliness, and limited face-to-face contacts can result from not limiting time spend online (Clemson University, 2012)</li> <li>• Online gender-based violence is associated with psychological, social, and reproductive health impacts, and often with offline physical and sexual violence for victims/survivors (UN Women, 2020).</li> </ul>
Social media	Predators can be drawn to content posted by girls (Odundo, 2012).
Facebook pages and Groups	The spread of fake news or misinformation can lead to inaccurate perceptions of health threats and the consequences of disasters (Meer & Jin, 2019)
Online donations and crisis giving	While cash transfers may alleviate stress and contribute to better gender relations and less violence in the home (Bell, 2015) they are often the source of significant tensions when the recipients are women.
Biometrics	Risk of false matches; beneficiaries' perceptions and/or concerns about surveillance; misuse of data (Kuner & Massimo, 2020).
Blockchain	Privacy and anonymity as well as other security vulnerabilities including the possibility of double spending (Hasanova, Baek, Shin, Cho, & Kim, 2018)
Artificial intelligence (AI) and big data	<ul style="list-style-type: none"> <li>• Bias in AI systems may reflect historical patterns of discrimination (West, Whittaker, &amp; Crawford, 2019).</li> <li>• Relations of power may be expressed in socio-algorithms, for example as used in some search engines, derived from long-established gender biases (Safiya Umoja Noble, 2018).</li> </ul>
Drones	<ul style="list-style-type: none"> <li>• Potential violation of UN principles on personal data protection and privacy, in particular: fair and legitimate processing, purpose specification, proportionality and necessity, retention, accuracy, confidentiality, security, transparency, transfers, accountability (Kuner &amp; Massimo, 2020).</li> <li>• Possibility of retaliatory actions by criminals if drones capture images or video of their criminal activities (Kuner &amp; Massimo, 2020).</li> </ul>
Internet of Things (IoT)	Abusive persons may use IoT devices to spy on their partners (Women In Identity, 2019).
Communications technology in general	There is a risk that the facilitation of more communication may be deemed a universal solution while in fact it may not be either equitable or accessible to all (Tapsell, 2009) (Höppner, 2010).

## 6 Analysis

This study has revealed a number of factors that lead to gendered disaster vulnerabilities and that perpetuate the gendered digital divide. Without regard to their origin, these factors may be reduced to:

- limited access to information and cash;
- limited engagement and participation in processes that directly and indirectly affect women's ability to benefit from ICT-enabled disaster resilience;
- limited opportunities for, and the means and confidence to access, learning;
- deeply rooted perceptions of gender, on the part of women and men, at risk and not.

Of interest to this report is the role that ICT can play in strengthening women's capacity to mitigate the impacts of, prepare for (before), respond to (during) and recover from (after) disasters, taking these vulnerability factors explicitly into account.

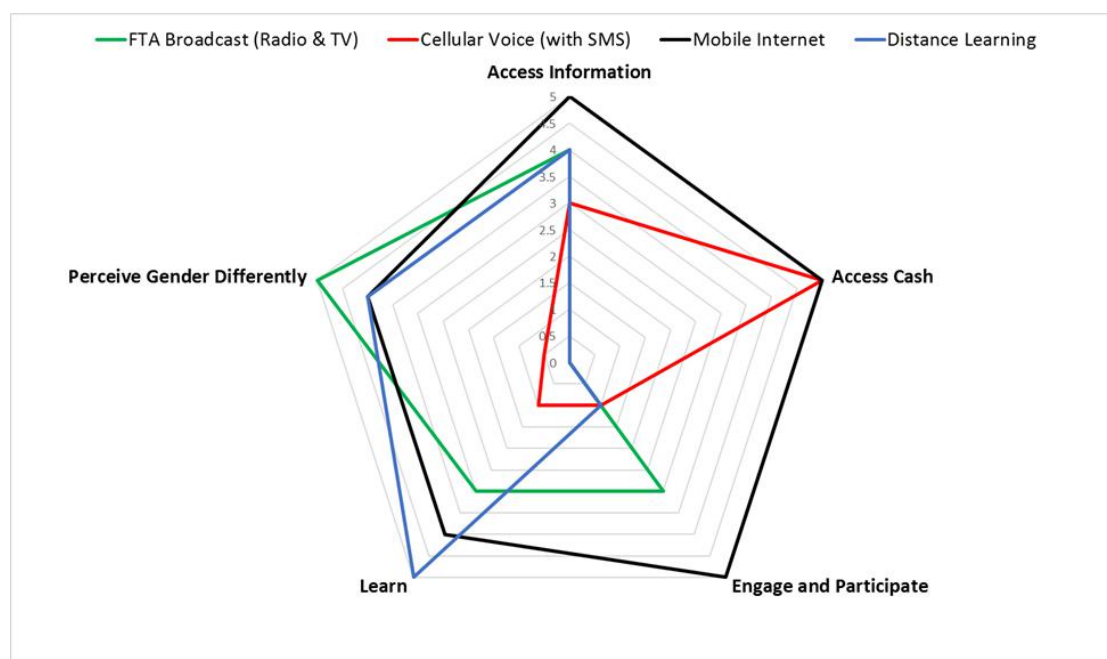
### 6.1 ICT services to address vulnerability factors

Key ICT services used by women to reduce their disaster risk are FTA broadcast radio and TV; cellular voice (with SMS) and mobile Internet. FTA radio and TV are rich channels for information, capable of systematically transforming perceptions of gender over time, but offer limited interactive capability and no facilitation of cash transactions. Basic voice and SMS are truly powerful services as they enable vulnerable women to receive essential messages, communicate orally in real time and to receive and spend cash, all at modest cost. The mobile Internet offers rich, interactive, multimodal capability; with access to multi-featured messaging apps, mobile applications, websites and social media. These are predominantly accessed through a mobile phone.

Figure 17 graphically compares the capabilities of FTA broadcast radio and TV, basic voice (with SMS) and mobile Internet services. Recognizing the richness of learning capabilities that at this time are better served on larger, more feature-rich hardware platforms (laptops and desktop computers), the Figure includes distance learning as an additional service on account of its role in addressing the learning factors that sustain disaster vulnerability. With future innovations in devices, supporting technologies and pedagogy, the distinctions will reduce but it is important to emphasize the role of pedagogy to learning.

The comparisons in Figure 17 are conducted across counter-measures to the key gendered disaster vulnerability factors: access to information and cash; engagement and participation in processes that affect women's ability to benefit from ICT-enabled disaster resilience; opportunities for, and the means and confidence to access, learning; and perceptions of gender.

Figure 17: ICTs for women with high disaster risk: Comparative capabilities



Source: ITU

### Access information

The access information axis refers to the ability of the ICT to provide information of specific relevance to disaster mitigation, preparation, response and recovery. It also assesses ICT ability to provide information that can compensate for vulnerabilities associated with patriarchal societies, such as control of information and finance; controlled mobility and location; spatial segregation; restrictive wear, and clothes that require a long time to put on. Such information can, for example, endorse the responsible use of digital channels to supplement traditional social networks; build awareness of the existence and context-appropriate capabilities of the Internet; and provide guidance on the need for national registration and opportunities to access low cost ICTs.

A large value on the access information axis indicates that this class of ICTs is an excellent channel for the delivery of information in ways that can enable women to overcome key constraints that limit their resilience to disasters. A very large value indicates that this information can be accessed as and when needed or sought by a user.

### Access cash

The access to cash axis captures the ability of the ICT to enable cash transactions such as receipt, payments and transfers.

### Engage and participate

The engage and participate axis captures the potential for the ICT to facilitate feedback from, and rich modes of support for vulnerable women; to enable their voice to be heard; and to advocate for change to prevailing gendered disaster vulnerabilities and the gendered digital divide. A low value indicates that the channel can be used for vulnerable persons to provide feedback, for example to surveys, but not to engage more fully. The higher the value, the richer the engagement and participation experience with consequently high potential for impact.

## Learn

The learning axis refers to the ICT's ability to facilitate impactful learning. Priority areas are digital literacy and lifesaving skills but also encompass a range of other thematic areas necessary to build women's agency, which in turn is a key enabler of resilience and empowerment. The higher the value, the deeper and richer the learning experience; and the greater the provision of tools and facilities for learning design, deployment, assessment and evaluation.

## Perceive gender differently

The perceive gender differently axis assesses the ICT as a channel to influence, over time, perceptions of gender and their stereotypical roles.

## 6.2 Underlying telecommunication services to address disaster vulnerability

The ICTs considered in this report are all made available through telecommunication services: FTA radio and TV service, voice service, Internet service, land mobile radio service and amateur radio service. FTA radio and TV services are provided through modest infrastructure and accessed through a radio and a television respectively. Basic voice service, with accompanying SMS capability, is delivered through landline or cellular access networks that ultimately connect to a global communications network. It is accessible from both feature and smart phones. Internet service is delivered through one of a number of different access networks, including cellular, which also ultimately connect to a global communications network. It is accessible from a variety of devices including smart phones, laptops, tablets and desktop computers. The Internet is required for messaging apps, websites and both social media and distance learning platforms. Though land mobile and amateur radio services do not require networks to communicate, they are normally delivered through network infrastructure to enable reasonable reach. These services are accessed from handheld, mobile or fixed radios.

