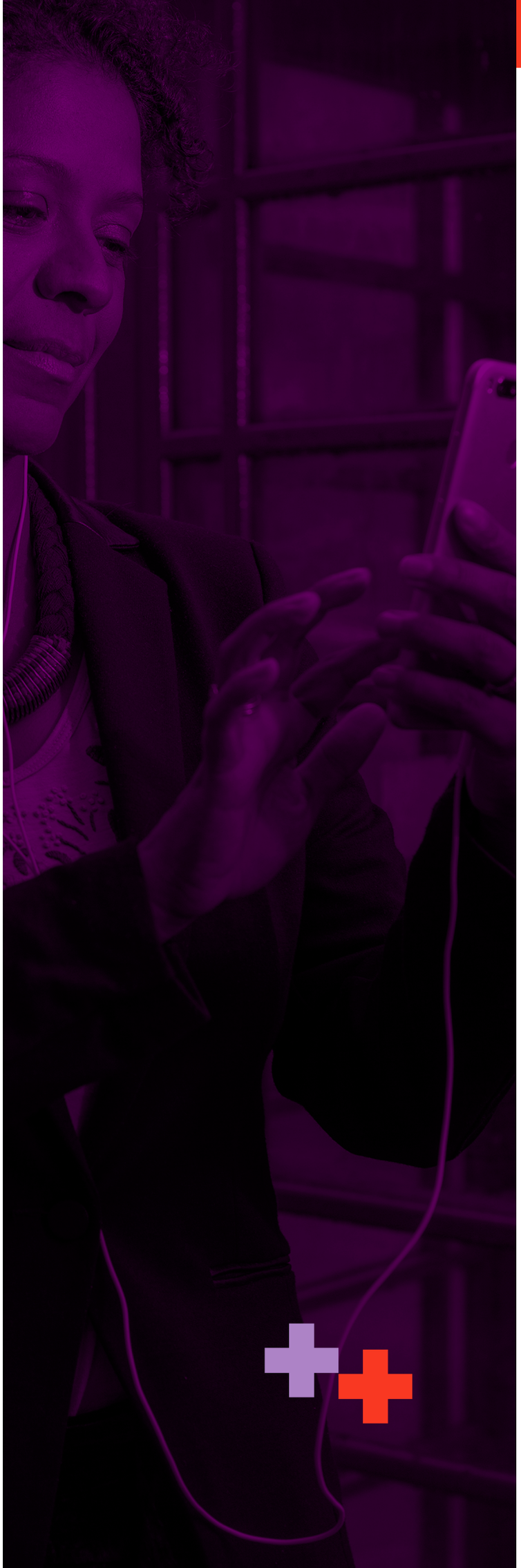
5

ICT IN A CHANGING CLIMATE: A PATH TO GENDER-TRANSFORMATIVE FOOD SECURITY

AUTHOR:
SOPHIA HUYER, PH.D., WOMEN IN GLOBAL SCIENCE AND TECHNOLOGY (WISAT) AND CGIAR CLIMATE CHANGE, AGRICULTURE AND FOOD SECURITY PROGRAMME (CCAFS)



ABSTRACT

Women play a critical role in food security in the developing world, but their agricultural activities are often characterised by gaps in information and resource access, with deficiencies in several areas: land, labour, credit, information, extension, and technology. Increasing stresses on food security, brought about by a changing climate, call for the active contributions of women in agriculture. This will require equal participation in decision making, equal access to agricultural resources and services, institutions that address their concerns, and technologies and information that are useful to them. ICTs are so far not providing them with the information, services, and knowledge they need and want. Sufficient evidence and experience exist, however, to develop agricultural information strategies for food security that support women and promote gender equality. This chapter provides a review of women's access to and use of climate and agriculture information; it provides examples of successful strategies for reaching women, with suggestions for further research and programming to promote gender equality along with climate information..

KEY FINDINGS

- ICT and information services have the potential to promote gender equality and empowerment of rural women, if they contribute to needs and priorities of both women and men in rural areas and increase their resilience to cope with climate change. Currently, however, information is not reaching women farmers adequately.
- ICT can play an important role in facilitating support to women in the critical areas defined by FAO for supporting women's activities in food security: livelihood support, reducing women's workloads, ensuring protection from gender-based violence, and equitable access to resources and services.
- "Mixed" approaches may provide the most successful approaches to reach women with agriculture and climate information, in view of women's low resource access and the widespread gender norms that inhibit women's information access. Intermediary organisations, such as farmer associations and women's organisations, also serve as important avenues for women's information access.

GENDER AND FOOD SECURITY IN A CHANGING CLIMATE

ICTs have the potential to promote gender equality and empowerment of rural women in developing countries, while increasing food security, by decreasing workloads, increasing decision-making power, diversifying agricultural production, enhancing ability to respond to climate and weather variability, and improving livelihoods. Although ICT4D has a significant track record in development, the technology has not yet provided rural women in developing countries with the information, services, and knowledge they need and want — even as climate change has increased their need for innovative solutions. The problem lies in designing the transmission of information that women need in ways they can access readily. When this does happen, women have shown their readiness and eagerness to use and benefit from information through technology.

