OPEN ACCESS Int. J. Agr. Ext. 09 (03) 2021. 559-566 DOI: 10.33687/ijae.009.03.3687

Check for updates

Available Online at EScience Press

International Journal of Agricultural Extension

ISSN: 2311-6110 (Online), 2311-8547 (Print)

https://esciencepress.net/journals/IJAE

DIGITAL AGRICULTURE THROUGH EXTENSION ADVISORY SERVICES- IS IT GENDER-RESPONSIVE? A REVIEW

Sapna Jarial, Sharad Sachan*

Department of Agricultural Economics and Extension, School of Agriculture, Lovely Professional University, Phagwara, Punjab-India.

ARTICLE INFO

Article History

Received: May 22, 2021

Revised: September 12, 2021

Accepted: October 20, 2021

Keywords

Digital agriculture

Extension Advisory Services,

Gender

ABSTRACT

Despite the global recognition of digital agriculture discourse entering into social sciences like Agricultural Extension and even with close links between Extension Advisory Services, the implications of these interlinkages for women farmers are under-explored. This paper seeks to fill this gap. Agritech 5.0 technologies, drones, unmanned vehicles, and internet of things applications overcome unsustainable agriculture practices through precision. Sustainable agriculture requires policy, technology and people. Presently Extension Advisory Services are gender unresponsive. Unprepared farmers, especially women, may struggle to adapt to digital agriculture; therefore, a gender-responsive approach is must for such an innovation. This entails genderize extension tools, update professional competence through retraining of women as technology teachers, tap unutilised expert knowledge, include women in app designs etc. Thus, a paradigm shift is required in agricultural planning, policy, and management. In addition, multistakeholder partnership and collaboration is necessary between government and private sector. Besides, responsible research and innovation (RRI) approach is required to address ethical concerns in digital agriculture.

Corresponding Author: Sharad Sachan

Email: sharad.19461@lpu.co.in

INTRODUCTION

Women work in India's agriculture and allied sectors and are considered the backbone of Indian agriculture. Women make up most farmworkers (Singh *et al.*, 2013). Agriculture employs 73% of women and 55% of men in rural India and women farmers have long been ignored by policymakers and law enforcement. They account for an estimated 60 per cent of the workers in livestock production and 32 per cent of the 13.5 million employed in aquaculture (Agarwal, 2021).

In most activities, rural women's collaborative participation with men was higher than women's autonomous participation (CIWA, 2019). However, the interstate disparity is observed in the role of rural women and their involvement in agricultural and other economic activities. Corona virus epidemic, climate change and conflict have increased poverty between 119 to 124 million people in 2020 (UNDP, 2021). The pandemic has harmed the livelihoods of young male and female workers, who are already more likely to be poor. Therefore, the UNDP's Sustainable Development Goals (SDGs), including Goal 5 of gender equality, fall short of their 2030 targets.

Globally, the need for smart agriculture emerges because 70% of the farming time is spent monitoring and understanding crop statuses rather than doing actual

field operations (Navulur *et al.*, 2017). Food and Agriculture Organization in 2011 reported that in developing nations, agriculture yields might be 20-30% higher if women farmers had equal access to land and other inputs as males. Women are not acknowledged as farmers despite their contribution (Jarial and Mehta-Bhatt, 2013). Due to lack of knowledge, the present generation abandons farming to the non-farm sector (Chand *et al.*, 2018; UNDP, 2021) but the trend is reversed because of the current pandemic (Mamgain, 2021). Women and men farmers face multiple problems ranging from unavailability of finance, climatic uncertainty, poor soils, insect pest and disease infestation, and unpredictable yields. Therefore, with insufficient technical agriculture and allied sectors knowledge, they perform unsustainable agricultural farming. Thus, digital agriculture could be a solution for sustainable agriculture.