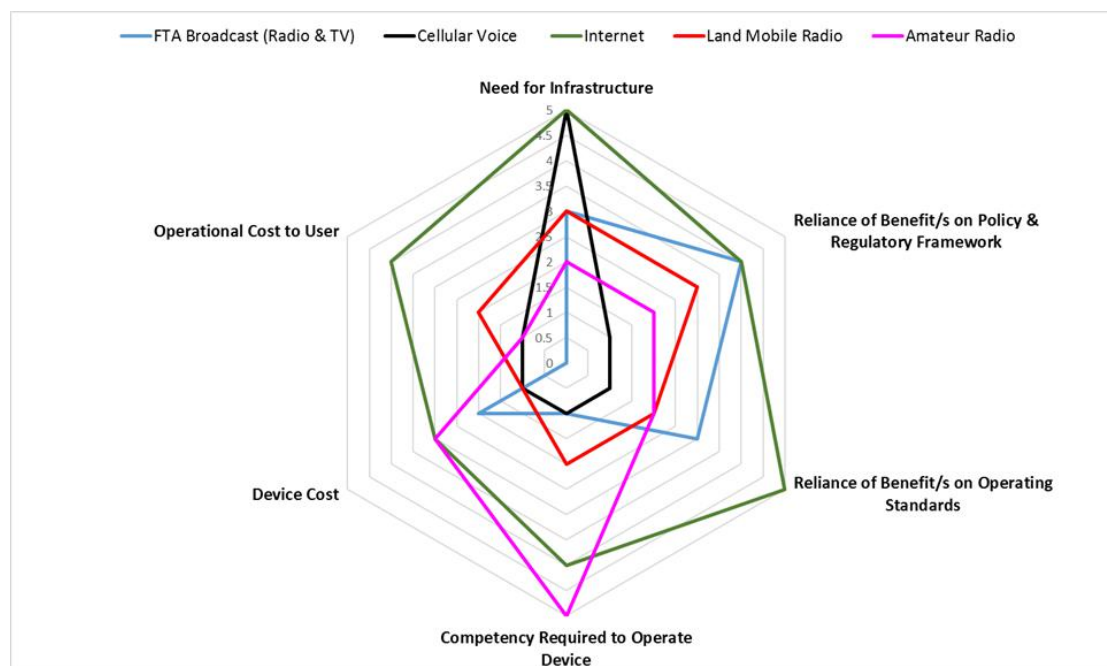
Figure 18 summarizes the comparative requirements of the telecommunication technologies that underlie the ICTs under consideration. It recognizes that the full potential of some technologies relies on an enabling environment, which ensures that there is telecommunication infrastructure in remote areas, associated policy and regulatory frameworks; and the application of standards that mitigate harmful effects and promote the dimensions of gender gap filling. The full potential of access technologies also variously relies on requisite knowledge and skills, as well as affordability for both the access device and its operational costs.

The cost axes refer to the cost to the affected person to use the technology to purchase the device and to use it. A high value indicates that the respective financial cost is high. The policy and regulatory framework axis refers to requirements necessary to ensure that affected persons are able to access the benefits of the technologies. A large value indicates that the effectiveness of the technology is highly dependent on these aspects of the enabling framework. The operating standards axis refers to the need, in this area, to ensure that affected persons are not disadvantaged by the technology. A high value indicates that the effectiveness of the technology relies on the adherence to specific standards above and beyond those normally imposed by the regulatory authority such as maximum transmission power or interference thresholds. This parameter captures the need to address persistent perceptions of gender roles and to control unintended consequences. The infrastructure axis refers to the reliance of the technology on infrastructure. A high value indicates that the technology requires full network infrastructure to operate. A moderate value indicates that some infrastructure, such as a single tower with station to transmitter communications, is required for the technology to operate. The lower the requirement for infrastructure, the higher the resilience of the technology for disaster purposes. The competency axis is a measure of the skill required to operate the ICT device.

## Free-to-air radio and TV

From Figure 18, it is apparent that FTA radio and TV feature the lowest barriers to entry for persons with low literacy skills. The purchase cost is higher for a TV than for a radio but in both cases the cost

Figure 18: Comparative features of underlying telecommunication services to address disaster vulnerability



Source: ITU

is amortized over all household members. Generally, these devices last for many years and disruptive changes in technology such as the transition from analogue to digital is rare. Due to the critical value of these channels for disaster messaging for the most vulnerable, provision should be made to ensure that all persons have access, either in their homes or elsewhere in the community; in either case with some form of adequate power. Hardy, low cost versions of these devices, even if through wind-up or pedal power, could be designed and provided to the poorest of communities. There is no operational cost to users for either FTA radio or TV.

### Basic voice with SMS

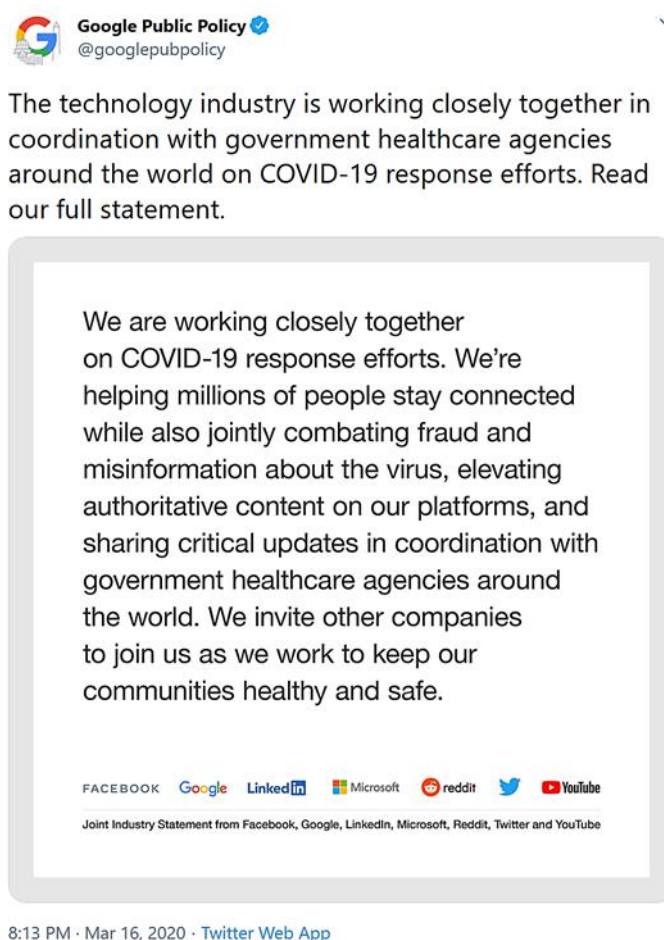
Feature phones represent the baseline in individual communications devices. They cost the least of all devices to purchase and incur very modest operating costs. As telephone communication is private between two persons without broadcast capability, there is no need to adhere to any particular code of conduct or standard of practice. While some level of literacy is required, this can be managed on account of the low feature set of the devices. Feature phones can only be used with an operational cellular network. The rapid development of digital payment models will continue to present additional opportunities throughout the processing chain of humanitarian aid.

### Internet

Smart phones typically represent the high end of devices used by vulnerable populations to access the Internet for general purposes. They cost the most of all devices to purchase and may incur considerable operating costs if data service is used regularly. Smart phone capability to access the mobile Internet enable them to be used in multi-party calls and video sessions. As the phones can send and receive photos, audio and videos, they provide considerable opportunity for women to be the victims of predatory behaviour. The crowd sourcing of funds is now far easier than ever before with the introduction of a variety of options such as Google Pay, Paytm and Facebook Pay. In June 2020, WhatsApp launched payment capability, using Facebook Pay, which enables users to send and receive money through the app. Smart phones can only be used with an operational cellular network, so provisions for coverage that apply to other technologies considered so far, also apply.

The spheres of influence and culture required to address prevailing gender-based vulnerabilities before, during and after disasters, goes far afield of their immediate geographies. The culture of the technology community, which designs and operates digital platforms used by more than three quarters of the world's population, is critically important. In particular, its value system and the will to apply policies, procedures and enforcement to align with its values, are equally critical. There are many hopeful signs. Among these is the joint industry statement issued on 16 March 2020 by Facebook, Google, LinkedIn, Microsoft, Reddit, Twitter and YouTube regarding their collaborative role in working closely with government healthcare agencies around the world on COVID-19 response efforts with a commitment to combatting fraud and misinformation (COVID-19 Joint Industry Statement, 2020). The Twitter post issued by Google Public Policy is shown in Figure 19.

Figure 19: Joint industry statement on COVID-19 response of digital platform operators



Source:Google (Google Public Policy, 2020)

### Mobile radio and amateur radio

Mobile and amateur radio operators are generally first responders. As shown in 18, the range of mobile and amateur radio costs is roughly the same as that of smart phones, considerably higher than that of feature phones and basic FTA radios. They are both single-user devices though they may be used by different persons at different times as in the case of radios owned by clubs or organizations. Though there is no service cost for mobile and amateur radio, they both generally require an annual licence fee paid to the local telecommunication authority. All radio operators require training of some sort. Amateur radio operators are required to pass a written examination so their capacity requirements are the highest of all device users.



The regulatory requirements for amateur radio are indicated as higher than those of mobile radio in Figure 18 as the former requires an operator licence, in addition to the equipment licence required of both types of radio, to operate legally.

Amateur and mobile radio operation is governed by strict codes of conduct. The Code of Conduct of the International Amateur Radio Union (IARU) is its Ethics and Operating Procedures for the Radio Amateur (Edition 2), which has been translated into more than 25 languages. The Code elaborates on the nature of the six features of amateur operators: considerate, loyal, progressive, friendly, balanced and always ready for the service to country and community (Devoldere & Demeuleneere, 2008). Though not all operators adhere to their respective codes, radio transmissions are generally heard by multiple parties who may insist on proper use of the radio channel. The need for the imposition of external standards of operation is only modest on account of the combination of this self-regulation, the codes of conduct and the relatively low use of these radios compared to those used for public broadcasting.

Though neither amateur nor land mobile radio operation requires infrastructure, the range of both is extended by repeaters, which are themselves radios mounted on towers at high elevations. These towers are susceptible to damage from some forms of disaster but radio operators often own homemade retractable towers, which they disassemble once they are aware of impending disasters. Once the event has passed, the towers are reassembled. Operators are also nimble at repairing damaged equipment and using any available structure, such as trees, as makeshift antennas. Battery and solar power facilities are also standard fare for them, as are their go-kits that are always on the ready.

## 7 Recommendations

### 7.1 Principled foundations

Global policies triangulate to show that gender equality and the participation of women in the development of, and access to ICTs, are essential for effective disaster risk reduction. Existing global frameworks for action provide the principled foundations for interventions that seek to reduce the disaster vulnerability of women. These include the Beijing Platform for Action, which recognizes that many women are particularly affected by environmental disasters and that gender-sensitive programmes and infrastructures are essential for effective disaster risk management. It recognizes that achieving equal access to ICTs fundamentally depends on the ability to incorporate women's perspectives into ICT production, and on their equal participation in policymaking. The Declaration asserts that "most women, especially in developing countries, are not able to access effectively the expanding electronic information highways and ... need to be involved in decision-making regarding the development of the new technologies in order to participate fully in their growth and impact" (UN, 1995).