Women play a critical role in food security in the developing world. Their participation in the agricultural labour force in sub-Saharan Africa ranges from 60% to 80%; in least developed countries (LDCs), 80% of women list agriculture as their major employment sector. These percentages will increase in many countries, as rural women play a growing role in smallholder agriculture as a result of male out-migration to urban centres for employment (Doss, 2011; FAO, 2011; UN, 2015). However, women's agricultural activities are often characterised by gaps in information and resource access, with deficiencies in critical areas: land, labour, credit, information, extension, and technology (Huyer, 2016). The Food and Agriculture Organisation (FAO) has calculated that, if women farmers were to have the same access to resources and services as male farmers, their production would increase by 10–14%, with a resulting massive decrease — of up to 150 million — in the global population that experience hunger (2011). Women's vital contribution to food production, subsistence farming, and the agricultural labour force in the developing world means that strategies to promote gender equality and women's empowerment in ICT in agricultural development must be a priority for global food security. Such efforts are also central to a global development agenda based on human rights and the Sustainable Development Goals (SDGs).

Globally, rural women fare worse than either rural men, urban women, or urban men, on every gender and development indicator for which data are available; they show lower levels of health, education, employment, and decision-making power. They face higher levels of poverty and violence. Women and girls also face a higher risk of undernourishment — about 60% of people living in hunger are female (UN, 2010; UN, 2015; FAO, 2017). They are more affected by environmental deterioration and hazards, as they depend on, and have responsibility for, natural

resources. In 2010, an estimated 66% of households in sub-Saharan Africa, 55% in South and Southeast Asia, and 31% in Latin America relied on collected fuelwood for cooking, with women being primarily responsible for fuelwood collection. Rural women are at especially high risk of negative impacts from climate change, as their household responsibilities entail natural resource-based activities, including subsistence agriculture and fetching water and fuelwood. Increasing rates of male out-migration from rural areas means that women also take on additional work in agricultural production. For these reasons, environmental stress in farming systems (such as those imposed by climate change) intensifies women's workloads while decreasing the assets of poor households (Jost et al., 2016; Agwu & Okhimamwe, 2009).

Despite global gains in food production and reduction in poverty, the world faces a crisis: some 795 million people still suffer from hunger, and more than two billion experience either micronutrient deficiencies or some form of over-nourishment. Increasing pressures on natural resources due to population growth and resource extraction are exacerbated by climate change, natural disasters, and other shocks, which threaten the sustainability of food systems at large (FAO, 2017). Other major challenges include increasing urbanisation and demand for food, erratic food prices, conflict, population displacement, and continuing economic inequality. A transformation of rural development is required, if agriculture in the developing world is to cope (IFAD, 2016). Given women's role throughout food production, nutrition, environmental management, and social well-being, gender equality needs to be integral to this transformation.

Different social groups of course have varying socio-economic status, political participation, and access to resources, affecting their ability to cope with and respond to the effects of climate change. However, reflecting widespread social, political and economic inequalities, women are almost invariably at a greater disadvantage than men in the same social group, with less access to land, fewer resources and entitlements, more limited access to information and services, and less participation in decision-making (FAO, 2017). The gendered division of labour additionally means they work longer days than men, and new activities requiring additional labour are often allocated to already burdened women (Grassi et al., 2015; Beuchelt & Badtue, 2013). The latest IPCC assessment on social vulnerability makes clear that climate change will exacerbate these existing gender inequalities (IPCC, 2014).

At the same time, women's contributions to resilience building and peace processes are often overlooked; they are rarely represented in leadership and decision-making institutions, from local to national levels. As a result of these inequalities, women have less opportunity to influence policies, programmes, and decisions that affect their lives. The effects of climate variability, shocks, and extreme weather events are likely to increase the existing inequalities and vulnerabilities faced by women (Dankelman, 2010; Kakota et al., 2015; IPCC, 2014).

But women are also active agents for community and household resilience and in developing responses to the impacts of climate change (Denton, 2002; Dankelman, 2010). Rural women's local knowledge in areas of environment, soils, water, and production are valuable resources for reduction and adaptation strategies. Engaging women in technology design and management decisions can improve community outcomes, as shown in Honduras, where women have re-designed eco-stoves and developed improved agroforestry management systems (Hottle, 2015). Women identified changes in Fiji's coral reef, such as bleaching, changes in spawning periods of certain fish, and algal blooms. Women in Micronesia were able to identify locations for new wells based on their knowledge of local water tables (Lane & McNaught, 2009).

Food security in a changing climate requires the active participation of women, that will entail: equal participation in decision making and equal access to agricultural resources and services; institutions that address their concerns; and technologies and information that are useful to them. ICT and information services have the potential to promote gender equality and empowerment of rural women, if these technologies and services contribute to the needs and priorities of women and men in rural areas and increase their resilience to cope with effects of climate change. However, information currently is not reaching women farmers adequately. ICTs are not providing them with the information, services, and knowledge they need and want. Sufficient evidence and experience are already available to inform new agricultural information strategies for food security that at the same time support women and promote gender equality.