Digital technologies span from 'low-tech' tools like mobile phones and computers to 'high-tech' solutions like Blockchain, Internet of Things (IoT), Artificial Intelligence, and Big data. Digital technologies can assist small farmers in improving agricultural productivity and earnings if they are effectively targeted to facilitate agriculture as a "road out of poverty" (Florey *et al.*, 2020). Gender role and relationships in agriculture are different, women and men often have different information needs and preferences (Mittal *et al.*, 2021). Agri-digitalization has now reached social science (Klerkx *et al.*, 2019) for example, in Agricultural Extension. Agricultural Extension Education and Research is also known as Extension Advisory Services (EAS), where numerous stakeholders engage with different interests and spaces (Klerkx, 2021) and gender in agriculture is such a space. Till date, studies are found on topics such as adoption and adaptation of technologies, farm labour, privacy, and ethical issues in digital agriculture. The focus of digital farming is on production and efficiency, excluding key actors such as citizens and consumers (Eastwood *et al.*, 2017) and gender concern is no exception. Gender responsiveness implies not only identifying and recognizing gender concerns and inequalities in agriculture but also purposefully addressing gender norms, roles, and relations for women empowerment. Digital technologies are typically linked to agriculture and future rural sustainability. As digital transformation process influences economic, environmental, social, technological, and institutional elements and relationships (Rijswijk *et al.*, 2021). Yet, topics such as gender responsive digital extension advisory services, suggest a dearth of literature in such space. With this backdrop, the present article is an exploratory review for the topic “Digital Agriculture through Extension Advisory Services- Is it gender-responsive? The research questions were:

1. What is status of women in Extension advisory services.
2. Is Digital Extension Advisory Services gender-responsive?
3. How to make Digital EAS Gender Responsive?

Keywords were searched in Mendeley search engines, Google scholar, Publons, Francis and Taylor Journals.

Status of women in Extension Advisory Services

Even though to improve gender equality in rural development, the Indian government selected 2001 as "Women's Empowerment Year" (Munjal *et al.*, 2012), little has changed for women in India despite decades of planning. Most women are unemployed, poor, overworked, and underpaid (Baby, 2014). Economic and social inequality continue to persist, males have been dominant in private property, state, and agriculture (Omvedt, 1986). However, despite its success in boosting cumulative food supply, the Green Revolution did not inevitably help the rural poor, especially women (Sharma, 2012). Gender issues in EAS became apparent in the early 1980s after green revolution era. Later, it became clear that EAS would have to address the different demands of men and women while avoiding further deepening of gender divide (Jafry and Sulaiman V, 2013).

Women collectives help women to acquire more freedom while minimising gender discrimination at the household level (Balanarayanan *et al.*, 2011; Thaker and Dutta, 2016; Sati and Juyal, 2008). Yet these collectives are only supported for leadership with no additional development opportunities available for males; women confront participation difficulties in mixed-gender cooperatives (Dohmwirth and Hanisch, 2017). Unemployment rates for rural women are higher in underdeveloped states like Odisha (Savath *et al.*, 2014). In contrast, in Minakuppam, Tamil Nadu, fisherwomen have more power. They are more active than Indian farming villages because they participate in economic production, despite the low status of fishing occupations

in society (Norr and Norr, 1992). In India, however, the EAS coverage and the relevance of extension advice is inadequate.

Traditional farming practices are weather resistant but offer low yields (Pankaj *et al.*, 2020). As a result, male outmigration occurs, women have a vital part in local natural resource management, but they lack economic and political power (Ogra and Badola, 2015). Evidence of feminization in grapes farm and agro-processing job networks demonstrated gender distinction and discrimination as well as the gendering of duties (Singh *et al.*, 2013). Additionally, inequality is further fuelled when resources are unavailable to class, caste, gender, and ethno-social identities (Karthick and Madheswaran, 2018). Female workers were likewise the most casualized (Chand *et al.*, 2018). An effective strategy to improve access to knowledge, women's empowerment in agriculture, agricultural practises, and production diversity may be through women's self-help groups (SHGs). However, due to financial restrictions, social conventions, and women's family responsibilities, SHG has a limited impact on agricultural practices or outcomes (Raghunathan *et al.*, 2019).

Is Digital Extension Advisory Services gender-responsive?

Evidence suggests that digital EAS are gender unresponsive with sporadic cases of success. With low literacy, limited knowledge, and little training, women's contributions to Indian agriculture and household subsistence are unrecognised (Majumder and Shah, 2017).