Also steering the integration of a gender-transformative approach to ICT is the UN 2030 Agenda for Sustainable Development (UN, 2015b) and its 17 goals. Goal 5 of the SDGs on gender equality and the empowerment of women crosscuts all other SDGs and is foundational to their progress, including Goal 9c to achieve universal and affordable access to ICTs in LDCs by 2020; and Goal 17.8 to "enhance the use of enabling technology, in particular information and communications technology." Goal 5 also sets a target to enhance the use of enabling technology, in particular ICTs, to promote women's empowerment (5.5b). The Agenda seeks, among other things, to achieve gender equality and the empowerment of all women; and to eliminate discrimination and violence against women. It resolves to protect the human rights of women and asserts that they must enjoy equal access to quality education, leadership and decision-making at all levels; and that young women and men are critical agents of change. The Agenda indicates that systematic mainstreaming of a gender perspective is crucial to its objects.

The Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR, 2015) declares that all disaster risk reduction policies, plans and programmes should include a gender perspective; and stresses the importance of empowering women to publicly lead and promote gender equitable and universally accessible response, recovery, rehabilitation and reconstruction. The Framework asserts that the participation of women is essential for effective disaster risk management and design as well as resourcing; and that it is necessary to build their capacity both for disaster risk management and to enable them to secure alternate means of livelihood after disasters. The Sendai Framework is firm that disaster risk reduction calls for the "empowerment and inclusive, accessible and non-discriminatory participation, paying special attention to people disproportionately affected by disasters, especially the poorest." It recognizes that shared responsibility, across multiple stakeholders and sectors in all states, is necessary for effective disaster risk reduction.

The UN Resolution, (A/74/381/Add.3) (UN, 2020) adopted by the General Assembly on 19 December 2019, recognizes that women and girls are "disproportionately exposed to risk, increased loss of livelihoods and even loss of life during and in the aftermath of disasters" and reaffirms previous recommendations, encouraging governments to promote the "full, equal and effective participation and leadership of women ... in the design, management, resourcing and implementation of gender-responsive and disability-inclusive disaster risk reduction policies, plans and programmes". The Resolution also emphasizes the importance of mainstreaming a gender perspective in disaster risk management to strengthen the resilience of communities and reduce incumbent social vulnerabilities to disasters. It echoes the need for the inclusive participation and contribution of women among other vulnerable groups.

The Hyogo Framework for Action (HFA) 2005-2015 (UNDRR, 2005) highlights the importance of integrating gender-responsiveness "into all disaster risk management policies, plans and decision-making processes, including those related to risk assessment, early warning, information management

and education and training.” Tracking of HFA progress to make disaster risk reduction more gender-sensitive revealed that 52 of the 95 reporting countries had made “substantial” or “comprehensive” achievement by 2015 (UNISDR, n.d.).

Resolution 70 (Rev. Dubai, 2018) of the ITU Plenipotentiary Conference recognizes that equal access to ICTs for women and men and equal participation of both at all levels and in all fields, especially in policy- and decision-making, are beneficial to society as a whole, particularly in the context of the information and knowledge society; and that ICTs are tools through which gender equality and the empowerment of women and girls can be advanced. The Resolution also recognizes that women experience multiple and intersecting forms of discrimination and that there is a need to bridge the gender digital divide, with special attention to women in rural and marginalized urban areas. It asserts that bridging this divide requires the fostering of digital skills, education and mentorship for women and girls, so as to advance their participation and leadership in the creation, development and deployment of ICTs, including telecommunications (ITU, 2018).

The Declaration on Promoting Gender Equality, Equity and Parity in the ITU Radiocommunication Sector (ITU, 2019e) adopted at the World Radiocommunication Conference in 2019 (WRC-19) among other things recognizes the low participation of women in international radiocommunications processes, the need to mainstream a gender perspective for an inclusive and egalitarian information society, and the importance of the EQUALS Global Partnership that comprises several United Nations agencies, governments, the private sector, academia and civil society organizations, to reducing the gender digital divide in the world.

## 7.2 Alliances and advocates

A broad spectrum of alliances and advocates are essential agents of change for the very many facets of gender-based agency and disaster resilience. Advocates in the Internet and technology spaces are very important to shape a safe and wholesome online environment for women. With a commitment to digital gender equality, the Internet Society (ISOC) is a nonprofit organization that supports and promotes the development of the Internet as a global technical infrastructure, a resource to enrich people’s lives, and a force for good in society. ISOC is concerned about the low representation of women in computer-related professions and on the Boards of startup companies; as well as the wage gap between men and women in the technology sector. The Society feels (Contreras, 2017) that increasing the access, skills and leadership of women and girls in ICT can contribute significantly to their improved health and agency. ISOC maintains a Special Interest Group (SIG) specially dedicated to promoting a global neutral space that encourages women to be involved in technology, and that contributes to reducing the digital gender gap.

ISOC has also provided enthusiastic support over the years to grow the AfChix member base and has provided expert facilitators, panellists and other speakers at their workshops and conferences. ISOC also sponsors fellowships for AfChix women to attend technical workshops and conferences, and an open Women-In-Tech fellowship for women to attend the annual African Peering and Interconnection Forum (AFPIF). The portfolio of ISOC programmes includes many capacity-building and practical Internet-based initiatives that address the many faces of the digital divide.

ISOC is a contributor to the Best Practice Forum (BPF) on Gender and Access of the Internet Governance Forum (IGF) intersessional work. Over the years, the BPF has examined different aspects of women’s meaningful access to the Internet: in 2015, with a special focus on online abuse and GBV; in 2016 with a focus on barriers for accessing the Internet; in 2017 with a focus on identifying the needs and challenges of Internet access for diverse women’s groups; and in 2018 the impact of supplementary models of connectivity on women’s Internet access. It has collected data on, and anecdotal evidence of, the challenges that contribute to the digital gender gap, but recognizes the need for gender-disaggregated data to more fully assess the situation.

Other key advocates for gender equity in ICT who have also expressed concern about the paucity of gender-disaggregated data include, but are not limited to, Women 20 (W20), the official engagement group, which advises the G20 on issues around gender equality and the economic empowerment of women; the UN Broadband Commission on Sustainable Development; the Alliance for Affordable Internet (A4AI), the World Wide Web Foundation, the Association for Progressive Communications (APC), and the GSM Association (GSMA).

The private ICT sector are critical partners in building the resilience of persons, particularly women and those in rural areas, through ICT. On account of the considerable uptake of mobile devices, the mobile industry is especially important, not only for the development and provision of infrastructure and service but also for critical analyses, assessments and market innovations. GSMA Intelligence, the research division of GSMA, has contributed very valuable mobile industry insights, forecasts and analyses. The Association represents the interests of companies in the mobile ecosystem including but not limited to more than 750 mobile operators and several hundred device and equipment manufacturers, software companies and Internet service providers.

ITU is firmly committed to gender equality in ICT. It has adopted a Gender Equality and Mainstreaming (GEM) Policy (ITU, 2013); and an associated plan of action (ITU, 2018), which includes the commitment to recommend measures at the international, regional and national level on policies and programmes that improve socio-economic conditions for women and girls particularly in developing countries; to incorporate the gender perspective in all of its operations; and to draw up indicators that take into account gender equality issues and highlight trends in the sector, disaggregated by gender. The GEM policy and plan of action express the ITU aim of becoming a model organization for gender equality that leverages the power of telecommunications/ICT to empower both women and men.

ITU has also established an internal Gender Task Force, as well as the ITU Network of Women, which is dedicated to promoting women in radiocommunications, telecommunications, ICT and related fields. Since 2011, ITU has been leading the annual Girls in ICT Day initiative to encourage girls and young women to consider ICT studies and careers, with more than 362 000 participants in more than 11 000 events in 171 countries since its inception (ITU, 2020b). ITU is also committed to building gender equality into global emergency response. On the occasion of its Global Forum on Emergency Telecommunications (GET-19) the Director of the Development Bureau, Ms Doreen Bogdan-Martin, shared that “We need to cultivate the reflex of integrating the special needs of women into national disaster response strategies. Including women in disaster planning teams and involving women in strategic consultations on disaster response would be an important first step in the right direction” (ITU, 2019f).

In addition to data on women in ICT and connectivity, the ITU Gender Dashboard tracks the percentage of female delegate speaking time in ITU meetings. At its 2018 Plenipotentiary Conference, women spoke on average 24.9 per cent of the time, and as little as 17.5 per cent of the time in some sessions. With a female chair, this increased to 33.8 per cent, which may indicate that female leadership can facilitate more opportunities for women’s voices to be heard in decision-making. Monitoring not only reveals inequality but enables the setting of targets to rectify it. Increasing the transparency of data on gender and leadership helps raise awareness of current imbalances and strengthens efforts to accelerate progress.

The ITU Radiocommunication Advisory Group (RAG), which among other things recommends measures to foster cooperation and coordination with other organizations and within ITU, has created a Correspondence Group on Gender that is open to any representative of an ITU Member State, ITU Radiocommunication Sector (ITU-R) Member or Associate, as well as small and medium enterprises and members of the academic community.

The continued commitment on the part of ITU, TSF, ETC and their partners to gender equality in all phases of disaster risk management is critical to effect behaviour change at institutional levels and within beneficiary communities. Like ITU, TSF and ETC assistance to affected communities is not limited to the provision of communications during and after disasters. In the case of TSF, for example,

Figure 20: Presenters at the Third Global Forum on Emergency Telecommunications (GET-19), Mauritius, 2019



Source: ITU

their assistance extends beyond the free Wi-Fi elaborated earlier in this report, to health, education, women's rights and food security. The many cases include satellite and broadband connections to support Syrian hospitals (TSF, 2019b), and women's empowerment centres that provide learning support for literacy skills, languages and Internet awareness in internally displaced persons camps in Syria (TSF, 2019c). Digital educational content made available at its other ICT centres include videos, encyclopaedias and Massive Online Open Courses (MOOCs) (TSF, 2020).