CLIMATE AND FOOD SECURITY INFORMATION IS NOT REACHING WOMEN

Access to ICTs — including ownership, control, and use — generally remains much lower for women than men in developing countries (ITU, 2016). Reasons for this include: lack of financial resources to secure the use of ICTs; lower levels of technological and language literacy among women and girls; norms that discourage women and girls from using technology; and lack of control over and ownership of technology (see Huyer & Hafkin, 2006). The resulting patterns of unequal access to climate information and advisory services determine which individuals can make use of such services to manage climate risk and strengthen their resilience at the farm level. The farmers who

tend to be most vulnerable to climate change stresses are resource-poor, female, and lower caste — individuals who are marginalised by their communities' sociocultural norms (Tall et al., 2014).

Reflecting the digital gender divide, as well as the general failure to recognise the full range of women's activities in agriculture (see FAO, 2017), women are consistently less considered in the design of agricultural information and extension services. A World Bank study investigated whether and how ICT can support women-managed agro-enterprises in Kenya and Zambia, concluding that women and men differ in their access to, use of, and need for ICT tools. It found high unmet demand for extension information among women farmers that ICT could help to fill (World Bank, 2015), since women's household responsibilities may prevent them from accessing radio programmes or extension sessions (Archer, 2003; Meinzen-Dick et al., 2010).

Agricultural extension and support services tend to be biased toward male farmers, particularly in cultures where women are responsible for household food production and men are responsible for commercial crops (World Bank, IFAD, & FAO, 2009; Meinzen-Dick et al., 2010). For example, in Ghana, women's lower use of fertiliser is related to their lack of access to agricultural extension (Emmanuel et al., 2016); in the developing world in general, information on nitrogen use has not been reaching women (Farnworth et al., 2017). In India, women-headed households with land are 25% less likely to receive an extension visit; and there is a gender gap in bank account ownership in most developing countries -- in Bangladesh, Pakistan, and Turkey the gap is nearly 30 percentage points (Demirgüç-Kunt et al., 2018). In one region in Kenya, whereas both husbands and wives had contact with extension officers during field visits, the husbands had more access to information on crop and livestock production and more access to other extension services than their wives (Ngigi et al., 2017).

A range of barriers constrain women's access to climate information related to agriculture: limited access to resources; gender norms relating to women's status, roles, and capabilities; and limited participation in household and community decision making. For example, although group communication processes have proven to be effective at enabling farmers to understand and act on climate-related information, culture-specific gender norms and power relations often inhibit women's attendance at community meetings (Roncoli et al., 2011). In South Asia, women farmers were unable to use advisories to inform their decision making due to inability to read the advisories, lack of time to watch radio or television, or low participation in community activities and meetings where the advisories were disseminated or discussed. The latter factor in turn reflects a number of obstacles: lack of time to attend meetings, childcare requirements, lack of transportation, or gender norms that prohibit women to participate in discussions attended by male farmers (Venkatasubramian et al., 2014; Roncoli et al., 2011). Women's information networks are often smaller than men's, and women tend not to have access to formal organisations, depending instead on informal networks such as family members, neighbours, and other traditional sources of information (Manfre & Nordehn, 2013). While women in rural farming communities largely depend on these informal sources for information, men are able to access information from agricultural extension services, NGOs, and community meetings (Kristjanson et al., 2015; Cramer et al., 2016; Perez et al., 2015).

Women also have fewer opportunities for learning about and taking up new productive and commercial opportunities (Sebstad & Manfre, 2011). In Southeast Asia, women and men played different roles in domestic labour, shaping their participation in agricultural production (Duong et al., 2017). Women were responsible for most meal preparation and daily care of children. With fewer domestic responsibilities, men had more time to engage in income streams outside of agriculture that are less weather-dependent and that generate higher levels of income, while women earned their income mainly through agriculture. Men also made most farm-related decisions, such as crop selection and application for loans. As a result, there were also gender differences in the effects of weather events: more women than men experienced major damage to their crops from natural disasters, such as prolonged rainy seasons, flooding, and temperature extremes. Contributing factors were differences in access to both information and resources to prevent weather-related damage, such as changing crop management strategies, investing in livestock vaccinations, stocking seed and animal feed, and buying new agricultural tools or equipment (Duong et al., 2017).

Women's different agricultural tasks and household responsibilities mean that they may require different information than men (Jost et al., 2016). Women farmers in Senegal, for example, need forecasts of rainfall cessation (rather than onset) and of dry periods, because they work their lands at different times than men (Tall et al., 2014b). In southern Mali, men are responsible for cultivating rain-fed staple grains, while women have more control over hand-irrigated garden crops. With little decision-making authority over rain-fed cereals, women have little interest in or ability to act on forecasts relevant to those crops (Carr et al., 2016). A failure to provide for women's priorities and needs may be one reason for their lower rates of access to formalised information channels: data collected in Uganda found that, although women are responsible for post-harvest handling of food, just over one-half of them received information related to these practices, reflecting lack of access to extension and other sources of information (Kristjanson et al., 2015). On the other hand, when the available information is valuable to women, they will pay the cost. In Rwanda, it was found that women lagged only slightly behind men in mobile use, and in emergency assistance for livestock, women

slightly predominated: they reported contacting veterinarians for livestock assistance on a regular basis. This assistance allowed them to save money on travel and to keep the livestock healthy in order to breed them successfully. Small livestock is often an area where women have decision-making power and can benefit from the proceeds, so they find it worthwhile to bear the cost of mobile phone use to improve results. (Martin & Abbott, 2011.)