Gender equality is critical for agricultural development and food security. To defeat hunger and extreme poverty, we must encourage women's empowerment in agriculture (FAO, 2011). When it comes to digitalization in agriculture, there is a lot of literature in the natural and technical sciences (Big data, internet of things, augmented reality, robotics, sensors, 3D printing, system integration, ubiquitous connectivity, artificial intelligence, among others; social scientists have recently begun studying digital agriculture concerning farm production systems, value networks, and food systems (Klerkx *et al.*, 2019). IoT has the potential to revolutionise agriculture in various ways. IoT and big data can boost productivity. Smart sensors can measure weather conditions, crop development progress, soil quality, and even livestock health with IoT (Naresh *et al.*, 2021). The fast expansion of the Internet, diffusion of personal mobile and IoT devices, and interactions between human users and their mobile devices push towards convergence of cyber-physical convergence and actions in one impacts immediately the other (Conti and Passarella, 2018). According to data from 66 countries from 2016 to 2018, mobile phone ownership among women was 6.8 percentage points lower than men (UNDP, 2021). Like India, in Kenya too, mobile apps are increasingly being used to answer development challenges worldwide. The development opportunities that apps offer is wide-reaching, but the technology's uptake varies (Ochilo *et al.*, 2019). In India, in 2019, 69% of rural internet users were men, while only 35% were women in comparison, 40% of urban female internet users and 60% of urban male internet users (Keelery, 2020). Clearly indicating gap in rural women technology access. Women in agriculture are based in rural setting. As in India, digital divide exists on the basis of rural or urban and gender context. This is further widened by skills gap and the gap in access to digital technology. Although, farming investors are convinced that data is the new cash crop (Tatge, 2016; Fraser, 2021). Yet data is not food, considering when one-seventh of India's population is hungry, India chases smart devices (FAO, 2020). And the key to raising production is expanding farmers' access to information, promoting more diverse crops, and improved cultivation practices are a must to a thriving agricultural extension (Raghunathan *et al.*, 2019). Digital transformation is a systemic change since it impacts how people, things, and organisations coordinate their activities (Klerkx and Rose, 2020). Misunderstanding of gender differences leads to poor project planning and design, the persistence of gender disparities, and lower returns on investment. Despite this, women farmers are rarely targeted in EAS (Mittal *et al.*, 2021).

Organization such as Digital Green have pioneered, tested and successfully scaled their video-enabled approach to women farmers in agricultural extension, Srijan a NGO is using CropIn apps on agriculture data collection where women collaborate as data collector, and SEWA in India are increasingly using Information and Communication Technologies (ICT) tools for market price information. But this is far from usual, and many extension systems continue to suffer (Barber *et al.*, 2018) to reach farmers. In India, ICT-based models have two goals: commercial, profitable expansion, and rural

welfare (Tiwari, 2008). ICT includes radio, television programmes, short message service (SMS), the Internet, new mobile technology for information. Women farmers in rural India reported utilising ICTs to care for sick animals and learn about current food prices (Jain *et al.*, 2012). Gender bias appears in both the content and delivery of digital EAS. When technologies are developed for women, men who do not grasp the importance or benefits of these technologies do not help their wives/sisters/mothers embrace these technologies (GFRAS, 2016). When technologies and development solutions are built and articulated, it is critical to understand women's responsibilities, needs, ambitions, obstacles, and opportunities (Mittal *et al.*, 2021). Women's increased participation in farm family technology adoption decisions is an essential measure of gender empowerment in agriculture (Aryal *et al.*, 2020). Social media platforms like YouTube, Facebook is also in use for delivering information related to agriculture and allied sectors.

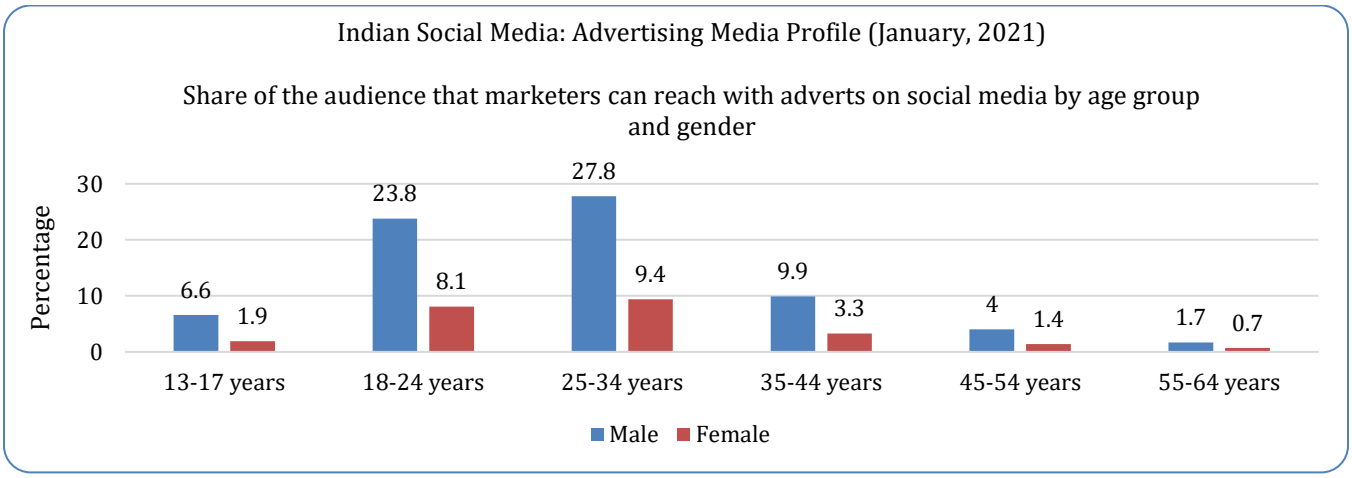

Figure 1. Advertising audience profile and gender. (Data portal, 2021)