Other organizations with intersectional interests in gender equality and disaster resilience include the Gender and Disaster Network (GDN), an educational and advocacy project. The network maintains a website, <http://www.gdnonline.org/>, as an international forum for discussion, networking, and information exchange. They are engaged in collaborative research and applied projects; document and analyse experiences, and advocate for change in policy and practice at all levels. Other critical sets of advocates are those whose *primary* focus is gender equality, such as UN Women and many others identified in this report, as well as those focused on disaster risk reduction (Aitsi-Selmi, et al., 2016).

There exist a number of other capacity building initiatives targeted at vulnerable women that are natural entry points to build disaster resilience. These include but by no means are limited to the Empowering Women through Digital Markets programme (Ayitic, 2018), funded by the IDRC. It has trained over 300 women on ICT in Haiti, a country whose 7.0 magnitude earthquake in 2010 was considered one of the largest economic and humanitarian disasters in the Western Hemisphere, and for which the 2018 Human Development Index ranking was 169 / 189 and the Gender Inequality Index was 150 / 162 (UNDP, 2019b). The implementers of the capacity building initiative are keen to scale the programme by partnering with other agencies including the Carlos Slim Foundation, Google, Inter-American Development Bank (IADB) Compete Caribbean, IADB State Modernization, UN Women Uruguay and Global Office, International Labour Organization (ILO) Inter-American Centre for Knowledge Development in Vocational Training (Cinterfor), USAID Global Development Lab, European Union Delegation in Uruguay, UNDP Uruguay, Ford Foundation, and World Bank ICT Department. Localization and repurposing of its curricula and content to suit different disaster-prone contexts would present significant opportunities for cross learning and economy.

Women-centred networks are powerful levers for capacity building and advocacy. AfChix, for example, recognizes that gender diversity is required in the computer science and ICT industries for increased creativity and innovation. The network provides a variety of mentoring and capacity building initiatives for women and girls, and facilitates member participation in tech conferences such as the Grace Hopper Conference for Women in Computing (GHC) and Africa Internet Summit (AIS). They also celebrate annual Girls in ICT Days. It is hoped that the training provided under the community network programme, described earlier in this report, will encourage the formation of Internet-based enterprises. One female trainee shared “This was my first technical training. I used to believe that it was only men who had to know about technical things but now I am confident, and I would like to learn more. I have the courage to climb up the roof to support the installation of solar equipment or to help in troubleshooting” (USAID, 2020). For many women, this is where impactful capacity building starts – in practical projects that are accessible, relevant and involve leadership by women. Capacity building is not only essential for women at high risk of disasters but all women who can mentor them and take up roles at various levels in both disaster risk management and ICT.

Other critical agents of change essential to the purpose of building the disaster resilience of women with the assistance of ICT include civil society and its organizations, community-based organizations, local governments and practitioners, the media, the research community, science and technology, and academia.

### 7.3 Stratified targets

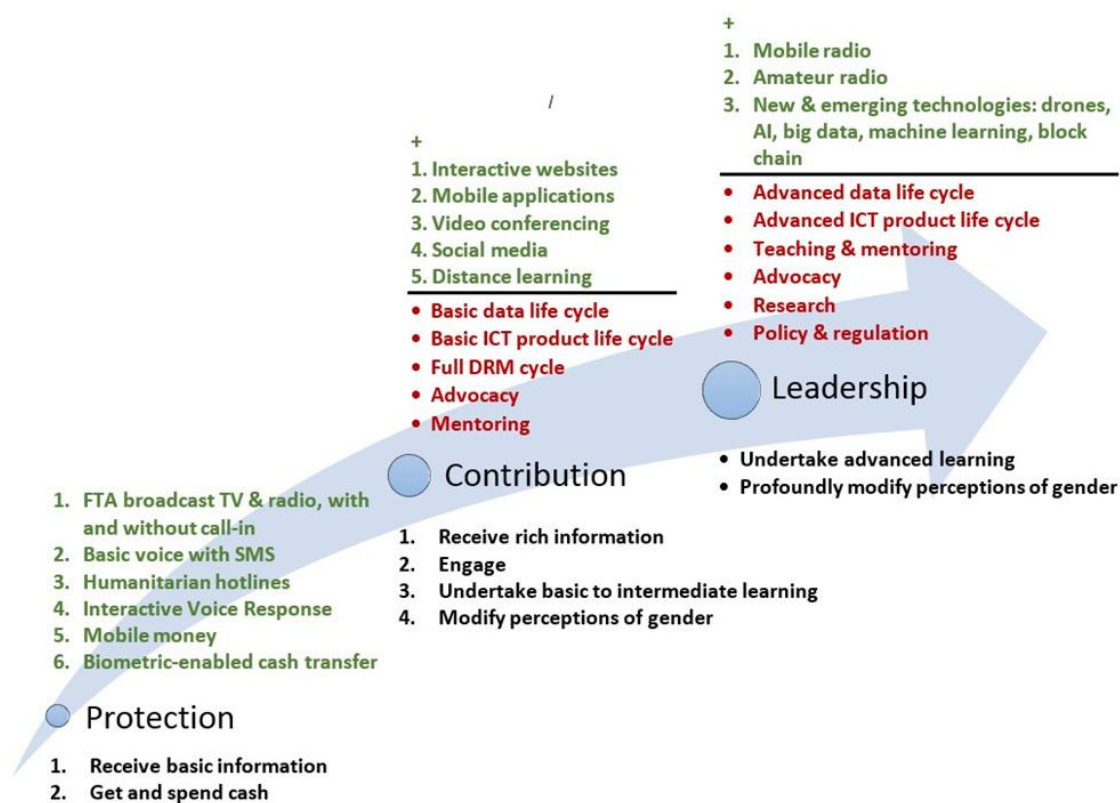
Stratified targets for gendered disaster resilience, shown in Figure 21, are recommended as not all women at high risk of the impacts of disasters are similarly situated. Culture, location and socio-economic profiles, as well as other factors such as the availability and cost of resilience-building tools including ICT products and services, are responsible for considerable variations in circumstances. Similarly, differences in geographies, infrastructure, policy and regulatory frameworks, political will and institutional capacities exist across and within countries and communities, even among those at risk. It is the case, therefore, that a mix of context-appropriate solutions is required for effective disaster risk reduction.

This report underlines the base line needs of vulnerable women to receive and understand basic disaster-related information and to access cash for essential needs. These capabilities constitute the first tier in the pathway to building ICT-enabled resilience. Appropriate options for ICTs at Tier 1 include FTA broadcast TV and radio, with and without call-in, basic voice with SMS, humanitarian hotlines, IVR, and access to cash through feature phones or through biometric validation of identity.

Tier 2 is considered as the pathway to building ICT-enabled resilience to feature access to richer forms of information, the ability to engage richly with others using ICT, the capability to undertake modest forms of learning through ICT channels, and to engage in a variety of activities able to shift embedded impressions of gender roles. All Tier 1 ICT channels are applicable to women at Tier 2, as are interactive websites, mobile applications accessed through smart phones, video conferencing, a range of social media platforms and distance learning, primarily via the smart phone. In Tier 2, women are able to comfortably participate in all phases of the disaster risk management cycle and are confident for their voices and experiences to be heard on matters that relate to their disaster vulnerability. They are comfortable to engage with a variety of stakeholders and have a critical role to play in both advocacy and mentoring. Tier 2 competencies are applicable to many basic roles in the data and ICT product life cycles and with visibility, these women are able to modify traditional perceptions of gender.

The building of higher levels of agency among women is essential for universal impact on traditional perceptions of gender, strongly associated with long term impacts on gendered disaster vulnerability. Agency refers to the ability to act on goals defined by intrinsic motivation, not from the internalization of social or cultural pressure. The ability to set these goals calls for the time, resources and opportunity for reflection, including self-reflection (Donald, Koolwal, Annan, Falb, & Goldstein, 2017). Women with

Figure 21: Gendered disaster resilience trajectory: Capabilities, service and technologies, activity spaces



Source: ITU

strong levels of agency have the profound ability to modify traditional perceptions of gender that contribute to the low uptake of women and girls in leadership roles and in technical areas of work.

### 7.3 Strategies for early adopters

Policies are the backbone of action as well as organizational, national and international processes, and complementary policies are essential to ensure that technologies, particularly new and emerging ones, do not amplify existing inequalities (Research ICT Africa, 2019). Strategies to build ICT-enabled disaster resilience for vulnerable women meet at the crossroads of many public, private and civil sectors and cover multiple independent and intersecting themes. They rely on policies and programmes that go beyond the disaster event itself (Baas, Ramasamy, Depryck, & Battista, 2008).

While many organizations are already well invested in gender policies, strategies and plans, many others do not have resident capacity to develop resources that protect against gender bias and that promote gender sensitivity. Some others are unaware of such policy positions. High strategic priorities for economy, effectiveness and efficiency are therefore to (i) lead by example (ii) draw on existing resources and (iii) facilitate adoption by providing and promoting easily accessible resources. In particular, it is recommended that those with the wherewithal to do so:

1. Adopt, enforce and promote policies that advance the individual and intersecting agendas that underpin ICT-enabled disaster resilience for women, for example along the lines of ITU Gender Equality and Mainstreaming (GEM) Policy (ITU, 2013)
2. Exert international pressure on digital platform operators to employ due diligence to ensure the protection of users' rights in accordance with the UN Guiding Principles on Business and Human Rights (UN Working Group on Business and Human Rights, 2011) (UN IGF, 2015)