In general, however, content addressing women's specific interests and priorities represents a large gap (Huyer, 2006; GSMA, 2012), particularly in the agricultural sector. Women seek out a wide range of information to support their household and farming activities, such as information on nutrition, reproductive health, education, and entrepreneurship, but much information is not readily available to them (Cramer et al., 2016; GSMA, 2012; Pshenichnaya, 2011; Caine et al., 2015).

DESIGNING CLIMATE INFORMATION FOR GENDER EMPOWERMENT

Ensuring that women have access to information and knowledge that they value and can use effectively represents an important step towards gender equality and women's empowerment (see Hafkin & Huyer, 2006). Research demonstrates that when women have access to information on agricultural technologies, along with the resources to implement it, they in fact implement the knowledge they have gained (Duong et al., 2016; Jost et al., 2016); the resilience of households, communities, and food systems are increased as a result (World Bank, FAO, & IFAD, 2009). Climate change, extreme weather events, and natural disasters make it even more important for farmers to have timely and accurate information on adaptive practices, inputs, and technologies, enabling them to take steps to minimise or prevent losses in agricultural production. Farmers need accurate climate information to help them cope with extreme weather events and variable rainfall patterns, including early warning systems, improved forecasting, and historical climate pattern information, as well as an extended range of options for adapting to changes in weather (Coffey et al., 2015).

FAO has identified four critical strategies to support women farmers in increasing food security: (1) practical measures to work towards greater equality, including livelihood support for women and girls; (2) reducing women's workloads; (3) ensuring protection from gender-based violence; and (4) equitable access to resources and services (FAO, 2016). ICT can play an important role in facilitating support to women in all four areas, by improving access to markets for livelihoods, easing work burdens through increased efficiency and information, increasing women's agricultural production, facilitating access to resources and services, and supporting women's leadership in their communities (Huyer, 2012).

In Congo, a group of women farmers used computers to access and exchange agricultural information over email and internet. They were able to source high-quality seeds from other countries and expand their information, networking, and market base. The increased income and status resulting from these benefits in turn increased their influence in the household and the community (APC, 2010). In Lesotho, cell phone use and reselling of airtime by women's farming cooperatives increased their income and public profile, enabling members to participate in agricultural shows, trainings, and conferences through national programmes to encourage small-scale farmers (Vincent et al., 2009).

Gender-specific information services take different forms. In relation to climate information, for example, efforts to involve rural women in the design of the services — adapting communication channels to take into account their concerns, responsibilities, travel and mobility, and schedules — can reduce the barriers women face in accessing these services (Tall et al., 2014a; Poulsen et al., 2015). Agricultural information can be incorporated into spaces and processes that are already part of women's routines and social networks, such as boreholes or women's groups (Tall et al., 2014a; Venkatasubramanian et al., 2014) — with transformative results. Social networks and community organisations, such as local women's organisations or health clinics, can play a crucial role in promoting women's access to information (Mooko, 2002). In Vietnam, intermediary organisations such as farmer associations and women's organisations played a central role in enabling women to access information on water-conserving agricultural production and to realise their personal goals (Farnworth et al., 2017). A survey in Uganda found that women preferred to receive climate information (in descending order of importance) via megaphones, letters, village leaders, farmers groups, school children, religious and social gatherings, and print media. They felt that information in these forms was useful since it was presented in the local language and was location-specific (McOmber et al., 2013).

In India, access to mobile-phone-based agricultural information has reduced knowledge gaps between large and small farmers as well as between women and men. The "listening rate" of women farmers was equivalent to that of men farmers; 70% of women farmers felt that the "agro advisories" had increased their knowledge about farming practices, increasing their yields as a result. At least 48% of the women farmers surveyed responded that the information helped them to reduce costs through more efficient input management, and 56% felt that the information helped them to reduce crop losses from rainfall. In one region, 83% of women farmers reported having taken action based on the information they received through

this service. Interestingly, women also felt that the information increased their participation in household decision making with their husbands (Mittal, 2016).

Another successful case of providing information to women is Shamba Shape-up in Kenya, a television programme on small-scale agriculture on the model of popular house makeover shows.
A survey found that most viewers of the show reported that the programme helped them improve the profitability of their enterprises and had a positive effect on their families' food security. It is estimated that 428,566 households made changes in their farming practices and/or reported increased income or food production as a result of watching the programme. The programme focused mainly on maize and dairy; survey results were sex-disaggregated. While both male and female maize farmers benefited from the changes they made on their farms, men benefited slightly more, increasing their consumed output by 58% compared to an increase for women of 23%. Similarly, output for sale doubled for men and increased by 83% for women. In dairy, although men farmers had greater returns than women, women dairy farmers experienced greater proportional returns: their production increased by 59%, compared to improvement for men of 41% (Africa Enterprise Challenge Fund & University of Reading, 2014).