3. Exert pressure on governments to sign on to international conventions that strengthen ICT-enabled disaster resilience for women, for example the removal of restrictions on the importation of telecommunication equipment and the movement of humanitarian teams under the Tampere Convention (UN, 1998)
4. Simplify the adoption of practices that advance the individual and intersecting agendas that underpin ICT-enabled disaster resilience for women by organizations and sectors through the production, promotion and open sharing of, for example:
  - i. templates of policies and action plans, in accordance with global frameworks for action;
  - ii. guidelines for:
    - the safe use of ICT;
    - gender-sensitive constitution of data collection, response, recovery and training teams;
    - gender responsive design in all stages of the ICT product life cycle;
    - gender-sensitive messaging, for example as set out in UNICEF South Asia's Gender Responsive Communication for Development: Guidance, Tools and Resources (UNICEF Regional Office for South Asia, 2018); etc.
  - iii. curricular and content on all aspects of disaster resilience and digital literacy to be freely shared, reused and repurposed;
  - iv. repositories of:
    - curated sex-disaggregated ICT and disaster data collected from multiple sources over multiple channels; made available in open format for public consumption and use;
    - primary, anonymized, open data relating to women, ICT, disasters and emergency telecommunications for public analysis;
    - methodologies for analysing gendered disaster risk and gendered digital divide, for example in the former case, the six-step process as elaborated in the UN Women and UNICEF Policy Brief on Gender and Age Inequality of Disaster Risk (UN Women / UNICEF, 2019);
    - tools for monitoring progress, for example as used in the ITU's Gender Dashboard;
    - channels of support as for example, the Global Database on Violence against Women as maintained by UN Women.
  - v. cautions regarding protection of personal data and privacy, for example as set out in the Handbook on Data Protection in Humanitarian Action 2<sup>nd</sup> Ed. (Kuner & Massimo, 2020) and the UN Internet Governance Forum (IGF) Dynamic Coalition on Platform Responsibility (DCPR) *Platform Regulations How Platforms are Regulated and How They Regulate Us* (UN IGF Dynamic Coalition on Platform Responsibility, 2017) is a rich resource;
  - vi. recommendations for the collection of gender disaggregated data as for example provided by UN Women's and UNICEF 2019 Gender and Age Inequality of Disaster Risk (UN Women / UNICEF, 2019), and incorporation of gender-disaggregated individual-level ICT questions in existing national data collection mechanisms as recommended by (EQUALS, 2019).

## 7.4 Strategies by ICT service

### Mobile radio and amateur radio

Both land mobile and amateur radio are essential fare for disasters but a number of policies and regulatory instruments are required for best advantage. In particular, national disaster frameworks comprising policies, plans and procedures; as well as national emergency telecommunications plans, are essential for efficient and effective operation. Among other things, these specify the roles, functions and reporting protocols for all first responder agencies and agents. National signatory to the



Tampere Convention (UN, 1998) is a priority as this waives standard regulatory requirements such as licensing requirements to use allocated frequencies, restrictions on the import of telecommunication equipment, and the movement of humanitarian teams.

A regulatory provision that is important to facilitate radio amateurs assist with recovery missions is reciprocal licensing arrangements between countries. These agreements enable radio users to operate under their local licence in other countries on a temporary basis. The administrative requirement to secure a licence in the mission country is a major barrier, particularly in the aftermath of a disaster. Another intervention with somewhat of a regulatory component is the provision of affordable access to amateur satellites, including miniaturized satellite for space research dubbed “cubesats”, as the basis of disaster-focused experimentation and innovation by operators.

A recommended practice is that all radio communities document their codes of conduct and implement strict self-regulation of users’ transmissions.

### **Free-to-air radio and TV**

To ensure that persons who face a high disaster risk are able to access the benefits of FTA radio and TV, national universal service policies are required and the attendant regulatory requirements must include reach into the most vulnerable areas. As the provision of service to these areas is generally not commercially viable, provisions should be made for incentives and concessions for network operators to ensure coverage. Access to universal service funds (USF), where they exist, is a natural avenue. Other licence concessions may also be considered.

Niche and community radio and TV service should be highly encouraged through incentives and concessions, and should also be keenly promoted as the beneficiaries of aid programmes comprising infrastructure, training and support. In all cases, a regulatory requirement should be imposed for minimum airtime on matters relating to context-appropriate disaster mitigation, preparedness, response and recovery. A standard resource pack of this information should be prepared in all local languages, endorsed by the relevant national authorities, and issued to all FTA radio and TV stations (national, community and niche) for broadcast. Policies that ensure that channels are not male dominated are also important as this has been found to impact women’s use of broadcast media, as mentioned earlier in this report.

Public broadcasting is a potent channel that can build agency on the part of women through strategic messaging and engagement around the factors that have been found to make women the most at risk from disasters: lifesaving skills, access to information, national registration, sexual and gender-based violence, Internet awareness, digital illiteracy, gender stereotypes and related cultural norms. Resources have been identified in this report. A mix of regulatory standards and incentives are recommended to systematically and persistently address these barriers to ensure that affected persons are not disadvantaged by the technology.

Free-to-air radio and TV have moderate requirements for infrastructure yet its towers may be quite vulnerable to damage under disaster conditions. Highly resilient construction codes should be specified, required and enforced; with concessions that recognize that these channels represent critical infrastructure essential to all phases of disaster risk management for the most vulnerable.

### **Basic voice with SMS**

To the extent physically practical, adequate cellular network coverage of areas vulnerable to disaster and those occupied by women and other persons at risk should be assured by national universal service policy, backed by relevant regulations. Universal service funds, where they exist, should be used to provide incentives for terrestrial network buildout in these areas. Also, there is need for increasing commitment to the provision of satellite-based universal access for very low-resourced communities. Again, global, cross-industry collaboratives are an important avenue for this.

To ensure that all feature phone users receive emergency messages, it is recommended that telecommunication service providers waive the cost of related text messages and that they are sent via cell broadcast in local languages to persons at most risk. To otherwise increase access, low cost, rugged telephones, and very low service costs are essential. Technology, service and business model innovations are required to address this need; and global, cross-industry collaboratives are an important avenue for this.

The creation and maintenance of support and emergency groups for at-risk women through mixed channels including voice, SMS and IVR are highly recommended. A number of excellent examples of such groups have been described in this report. WOUGNET provides an exemplary example of the use of the SMS channel to support women in a variety of ways including the provision of reinforced messages with guidance on the distinction between authoritative and illegitimate sources; and fake news. Mobile money service should be available to enable use by owners of feature phones. Community mentors to provide assistance are highly recommended.

### Internet

To the extent physically practical, adequate network coverage of areas vulnerable to disaster and those occupied by women and other persons at risk should be assured by national universal service policy, backed by relevant regulations. Universal service funds, where they exist, should be used to provide incentives for network buildout in these areas. As the mobile Internet can only be accessed through paid data service or through Wi-Fi, the provision of public Wi-Fi hotspots accessible to persons at risk is highly recommended. Community networks, as described in this report, are also highly recommended. The model employed by AfChix is an exemplary one as it is led and operated by women with a deep sensitivity to women's issues and the promotion of their agency.

The creation and maintenance of support and emergency groups for at-risk women through mixed channels including voice, SMS, IVR, mobile apps and social media are highly recommended. A number of excellent examples of such groups have been described in this report. Community mentors to provide assistance to learn to use and maintain the device are highly recommended. Mobile money service should be available to owners of smart phones. Training, advisories, mentorship, as well as recommendations on protective tools and strategies are strongly encouraged.

All other recommendations regarding the Internet previously indicated apply. These include the exertion of international pressure on digital platform operators to ensure the protection of users' rights.

## 7.5 Strategies specific to key vulnerability factors

Drawing on the intersectional findings of women, ICTs and emergency telecommunications explored in this report, Table 3 summarizes *sample* strategies to reduce gender-based disaster vulnerability. The strategies are structured according to the ICT levers that address the key barriers of access to information, access to cash, engagement and participation, learning and perceptions of gender. The table captures several dimensions of access that together determine the likelihood of women at risk receiving critical information necessary to reduce their vulnerabilities to disasters. These factors apply at a mix of phases within the disaster risk management (DRM) cycle, predominantly during the mitigation phase. The table also draws on report findings to provide sample strategies to mitigate harmful unintended consequence of ICTs.

Table 3: ICT levers, vulnerability factors, and sample strategies

ICT Levers <i>Motivating factors</i>	Sample strategies
<b>I. Access Information</b>	<i>Strategy: Address all dimensions of barriers to access</i>
<p>1. <i>Affordability of ICT device</i></p> <p>2. <i>Affordability of ICT service</i></p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: free-to-air TV and radio as well as public access facilities for Internet.</li> <li>• Free-to-air TV and radio coverage for at-risk communities e.g. through universal service policy and regulations.</li> <li>• Use of all existing ICT channels for messaging through all disaster risk management cycle phases.</li> <li>• Use of traditional transmission means such as ‘boda boda’ radio, a motorcycle taxi used in Tanzania to transport memory cards with messages played to remote communities via hand powered playback devices.</li> <li>• Use of a mix of channels to accommodate different competencies and contexts of vulnerable persons for example as employed by the Women’s Programme on Voice of Viet Nam FTA radio, loudspeakers and booklets.</li> <li>• Zero-rated SMS messaging for early warning.</li> <li>• Technology innovations for affordable ICT devices through industry pressure, incentives and collaboratives.</li> <li>• Service and market innovations to facilitate affordable mobile packages.</li> <li>• Cash based transfers to mobile money accounts, mobile cash-out vouchers, mobile merchant vouchers or biometric-based direct or virtual account access (see <b>II. Access Cash</b>).</li> <li>• Community access centres.</li> <li>• Free community Wi-Fi hotspots, prioritized for donor and universal service funding.</li> <li>• Gender-sensitive guidance on biometrics for service staff and beneficiaries (see <b>II. Access Cash</b>).</li> <li>• Training and mentorship at public facilities, supported by documented gender-sensitive guidelines.</li> </ul>
<p>3. <i>Basic literacy</i></p> <p>4. <i>Basic ICT skill</i></p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: TV, radio, shared fixed line and mobile phones where practical with interactive voice response as, e.g. employed by Farm Radio.</li> <li>• Incentivize, through universal service funds for example, community radio stations to provide programming in local languages.</li> <li>• Use of traditional transmission means such as ‘boda boda’ radio.</li> <li>• Promotion, incentives and capacity building for broadcasters to use of free-to-air radio in rich and interesting ways as are used by the Women’s Programme of the Voice of Viet Nam (VoV) and PEKKA.</li> <li>• Use, repurposing and extension of existing ICTs e.g. as WOUNET and others have done during COVID-19.</li> <li>• Standards-based design of ICTs for accessibility e.g. ITU-T Recommendation F.790 Telecommunications accessibility guidelines for older persons and persons with disabilities (ITU-T, 2007).</li> <li>• Gender sensitive design of ICT products and empowerment of female designers as elaborated by (Rommès, Slooten, Oost, &amp; (eds), 2004).</li> <li>• Integration of ICTs with existing capacity building programmes such as the <i>Télécoms Sans Frontières</i> resource centres.</li> </ul>

ICT Levers <i>Motivating factors</i>	Sample strategies
<p>5. <i>Internet awareness</i></p> <p>6. <i>Reluctance to use ICT</i></p> <p>7. <i>Inappropriate ICTs</i></p> <p>8. <i>Patriarchal controls</i></p> <p>9. <i>Home-based work</i></p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: existing ICT and traditional channels such as free-to-air TV and radio.</li> <li>• Integration of ICTs with existing strategies and tools to reduce gendered disaster vulnerability and the gendered digital divide.</li> <li>• Engagement with women at risk to understand needs and prevalent forms of communication (GFDRR, 2018).</li> <li>• Design of ICTs according to accessibility standards.</li> <li>• Design of ICT products <i>specifically</i> for diversity.</li> <li>• Encouragement and empowerment of female designers.</li> </ul>
<p>10. <i>Male domination of public media channels</i></p>	<ul style="list-style-type: none"> <li>• Legislation against gender-based discrimination.</li> <li>• Regulations regarding gender parity in governance and production by public broadcasters.</li> <li>• Support to private sector broadcasters on gender-equal leadership.</li> <li>• Strong international, national and institutional leadership, committed to equity in the work force.</li> </ul>
<p>11. <i>Service Availability</i></p>	<ul style="list-style-type: none"> <li>• Gender-sensitive specifications of practical requirements for universal service for free-to-air TV and radio, as well as cellular networks, for under-served communities prone to disaster.</li> <li>• Free-to-air TV, radio and cell coverage in at risk communities through universal service obligations and incentives.</li> <li>• Resilient construction codes for free-to-air infrastructure; with incentives and concessions for this critical infrastructure</li> <li>• Community Wi-Fi networks and necessary capacity building incentivized through universal service and donor funds as, for example, implemented through the Afchix community networks project.</li> <li>• Drones for dissemination of early warning and other critical messages where practical and where more traditional means of communication are not available.</li> </ul>
	<ul style="list-style-type: none"> <li>• Inclusive innovations to facilitate gender-sensitive service in remote areas using a mix of terrestrial and satellite-based solutions, drones, high altitude balloons etc., as well as spectrum innovations.</li> <li>• Humanitarian calling centres in immediate aftermath of disaster as often facilitated by <i>Télécoms Sans Frontières</i>.</li> <li>• Amateur radio learning and certification opportunities for, and use by, women.</li> <li>• Routine radio and emergency messaging channel checks.</li> <li>• Affordable access to satellites for disaster-focused experimentation, research and innovation by local radio operators, with particular emphasis on women participants.</li> <li>• Collaborative, gender-sensitive ICT solution designs (including line of sight simulations to estimate coverage for free-to-air TV and radio, as well as cellular networks, based on both existing and proposed tower infrastructure) for high risk communities, to finesse when aid becomes available</li> </ul>
<p>12. <i>To mitigate unintended consequences</i></p>	<ul style="list-style-type: none"> <li>• For the provision of services, such as Wi-Fi, which in any way transport or receive user data, and for the use of drones capable of recording data, provide strictly in accordance with data processing principles of: legal bases for personal data processing, data security; data retention and provision of information regarding the processing of use data as outlined in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</li> </ul>

ICT Levers <i>Motivating factors</i>	Sample strategies
<p>13. Receipt of critical information through all phases of the disaster risk management cycle including during the response phase while attending to the needs of others.</p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: all available, ensuring reach to women at risk through basic channels.</li> <li>• Establishment of a priori arrangements with communications service providers for temporary service restoration in immediate aftermath of disaster.</li> <li>• National disaster risk management framework comprising policies, legislation and plans.</li> <li>• DRR strategy (UNDRR, 2019) catering to the needs of women at risk.</li> <li>• National emergency telecommunication plans that, inter alia, set out context-appropriate (i) multimodal communications for all disaster risk management phases, taking explicit account of the needs of women at high risk; (ii) the requirement for and means through which emergency messages from authorized sources are transmitted across multiple communications channels including free-to-air TV and radio, and SMS.</li> <li>• Requirement for free-to-air broadcasters to regularly broadcast tips for all phases of the disaster risk management cycle.</li> <li>• Multimodal messaging including campaigns, participatory learning, informal education and formal education; employing the principles of consistency, legitimacy, credibility, scalability and sustainability; and a mix of tools including publications, curricula, modules, presentations, e-learning, performance and the arts, games and competitions, audio and video materials, web resources and social media as, for example, IFRC <i>Public awareness and public education for disaster risk reduction</i> guide (IFRC, 2011).</li> <li>• Standards and guidelines for gender-sensitive messaging e.g. UNHCR Code of Conduct (UNHCR, 2015).</li> <li>• Communication toolkit targeted at women audiences along the lines of the UNICEF Behaviour Change Communication in Emergencies: A Toolkit (UNICEF, 2006).</li> </ul>
<p>14. Single point of contact for assistance, particularly in the disaster risk management recovery phase</p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: toll free phone and online hotlines for women as is done, for example, by the Emergency Telecommunications Cluster (ETC).</li> <li>• Adherence to AAP guidelines for gender equality and commitments to women.</li> </ul>

ICT Levers <i>Motivating factors</i>	Sample strategies
<b>II. Access cash</b>	<p><i>Ensure that the most vulnerable have access to cash through a variety of channels according to their circumstances using mobile phones or biometrics for identification.</i></p>
<p><i>1. For beneficiaries with at least a phone and national identification but without a bank account</i></p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: basic feature phone.</li> <li>• Efficient and effective cash transfer capabilities, through strategic partnerships, during disaster risk management mitigation phase.</li> <li>• Transfer of funds through existing systems and infrastructure, to the extent possible, to: <ul style="list-style-type: none"> <li>○ mobile money accounts, where they exist, to redeem with basic phone (i) as cash at ATMs (Automated Teller Machine) or (ii) to purchase goods or services at a point of sale;</li> <li>○ mobile cash-out vouchers to redeem cash, with phone SMS message and personal identification;</li> <li>○ mobile merchant vouchers to redeem goods or services with phone SMS message and personal identification;</li> <li>○ gender-sensitive guidance to staff and beneficiaries.</li> </ul> </li> </ul>
<p><i>2. For beneficiaries without: basic literacy or phone or national identification</i></p>	<ul style="list-style-type: none"> <li>• Biometric systems to authenticate identity of cash beneficiary.</li> <li>• Virtual record systems e.g. facilitated through blockchain.</li> </ul>
<p><i>3. To mitigate unintended consequences</i></p>	<ul style="list-style-type: none"> <li>• For all cash transfer schemes: select the methodology carefully on the basis of existing infrastructure and services and beneficiary circumstances; safeguard beneficiaries' rights to data privacy, only collect data that is relevant and necessary; ensure all agents and donors are very clear on the use and limitations of the facilities; and utilize in accordance with nominal data processing principles of: legal bases for personal data processing, purpose limitation and further processing, data minimization, data retention and data security; with the assurance that beneficiaries retain the right of access, rectification and erasure as set out in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</li> <li>• Additionally, for biometrics: utilize only with beneficiaries' consent and in accordance with the additional data processing principle of fair and lawful processing.</li> <li>• Additionally, for blockchain: secure advice from neutral experts; use trusted facilities; take guidance from analytical assessment and emerging standards e.g. ISO/TC 307 blockchain and distributed ledger technologies; and as set out in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</li> </ul>

<b>ICT Levers</b> <i>Motivating factors</i>	<b>Sample strategies</b>
<b>III. Engage and participate</b>	<i>Encourage and facilitate engagement and participation steadily from the most basic level to leadership</i>
<i>1. For gender equality</i>	<ul style="list-style-type: none"> <li>• A mix of gender-sensitive strategies as per examples provided in this report, and further innovations.</li> <li>• Use of traditional media channels for campaigns, e.g. #MeToo, to raise awareness of gender-based violence and harassment.</li> </ul>
<i>2. In disaster risk management cycle</i>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: all available including multi-featured messaging apps, mobile applications, evolved websites and social media.</li> <li>• Facilitate opportunities for affected women to tell their stories across a variety of channels including free-to-air TV and radio, and social media using a variety of media.</li> <li>• Encourage and facilitate the full participation of women as key agents of positive change (UNDP, 2013). Numerous initiatives such as the Devex series of 10 workshops including “Ensuring women’s representation in COVID-19 policymaking” are valuable examples.</li> <li>• Advocate to main stream gender in the national disaster risk reduction strategy (UNDRR, 2019) and national emergency telecommunication plans (ITU, 2019c) to ensure critical messages are received over appropriate ICT channels by women at risk.</li> <li>• Women’s participation in all disaster risk management phases by making gender equality a fully integrated objective of reconstruction strategies; developing sector-wide and theme-based gender analysis as early as possible after a disaster; strengthening operational gender expertise; institutionalizing gender in operational procedures, supervision and support systems; providing funding for special programmes with gender focus to complement regular reconstruction projects and mainstreaming gender equality objectives into procurement and contracting (World Bank, 2012).</li> <li>• Targeted recruitment of women on recovery crews e.g. within UNHCR ICT emergency standby partners (UNHCR, 2015).</li> <li>• Reciprocal licensing arrangements to enable radio users to operate temporarily under their local licence.</li> </ul>