Radio continues to be an effective transformation tool in many rural areas. In a village in Kenya, Kamba women were able to hear women like themselves on Radio Mang'elete, providing market information, notification of social events, discussion forums, and entertainment in the forms of radio vignettes and plays. They were able to interact with community leaders and programme hosts online to suggest programming and offer content, providing them an opportunity to speak out publicly and demand answers from local leaders. As a result, they experienced increased agency and positive self-perception while gaining recognition of their input from the larger community (Sterling & Huyer, 2009). Dimitra community listening clubs in Congo and Niger represent a gender-responsive participatory approach to information dissemination and gender empowerment. They facilitate dissemination and exchange of information on local issues such as agricultural practices, climate change, food and nutrition security, women's unequal workload, and access to water, land, sanitation, and health. Community members can request information on topics of interest. Information is disseminated using both new technologies (internet, on-line database, etc.) and more "traditional" means of communication (newsletter, brochures, and community radio). The experience of male-female interaction in a community forum allows the public airing and debate of many issues and has provided a platform for examination of gender roles. In one example, men in a rural community began to take on childcare duties, when their wives had responsibilities outside of the household (DIMITRA, 2013).

A more traditional approach to information dissemination, using training sessions, proved successful in serving women rice farmers in Vietnam, improving livelihoods and empowering participants. Their knowledge increased in almost all aspects of rice production: by obtaining better yields from the seeds they planted and using lower rates of inputs (such as seeds, fertiliser, and pesticides), they lowered their production costs. They enjoyed increased income from related farming activities, such as raising piglets using rice bran as feed. Women experienced increased participation in household decision-making related to farming decisions beyond animal rearing, on rice varietal choice, crop management, and post-harvest management. Further, women's decision-making authority increased on household finances, regarding "how much money to spend on food" and expenditures on children's education, as well as allocation of remittances received.

Three quarters of the women participants felt that their social position in the household and community improved. Most (84%) said that they were more highly respected by their husbands, children, and other family members because they contributed to higher rice yields and higher income. Men observed that after the training, women were able to discuss crop varieties and management practices (choice, timing, and amount of fertiliser) and that the trainings benefited the family; as a result, they encouraged their wives to attend agriculture training workshops. Fully 87% of participants experienced increased confidence in discussing rice technologies with their families, and 66% were more confident in interacting with agricultural extension services (Chi et al., 2015).

Successful approaches to reach women in the developing world with climate information most often consist of "mixed" approaches; unavailable resources as well as gender norms often inhibit women from interacting with formal and organised information channels and networks or from accessing certain communications technologies. Mixed modes or channels of communication can overcome the barriers faced by women at various points in the information dissemination process, taking advantage of existing communications networks and channels. For example, traditional local social networks can transmit information from mobile phones, producing a significant increase in the quality and speed of information delivery (Caine et al., 2015). Intermediaries (or "infomediaries") who are respected community members can pass on the information they receive on their mobiles to other members of the community. An example of this is the Community Knowledge Worker project in Uganda (World Bank, 2012). Similarly, mAgri initiatives have used farmer co-operatives to spread information to farmers through their existing social networks (Caine et al., 2015). Cherotich et al. (2012) suggest that a combination of extension agents, radio, and local administration is most effective for disseminating climate information and support services to vulnerable people in marginal areas.

Finally, the potential for women farmers to use and benefit from the newest technologies needs to be researched and supported. Technological approaches including drones, big data, smart farms, geo-intelligence, and bioinformatics will play an ever-increasing role in food production in the developing world.

Unfortunately, the representation of women in STEM fields is low in general, and particularly low in fields related to ICT, natural resources management, and agriculture. Women are not well-represented as researchers, agricultural extension agents, skilled workers, professionals, or decision-makers (Huyer, 2015; Akeredolu, 2008; World Bank & IFPRI, 2010). Remedying these glaring gaps must be an urgent priority: increasing the enrolment of women and girls in these subjects, employing non-formal educational approaches on the ground, promoting the employment and retention of women in these fields, and ensuring their representation in decision-making in these fields at all levels.

CONCLUSION AND RECOMMENDATIONS

ICT and information services have the potential to promote gender equality and empowerment of rural women while increasing food security, through decreased workloads, increased decision-making power, diversified agricultural production, ability to respond to climate and weather variability, and improved livelihoods. But these gains are possible only if information and knowledge are well designed to respond to women's situations, access to resources, and priorities. Information providers need to work with women's community organisations to develop communication channels that are adaptive to the obstacles women face. This will require a range of options and approaches, including: consultation with women to determine their information needs and priorities; mixed ICT approaches that combine different media with different intermediary groups or community structures; and tailored approaches based in local community contexts and realities.