<b>ICT Levers</b> <i>Motivating factors</i>	<b>Sample strategies</b>
<p><i>3. In ICT-product lifecycles</i></p>	<ul style="list-style-type: none"> <li>• Nominal ICT channels: all available including multi-featured messaging apps, mobile applications, evolved websites and social media.</li> <li>• Include women in design, development, deployment, analysis, and advocacy to promote scientific creativity and innovation on the basis of gender diversity (Nielsen, et al., 2017).</li> <li>• Implement gender strategies that promote gender equality in the technical community and inform institutional messages about gender initiatives e.g. as implemented by LACNIC, the Internet addresses registry for Latin American and Caribbean.</li> <li>• Actively encourage innovations from the field, that is to say, from affected communities themselves, and share the initiatives widely (FAO, 2018).</li> <li>• Introduce gender policies in first responder agencies as REACT Trinidad and Tobago, for example, is currently doing.</li> <li>• Solicit inputs into the design of ICT solutions from a broad cross-section of women and girls to ensure that their needs, barriers, interests and ways of communicating are considered. Among other things, this can be effected through maker spaces in schools, libraries and community centres.</li> <li>• Recognize contributions of women in technology. The annual EQUALS in Tech Awards celebration is an example of such for work in digital access, skills, leadership and research.</li> </ul>
<p><i>4. To mitigate unintended consequences</i></p>	<ul style="list-style-type: none"> <li>• For mobile messaging apps, application of basic data processing principles e.g. through no retention of message content, end to end encryption, user ownership of data, no or minimal retention of meta data, limited personal data sharing with third parties etc. as outlined in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</li> <li>• For social media, application of basic data processing principles e.g. through the legal bases for data processing, provision of information regarding the processing of user data, data retention and data security as outlined in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</li> </ul>



ICT Levers <i>Motivating factors</i>	Sample strategies
<b>IV. Learn</b>	
1. <i>Basic literacy</i> 2. <i>Lifesaving skills</i>	<ul style="list-style-type: none"> <li>• TV, radio, interactive voice response.</li> <li>• Use, repurpose and extend existing ICTs.</li> <li>• Design to accessibility standards.</li> </ul>
3. <i>Digital literacy</i> 4. <i>Intermediary and advanced learning, including lifesaving skills</i>	<ul style="list-style-type: none"> <li>• Broad promotion of digital literacy capacity building opportunities for women.</li> <li>• Promote, incentivize and provide capacity building for the use of free-to-air TV and radio in rich and interesting ways.</li> <li>• Nominal ICT channels: distance learning platforms.</li> <li>• Multimodal resources including curricula, modules, presentations, e-learning, audio and video materials, web resources and social media, as per the IFRC <i>Public awareness and public education for disaster risk reduction guide</i> (IFRC, 2011).</li> <li>• A tiered digital literacy curriculum to:                             <ul style="list-style-type: none"> <li>○ provide an equal opportunity for all women to build digital literacy for the purposes of protection, contribution and leadership as appropriate to their profiles;</li> <li>○ build transferable skills applicable to ICT-enabled disaster for vulnerable women. The EU Digital Competence Framework for Citizens, DigComp 2.0 (Vuorikari, 2016) is an example framework. The ITU Digital Skills Insights (ITU, 2019g) provides a comprehensive account of existing reference frameworks' commonalities and differences.</li> </ul> </li> <li>• Policy of learning resource interoperability and sharing for use, reuse and repurposing.</li> <li>• Free and open learning materials in accordance with the tiered digital literacy curriculum for vulnerable women and additionally covering competencies for ICT-enabled disaster mitigation, preparation, response and recovery at the levels of (i) protection (ii) contribution and (iii) leadership, taking account of on social characteristics and information needs. Excellent examples are the free online learning and certification offered by REACT International and other emergency response agencies.</li> <li>• Mixed mode delivery methodology and rich learning resources as used in the Empowering Women through Digital Markets capacity building programme (Ayitic, 2018) and other programmes.</li> <li>• Free and open distance learning programmes (using the learning materials developed in accordance with the tiered digital literacy curriculum for vulnerable women) for a variety of learning channels (free-to-air radio and TV, toll-free interactive voice response, social media and distance learning platforms) for feature phones, smart phones and tablets, taking account of the capacities and circumstances; using various degrees of computer mediation.</li> <li>• An accessible repository of free and open distance learning programmes along the lines of UNHCR in response to COVID-19.</li> </ul>

ICT Levers <i>Motivating factors</i>	Sample strategies
<b>V. Perceive gender differently</b>	
<p>1. <i>Gender stereotypes</i></p> <p>2. <i>Gender role models</i></p>	<ul style="list-style-type: none"> <li>• Nominal channels: all, ICT and non-ICT channels.</li> <li>• Integration of ICTs with existing systems, strategies and tools – ICT-based and not.</li> <li>• Promotion of gender-sensitive policies in film through channels such as UNESCO Policy Monitoring Platform.</li> <li>• Legislation against gender-based discrimination.</li> <li>• Regulations regarding gender parity in governance and production by public broadcasters.</li> <li>• Promotion of gender equality in media along the lines, for example, of the UNITWIN Cooperation Programme established between UNESCO and the International Network on Gender, Media and ICTs; and promoted, for example, in (McCracken, FitzSimons, Priest, Girstmair, &amp; Murphy, 2018).</li> <li>• Support to private sector broadcasters on gender-equal leadership.</li> <li>• Strong international, national and institutional leadership, committed to equity in the work force.</li> <li>• Encouragement and empowerment of female designers.</li> <li>• Gender style guides, widely promoted in the media and design communities.</li> <li>• Gender-sensitive policies in disaster risk management.</li> <li>• Gender-sensitive policies in the full ICT product life cycle.</li> <li>• AI for good, to promote gender equality across all applicable media.</li> <li>• Practical ICT service capacity building for agency in community networks as has been done by AfChix.</li> <li>• Longitudinally sustained gender responsive communications drawing on (UNICEF Regional Office for South Asia, 2018).</li> <li>• Promotion of stories of women workers and leaders in ICT including standards development, as per (Hudson, 2019).</li> </ul>
<p>3. <i>To mitigate unintended consequences</i></p>	<p>Follow the comprehensive guidance on mitigation strategies for AI, data analytics, big data and cloud services as elaborated in the Handbook on Data Protection in Humanitarian Action (Kuner &amp; Massimo, 2020).</p>

## 7.6 Research and innovation

There are very many areas of research necessary to fully assess the impact of ICT on women’s resilience to disasters as well as to guide the research, development, deployment and use of ICTs for this purpose while mitigating negative unintended consequences. Sandvik *et al*, for example, identify the need for research on the impact of new technologies on the degree to which humanitarian interventions are able to adhere to the humanitarian principles of humanity, impartiality and neutrality (Sandvik, Jumbert, Karlsrud, Kaufmann, & Harvard, 2014).

Van der Spuy *et al* outline several dimensions of research necessary to promote meaningful and substantial access across gender barriers; to support gender equity and equal participation in digital economies; to understand relations between human and technology from the lens of gender and feminist understanding; to enable women to exercise their human rights online, including the right to freedom of expression and privacy; to focus on ICTs (and digital technology broadly) as modes of

pleasure, expression, building safe spaces and ensuring openness towards varying gender expressions, sexual orientations and identities; to build movements for social change online, especially those needed to challenge patriarchy and gender norms; to support women to develop proactive responses and actively participate in governance and decision making that affect digital technology (especially ICTs); and to dismantle existing power dynamics of doing research and the necessity of feminist methodology (Anri van der Spuy & Namita Aavriti, 2018).

Innovations in technology and business models are also necessary to effect change. GSMA recommends several focal points to reduce the cost of network deployment and operation, the most crippling barrier to reaching users in underserved areas (GSMA, 2019c). These are necessary to increase the performance, lower the cost and/or increase the efficiency of cellular towers; cell sites and rural backhaul (links between cell sites and the core network); and their underlying technologies including traditional microwave links, emerging satellite technologies and high-altitude balloon and platform solutions; as well as off-grid power including solar and fuel cell solutions. Innovations in spectrum use as well as novel transmission schemes also offer potential. Points of focus for business innovations need to enable sustainable business models to ensure that underserved areas, which are not traditionally lucrative to serve, are reached. Technical and business innovations to enable ongoing provision of affordable universal access, particularly satellite-based, in very low-resourced communities calls for broad scale collaboration across multiple agents.

Another potent area of research, development and innovation is that of learning technologies and methodologies for low-resourced communities. These include a full spectrum of devices, technologies and strategies that have traditionally supported formal and informal learning as well as new technologies such as AI, big data, machine learning and IoT in ways that are gender sensitive and dignifying to beneficiaries. Underpinning these innovations are innovations in resource- and gender-sensitive pedagogy that prioritize purposeful learning outcomes along a contiguous pathway to agency.

## 8 Conclusions

This report has found that gender-based asymmetries do not only manifest in the access to, and use of, ICTs but also in the participation in the design, development and deployment of ICTs; as well as in the planning of the use of ICTs in disaster risk management. These asymmetries widen pre-existing asymmetries in mitigating, coping and adaptive capacities prior to, during and following disasters. Women who are otherwise disadvantaged by the triple divide (FAO, 2018) of digital exclusion, rural marginalization and gender inequalities, face a fourth dimension of risk if they reside in disaster-prone areas.

Examinations in this report reveal some of the reasons why women do not benefit from ICTs as much as men do in disaster risk reduction. These include differentials in access to information and cash; opportunities and confidence to engage and participate in the disaster risk management cycle, and in the ICT product life cycle; and opportunities to learn. Many of these asymmetries arise from deeply rooted cultural norms and perceptions of gender that manifest variously in the four phases of the disaster risk management (DRM) cycle, and differently across individuals and communities. The report shows many cases and opportunities to use ICTs themselves to chip away at offending perceptions of gender that prevail as barriers to women's agency.

The report considers a number of ICT channels and platforms, characterizing each in terms of the extent to which it is able to reduce the key barriers to women's disaster resilience: access to information and cash; engagement and participation, learning, and perceptions of gender. The report also classifies available ICTs according to device cost, service cost, competence required to operate the device, reliance on infrastructure, and the extent to which its benefits rely on policy and regulatory frameworks, as well as on the operating standards and procedures employed. Comparative graphical summaries of these characteristics provide intuitive guidance for the selection of context-appropriate ICTs.

A 3-tiered trajectory is used to model broad categories of gendered disaster resilience to depict the components of enduring ICT impact, enabling women (i) to take protective measures to reduce their disaster risk, (ii) to contribute to the DRM and ICT product life cycles, and (iii) to take leadership roles to influence disaster and ICT planning and outcomes; provide mentorship to other women, and to shift perceptions of gender. Overlaid on the trajectory are the nominal ICTs and sample roles for each tier.

The report is clear that information and communications technologies exist alongside very many other resilience-building tools, technological and non-technological. In some contexts, technological solutions are entirely inappropriate, in others they are counter-productive, causing more harm than good. Indeed, a word of caution is essential. Humanitarian ICTs, that is to say ICTs used for humanitarian purposes, do not in any way contravene basic humanitarian principles of humanity, neutrality, impartiality and independence (UNHCR, 2015). Therefore, not all information and communications technologies are applicable to humanitarian intervention, nor are all applicable ICTs always used in ways that are acceptable to such intervention. The report provides insight into many unintended (though not always unintentional) consequences of the use of ICT and resources for mitigation.

In many cases the success of ICT rests largely outside the technology. In the absence of enabling policies, programming and perceptions, which are themselves always context-sensitive, ICT interventions can be colossal failures. The report reviews a number of global frameworks for action and calls upon those agencies with the wherewithal to develop and share resources, to do so in highly accessible ways, and to advocate for change at all levels. It frames a 360 strategy of ICT-enabled Interventions: longitudinally through disaster mitigation, preparation, response and recovery; instrumentally using context appropriate technologies: pre-existing and new; traditional and contemporary, basic and advanced; laterally across multiple dimensions and disciplines of intervention including but not limited to technology, policy, regulation, advocacy, research, innovation, enabling and debilitating systems and ecosystems (international, national and local), projects and communities; stratified across all tiers of the gendered disaster resilience-building trajectory; temporally in, and for, the short, medium and long term; methodologically: systematic and ad hoc; institutionalized and informal; in all cases sensitively recognizing compounding factors that give rise to multiple dimensions of marginalization

such as those experienced by women who live in deeply rural areas, are differently abled, and who head households.

The case of the 2020 COVID-19 global pandemic is a staggering example of the many faces of ICT for women in disaster situations. Gender-based violence has reared its ugly head yet a number of online safe houses brought relief to women and many public online forums were dedicated to gender-based violence, gendered disaster vulnerability, and the gendered digital divide. The debates engaged speakers and audiences from the academic community, private sector, government officials, NGOs, the technology community and several youth communities. Safety apps and maps provided support for pregnant women, women in labour and postpartum women. Mobile and online payments were introduced where they had been sorely in need. Social media channels such as Facebook and WhatsApp were the lifeblood for some while others relied on traditional media and community radio stations for critical information. With quick dispatch, primary through tertiary level teaching went online. At the same time, providers of all enabling services and learning platforms kicked into action and telecommunication regulators pitched in by authorizing the use of extended spectrum for wireless communications at no additional licence fee. Meanwhile research and advocacy groups generated and shared data dashboards that revealed gender gaps in disaster risk.

Despite the devastating and debilitating impact of disasters, they have been the catalyst for many innovations, seamlessly transferrable to everyday life. The year 2020 is the start of a cycle of disaster driven innovation → every day adoption → disaster resilience, that has gripped the attention of the ecosystem of actors necessary to reduce the double divides of gender and ICT that impact women's disaster resilience. This ever-expanding ecosystem now firmly includes the community of digital humanitarians who are rapidly changing the landscape of disaster resilience with a rich palette of data, information and communications tools.

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**Office of the Director**  
**International Telecommunication Union (ITU)**  
**Telecommunication Development Bureau (BDT)**  
Place des Nations  
CH-1211 Geneva 20  
Switzerland

Email: [bdtdirector@itu.int](mailto:bdtdirector@itu.int)  
Tel.: +41 22 730 5035/5435  
Fax: +41 22 730 5484

#### Digital Networks and Society (DNS)

Email: [bdt-dns@itu.int](mailto:bdt-dns@itu.int)  
Tel.: +41 22 730 5421  
Fax: +41 22 730 5484

#### Digital Knowledge Hub Department (DKH)

Email: [bdt-dkh@itu.int](mailto:bdt-dkh@itu.int)  
Tel.: +41 22 730 5900  
Fax: +41 22 730 5484

**Office of Deputy Director and Regional Presence**  
**Field Operations Coordination Department (DDR)**  
Place des Nations  
CH-1211 Geneva 20  
Switzerland

Email: [bdtdeputydir@itu.int](mailto:bdtdeputydir@itu.int)  
Tel.: +41 22 730 5131  
Fax: +41 22 730 5484

#### Partnerships for Digital Development Department (PDD)

Email: [bdt-pdd@itu.int](mailto:bdt-pdd@itu.int)  
Tel.: +41 22 730 5447  
Fax: +41 22 730 5484

## Africa

### Ethiopia

**International Telecommunication Union (ITU) Regional Office**  
Gambia Road  
Leghar Ethio Telecom Bldg. 3<sup>rd</sup> floor  
P.O. Box 60 005  
Addis Ababa  
Ethiopia

Email: [itu-ro-africa@itu.int](mailto:itu-ro-africa@itu.int)  
Tel.: +251 11 551 4977  
Tel.: +251 11 551 4855  
Tel.: +251 11 551 8328  
Fax: +251 11 551 7299

### Cameroon

**Union internationale des télécommunications (UIT)**  
**Bureau de zone**  
Immeuble CAMPOST, 3<sup>e</sup> étage  
Boulevard du 20 mai  
Boîte postale 11017  
Yaoundé  
Cameroon

Email: [itu-yaounde@itu.int](mailto:itu-yaounde@itu.int)  
Tel.: + 237 22 22 9292  
Tel.: + 237 22 22 9291  
Fax: + 237 22 22 9297

### Senegal

**Union internationale des télécommunications (UIT)**  
**Bureau de zone**  
8, Route des Almadies  
Immeuble Rokhaya, 3<sup>e</sup> étage  
Boîte postale 29471  
Dakar - Yoff  
Senegal

Email: [itu-dakar@itu.int](mailto:itu-dakar@itu.int)  
Tel.: +221 33 859 7010  
Tel.: +221 33 859 7021  
Fax: +221 33 868 6386

### Zimbabwe

**International Telecommunication Union (ITU) Area Office**  
TelOne Centre for Learning  
Comer Samora Machel and Hampton Road  
P.O. Box BE 792  
Belvedere Harare  
Zimbabwe

Email: [itu-harare@itu.int](mailto:itu-harare@itu.int)  
Tel.: +263 4 77 5939  
Tel.: +263 4 77 5941  
Fax: +263 4 77 1257

## Americas

### Brazil

**União Internacional de Telecomunicações (UIT)**  
**Escritório Regional**  
SAUS Quadra 6 Ed. Luis Eduardo  
Magalhães,  
Bloco "E", 10<sup>o</sup> andar, Ala Sul  
(Anatel)  
CEP 70070-940 Brasília - DF  
Brazil

Email: [itubrasilia@itu.int](mailto:itubrasilia@itu.int)  
Tel.: +55 61 2312 2730-1  
Tel.: +55 61 2312 2733-5  
Fax: +55 61 2312 2738

### Barbados

**International Telecommunication Union (ITU) Area Office**  
United Nations House  
Marine Gardens  
Hastings, Christ Church  
P.O. Box 1047  
Bridgetown  
Barbados

Email: [itubridgetown@itu.int](mailto:itubridgetown@itu.int)  
Tel.: +1 246 431 0343  
Fax: +1 246 437 7403

### Chile

**Unión Internacional de Telecomunicaciones (UIT)**  
**Oficina de Representación de Área**  
Merced 753, Piso 4  
Santiago de Chile  
Chile

Email: [itusantiago@itu.int](mailto:itusantiago@itu.int)  
Tel.: +56 2 632 6134/6147  
Fax: +56 2 632 6154

### Honduras

**Unión Internacional de Telecomunicaciones (UIT)**  
**Oficina de Representación de Área**  
Colonia Altos de Miramontes  
Calle principal, Edificio No. 1583  
Frente a Santos y Cía  
Apartado Postal 976  
Tegucigalpa  
Honduras

Email: [itutegucigalpa@itu.int](mailto:itutegucigalpa@itu.int)  
Tel.: +504 2235 5470  
Fax: +504 2235 5471

## Arab States

### Egypt

**International Telecommunication Union (ITU) Regional Office**  
Smart Village, Building B 147,  
3<sup>rd</sup> floor  
Km 28 Cairo  
Alexandria Desert Road  
Giza Governorate  
Cairo  
Egypt

Email: [itu-ro-arabstates@itu.int](mailto:itu-ro-arabstates@itu.int)  
Tel.: +202 3537 1777  
Fax: +202 3537 1888

## Asia-Pacific

### Thailand

**International Telecommunication Union (ITU) Regional Office**  
Thailand Post Training Center  
5<sup>th</sup> floor  
111 Chaengwattana Road  
Laksi  
Bangkok 10210  
Thailand

*Mailing address:*  
P.O. Box 178, Laksi Post Office  
Laksi, Bangkok 10210, Thailand

Email: [ituasiapacificregion@itu.int](mailto:ituasiapacificregion@itu.int)  
Tel.: +66 2 575 0055  
Fax: +66 2 575 3507

### Indonesia

**International Telecommunication Union (ITU) Area Office**  
Sapta Pesona Building  
13<sup>th</sup> floor  
Jl. Merdan Merdeka Barat No. 17  
Jakarta 10110  
Indonesia

*Mailing address:*  
c/o UNDP – P.O. Box 2338  
Jakarta 10110, Indonesia

Email: [ituasiapacificregion@itu.int](mailto:ituasiapacificregion@itu.int)  
Tel.: +62 21 381 3572  
Tel.: +62 21 380 2322/2324  
Fax: +62 21 389 5521

## CIS

### Russian Federation

**International Telecommunication Union (ITU) Regional Office**  
4, Building 1  
Sergiy Radonezhsky Str.  
Moscow 105120  
Russian Federation

Email: [itumoscow@itu.int](mailto:itumoscow@itu.int)  
Tel.: +7 495 926 6070

## Europe

### Switzerland

**International Telecommunication Union (ITU) Office for Europe**  
Place des Nations  
CH-1211 Geneva 20  
Switzerland

Email: [euregion@itu.int](mailto:euregion@itu.int)  
Tel.: +41 22 730 5467  
Fax: +41 22 730 5484

International Telecommunication Union  
Telecommunication Development Bureau  
Place des Nations  
CH-1211 Geneva 20  
Switzerland

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