Few ICT and agricultural technology providers have recognised the potential market represented by rural women as a group, with some exceptions (see Wilkes & van Dijk, 2017). GSMA found that in Madagascar both women and men were willing to pay for recorded information on gender and health, on dedicated voice information lines (GSMA, 2015). Targeting rural women in developing countries as information and technology consumers is an area with substantial potential requiring more research.

Experience and evidence suggest several promising avenues for promoting gender equality[62]:

- Consult with women and women's organisations in the development of ICT-enabled agricultural information, to ascertain their information needs and priorities.
- Assess climate information needs of women and men farmers separately, with further disaggregation — by male- or female-headed household, age, and socioeconomic status — or other factors that may shape roles, constraints, and information needs.
- Assess gender barriers in accessing ICT and information.
- Select or develop ICT services and channels in consultation with women's and community organisations.
- Consider providing a range of useful and affordable information services tailored to women's expressed interests, including nutrition, health, weather, and livelihood, in order to increase the value of these services to women.
- Assess the value of climate information services to women in terms of rate of access, use, and perceived benefits from use.
- Promote the participation of women and girls in STEM-related subjects, workforce, and decision-making at all levels.
- Work with the private sector to recognise the potential of women as a market for agricultural technologies, including ICT.
- Assess the value of climate information services to women in terms of rate of access, use, and perceived benefits from use.
- Assess impacts of key factors and strategies promoting women's empowerment in the use of climate information, including choice of content and channel.

REFERENCES

Africa Enterprise Challenge Fund & University of Reading. (2014). Assessing the impacts of Shamba Shape Up. Nairobi: Africa Enterprise Challenge Fund. Retrieved from: https://cgspace.cgiar.org/rest/bitstreams/64998/retrieve

Agwu, J. & Okhimamwe, M. (2009). Gender and climate change in Nigeria. Lagos: Heinrich Böll Stiftung (HBS).

Akeredolu, M. (2008). Women in leadership positions in the Malian Ministry of Agriculture: Constraints and challenges. South African Journal of Agricultural

62 *The first seven recommendations are based on Huyer et al. (2017).*

Extension, 37, 208, 27–44.
Archer, E. R. 2003. Identifying underserved end-user groups in the provision of climate information. Bulletin of the American Meteorological Society 84, 1525-32.

Association for Progressive Communications (APC) (2010). Gen ARDIS 2002-2010: Small grants that made big changes for women in agriculture.

Beuchelt, T. D., & Badstue, L. (2013). Gender, nutrition- and climate-smart food production: Opportunities and trade-offs. Food Security, 5(5), 709–721. Retrieved from: https://doi.org/10.1007/s12571-013-0290-8

Caine Dorward, P., Clarkson, G., Evans, N., Canales, C., Stern, D. & Stern, R. A. (2015). Mobile applications for weather and climate information: Their use and potential for smallholder farmers. Working Paper 150. Retrieved from: https://doi.org/10.2139/ssrn.701181

Carr, E. R., Fleming, G., & Kalala, T. (2016). Understanding women's needs for weather and climate information in agrarian settings: The case of Ngetou Maleck, Senegal. Weather, Climate, and Society, 8(3), 247–264. Retrieved from: https://doi.org/10.1175/WCAS-D-15-0075.1

Cherotich, V. K., Saidu, O., & Bebe, B. O. (2012). Access to climate change information and support services by the vulnerable groups in semi-arid Kenya for adaptive capacity development. African Crop Science Journal, 20(s2), 169–180.

Chi, T. T. N., Paris, T., Anh, T. T. T., Duy, L., & Loan, D. T. (2015). Enhancing the roles of women in rice farming as an adaptation strategy to climate change risks: A case study in submergence villages in Hau Giang province, South Vietnam. Technical Report. Hanoi, Viet Nam: Cuu Long Rice Research Institute (CLRRI).

Coffey, K., Menghestab, H., Halperin, M., Wamukoya, G., Hansen, J., Kinyangi, J., & Tesfaye Fantaye, K. (2015). Expanding the contribution of early warning to climate-resilient agricultural development in Africa. Working Paper No. 115. Copenhagen, Denmark: CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS). Retrieved from: https://cgspace.cgiar.org/handle/10568/66596

Cramer, L., Mutie, I., & Thornton, P. K. (2016). Connecting women, connecting men: How communities and organizations interact to strengthen adaptive capacity and food security in the face of climate change. Gender, Technology and Development, 20(2). Retrieved from: https://doi.org/10.1177/0971852416639771

Dankelman, I. (2010). Introduction: Exploring gender, environment, and climate change. In: I. Dankelman (Ed.), Gender and climate change: An Introduction. London: Routledge.

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter? Gender and Development, 10(2), 10–20.

Dimitra Project. (2013). Dimitra community listeners' clubs and poverty reduction, a forum to share results. Dimitra Newsletter 24. Rome: FAO.

Doss, C. (2011). If women hold up half the sky, how much of the world's food do they produce? Rome: FAO.

Duong, T. M., Smith, A., Le, T. T., Simelton, E., & Coulier, M. (2017). Gender-differences in agro-climate information services. Copenhagen, Denmark: CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS).

Emmanuel, D., Owusu-Sekyere, E., Owusu, V., & Jordaan, H. (2016). Impact of agricultural extension service on adoption of chemical fertilizer: Implications for rice productivity and development in Ghana. NJAS - Wageningen Journal of Life Sciences, 79, 41–49. Retrieved from: https://doi.org/10.1016/j.njas.2016.10.002

Food and Agriculture Organization, (FAO). (2011). The state of food and agriculture 2010-2011: Women in agriculture - closing the gender gap for development. Rome: FAO.

FAO. (2017). The future of food and agriculture – Trends and challenges. Rome: FAO. Retrieved from: https://doi.org/ISBN 978-92-5-109551-5

FAO. (2016). Gender, food security and nutrition in protracted crises. Rome: FAO.

Farnworth, C. R., Hà, T. T., Sander, B. O., Wollenberg, E., Haan, N. C. De, Mcguire, S., … Mcguire, S. (2017). Incorporating gender into low-emission development: A case study from Vietnam. Gender, Technology and Development, 8524(November), 5–30. Retrieved from: https://doi.org/10.1080/09718524.2017.1385314

Grassi, F., Landberg, J., & Huyer, S. (2015). Running out of time: The reduction of women's work burden in agricultural production. Rome: FAO.

GSMA mWomen Programme. (2012). Striving and surviving: Exploring the lives of women at the base of the pyramid. Retrieved from: http://www.mwomen.org/Research/striving-surviving-exploring-the-lives-of-women-at-the-base-of-the-pyramid

Hafkin, N., & Huyer, S. (Eds). (2006). Cinderella or Cyberella: Empowering women in the knowledge society. Connecticut: Kumarian Press.

Hottle, R. (2015). Women-led agroforestry and clean cookstoves in Honduras: Field evaluation of farmer-led gender-transformative strategies for low emissions agriculture (No. 125). Copenhagen, Denmark: CGIAR Climate Change, Agriculture and Food Security Programme. Retrieved from: https://cgspace.cgiar.org/rest/bitstreams/64369/retrieve

Huyer, S., Hansen, J., Rose, A., Vaughan, C., & Huysen, T. Van. (2017). What we know about gender and rural climate services preliminary findings and guidance. Copenhagen, Denmark: CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS).

Huyer, S. (2016). Closing the gender gap in agriculture. Gender, Technology and Development, 20(2). Retrieved from: https://doi.org/10.1177/0971852416643872

Huyer, S. (2015). Is the gender gap narrowing in science and engineering? UNESCO Science Report. Paris: UNESCO.

Huyer, S. (2012). Gender mainstreaming in ICT for agriculture. Retrieved from: http://www.itu.int/ITU-D/sis/newslog/2012/11/16/

Huyer, S. & Hafkin, N. (2006). Introduction. In: N. Hafkin & S. Huyer (Eds.), Cinderella or Cyberella: Empowering women in the knowledge society. Connecticut: Kumarian Press.

IFAD. (2011). Women and rural development. Retrieved from: http://www.ifad.org/pub/factsheet/women/women_e.pdf.

IFAD. (2016). Rural Development Report 2016: Fostering inclusive rural transformation. Rome: IFAD. Retrieved from: https://www.ifad.org/documents/30600024/30604583/RDR_WEB.pdf/c734d0c4-fbb1-4507-9b4b-6c432c6f38c3

IFAD, World Bank, & FAO. (2009). Gender in agriculture sourcebook. Washington, DC: World Bank.

IPCC. (2014). Summary for policy makers. In: Intergovernmental Panel on Climate Change, Climate change 2014: Impacts, adaptation and vulnerability: Contributions of the Working Group II to the Fifth Assessment Report (1–32). Cambridge, UK, and New York: Cambridge University Press. Retrieved from: https://doi.org/10.1017/CBO9781107415379

International Telecommunications Union (ITU). (2016). Facts and Figures 2016. Geneva: ITU Retrieved from: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf.

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., et al. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Climate and Development, 8(2), 1–12. Retrieved from: https://doi.org/10.1080/17565529.2015.1050978

Kakota, T., Nyariki, D., Mkwambisi, D., & Kogi-Makau, W. (2011). Gender vulnerability to climate variability and household food insecurity. Climate and Development, 3(4), 298–309. Retrieved from: https://doi.org/10.1080/17565529.2011.627419

Kristjanson, P., Bernier, Q., Bryan, E., Ringler, C., & Meinzen-Dick, R. A. E. (2015). Uganda: Insights from Rakai. Gendered Perceptions of Climate (3), 18–21. Retrieved from: https://www.ifpri.org/publication/gender-and-climate-change-adaptation-uganda-insights-rakai

Lane, R., & McNaught, R. (2009). Building gendered approaches to adaptation in the Pacific. Gender and Development, 17(1), 67–80. https://doi.org/10.1080/13552070802696920

Manfre, C., & Nordehn, C. (2013). Exploring the promise of information and communication technologies for women farmers in Kenya. Washington DC: USAID.

Martin, B. L., & Abbott, E. (2011). Mobile phones and rural livelihoods: Diffusion, uses, and perceived impacts among farmers in Rural Uganda. Information Technology for International Development, 7(4), 17–34.

McOmber, C., Panikowski, A., McKune, S., Bartels, W., & Russo S. (2013). Investigating climate information services through a gendered lens. CCAFS Working Paper no. 42. Retrieved from: http://hdl.handle.net/10568/27887

Meinzen-Dick, R. Quisumbing, A., Behrman, J., Biermayr-Jenzano, P., Wilde, V., Noordeloos, M., Ragasa, C. & Beintema, N. (2011). Engendering Agricultural Research, Development, and Extension. Research monograph. Washington, DC: IFPRI.

Mittal, S. (2016). Role of Mobile Phone-enabled Climate Information Services in Gender-inclusive Agriculture. Gender, Technology and Development, 20(2).

Mooko, N. P. (2002). The use and awareness of women's groups as sources of information in three small villages in Botswana. South African Journal of Libraries and Information Science, 68(2), 104. Retrieved from: http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=9911812&site=ehost-live&scope=site

Ngigi, M. W., Mueller, U., & Birner, R. (2017). Gender differences in climate change adaptation strategies and participation in group-based approaches: An intra-household analysis from rural Kenya. Ecological Economics, 138, 99–108. Retrieved from: https://doi.org/10.1016/j.ecolecon.2017.03.019

Perez, C., Jones, E. M., Kristjanson, P., Cramer, L., Thornton, P. K., Forch, W., & Barahona, C. (2015). How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. Global Environmental Change, 34, 95–107. Retrieved from: https://doi.org/10.1016/j.gloenvcha.2015.06.003

Poulsen, E., Sakho, M., McKune, S., Russo, S., & Ndiaye, O. (2015). Exploring synergies between

health and climate services: Assessing the feasibility of providing climate information to women farmers through health posts in Kaffrine, Senegal. CCAFS Working Paper no. 131. Retrieved from: http://hdl.handle.net/10568/6814

Pshenichnaya, N. (2011). Bridging the gender gap in agriculture: Can agricultural VAS address the issue? Retrieved from: http://www.gsma.com/mobilefordevelopment/bridging-the- gender-gap-in-agriculture-can-technology-address-the-issue

Roncoli, C., Jost, C., Kirchen, P., Sanon, M., & Al, E. (2011). From accessing to assessing forecasts: An end-to-end study of participatory climate forecast dissemination in Burkina Faso (West Africa). Climatic Change, 92, 433–460.

Sebstad, J., & C. Manfre. (2011). Behavior change perspectives on gender and value chain development: A framework for analysis and implementation. FIELD Report 12. Washington DC: FHI 360. Retrieved from: https://www.microlinks. org/sites/microlinks/files/resource/files/FIELD%20 Report%20No%20 12_Gender%20and%20Behavior%20 Change%20 Framework.pdf.

Sterling, R., & Huyer, S. (2010). 89.1 FM: The Place for Development: Power shifts and participatory spaces in ICTD. The Journal of Community Informatics. Retrieved from: http://www.ci-journal.net/index.php/ciej/article/view/637/461

Tall, A., Hansen, J., Jay, A., Campbell, B., Kinyangi, J., Aggarwal, P. K., & Zougmoré, R. (2014a). Scaling up climate services for farmers: Mission Possible. Learning from good practice in Africa and South Asia (Report No. 13). Copenhagen, Denmark: CGIAR Climate Change, Agriculture and Food Security Programme. Retrieved from: https://doi.org/CCAFS Report No. 13

Tall, A., Kristjanson, P., Chaudhury, M., & Mckune, S. (2014b). Who gets the information? Gender, power and equity considerations in the design of climate services for farmers. Copenhagen, Denmark: CGIAR Climate Change, Agriculture and Food Security Programme.

UNDP. (2010). Gender, climate change and community-based adaptation. New York.

United Nations. (2010). The World's Women 2010. New York: United Nations.

United Nations. (2015). The World's Women 2015. New York: United Nations, Department of Economic and Social Affairs, Statistics Division.

Venkatasubramanian, K., Tall, A., Hansen, J., & Aggarwal, P. (2014). Assessment of India's integrated agro-meteorological advisory service from a farmer perspective. Copenhagen, Denmark. Retrieved from: https://doi.org/10.2139/ssrn.701181

Vincent, K., Cull, T., & Freeland, N. (2009, February 1). Ever Upwardly Mobile: How do Cell Phones Benefit Vulnerable People? Lessons from Farming Cooperatives in Lesotho. The Digital and Development Network. Retrieved from: http://www.comminit.com/ict-4-development/content/ever-upwardly-mobile-how-do-cell-phones-benefit-vulnerable-people-lessons-farming-cooper.

World Bank. (2015). Supporting Women's Agro-enterprises in Africa with ICT: A Feasibility Study in Zambia and Kenya. Retrieved from: http://documents.worldbank.org/curated/en/2015/02/23989243/supporting-womens- agro-enterprises-africa-ict-feasibility-study-zambia- kenya.


planet
HATHWAY