Innovations of smart farming (Conti and Passarella, 2018) reveals a new facet of the reality of social and rural life for Agri tech companies. Ag Tech firms' products will be women and men farmers (Zuboff *et al.*, 2019) based on surveillance capitalism. As a result, scholars are advising for a responsible research and innovation (RRI) approach to address ethical problems, (Eastwood *et al.*, 2017) in digital transformation of agriculture using four main principles: "anticipation, inclusion, responsiveness and reflexivity" (Rijswijk *et al.*, 2021). As digital agricultural technology will be used by young women and men future farmers interested in agriculture.

How to make Digital EAS Gender Responsive?

Farmers' social status may improve when young educated men and women choose to farm using digital technology to be certain in risky agriculture profession. For digital agriculture to deliver on its promise, it is critical not only to design digital agriculture interventions that consider the target populations' needs, constraints, and appropriateness but also to ensure that digital technologies do not exacerbate social and economic inequalities (Florey *et al.*, 2020) to women farmers.

Extension providers must be up-to-date on the latest tools, assess and select the best ones for their conditions and context. To genderize extension tools, one must learn to 'see' people, technologies, and circumstances differently, known as using a gender lens. Once EAS providers understand the peculiarities of Gender Analysis, they can apply it to the instruments they utilise to offer extension programmes (Mittal *et al.*, 2021). Extension renders socio-political factors, but a humanized extension may more successfully support farmers (Cook *et al.*, 2021). Agriculture's digital transformation will alter agricultural and societal processes, render some skills obsolete, and necessitate retraining (Rijswijk *et al.*, 2021). Automation may lead to worker deskilling marginalisation, and unemployment and women farmers will be worst affected. Retraining rural women as technology teachers and information producers are a crucial (Munjal *et al.*, 2012) step in this direction.

Farmers and advisors face new connections, skills, arrangements, approaches, and gadgets required to realise value from digital tools and services (Ayre *et al.*, 2019). Therefore, gender-based digital new extension advisory roles are not straightforward to create or adapt. Therefore, training need assessments should be done followed by updating and training professional competence. Furthermore, agricultural extension service delivery should be boosted through timely recruitment, and provision of adequate logistics (Danso-Abbeam *et al.*, 2018). Also, experts' knowledge is underutilised in digital agriculture (Eastwood *et al.*, 2017) thus more efforts needed to tap such resources.

Because gender and age influence agricultural extension agents' use of technology. The positive impact of incorporating women's needs and constraints in the design of the agricultural extension system can make EAS gender-responsive; however, it still is unable to reduce the pre-existing gender gap of farming outcomes (Buehren *et al.*, 2019). As individualistic, digital technology can cater to distinct farmer information needs (Janc *et al.*, 2019), whether men or women. Involving app users, especially women farmers, in the design process improves usability in the agricultural industry (Ochilo *et al.*, 2019). Rural women's access to technical information should be enhanced through training tailored to their needs (Munjal *et al.*, 2012).

Inclusion of women needs in several types of media is a must, (for example, written, audio-visual) through different forms such as ICT kiosks, information centres, messages through mobile phones (Klerkx, 2021). Comics can be used to promote local awareness and comprehension. This, however, necessitates those artistic details utilised to aid farmers in adopting a point-of-view inside the comic plot be used with care (Stenchly *et al.*, 2019). Women perspectives should be taken into consideration. Men and women farmers apply ideas from one environment to another through video communications (Van Campenhout *et al.*, 2017). Women in agriculture can play an enabler of change role through a content provider in social media platforms.

Thus, Gender-sensitive digital EAS necessitate a major shift in programme design and delivery. Sustainable agriculture requires policy, technology and people. Unprepared farmers, especially women, may struggle to adapt to IoT in agriculture; therefore, a gender-responsive approach is a must for such an innovation. This represents a paradigm shift in agricultural planning, policy, and management. Gender-responsive agriculture planning and management are required with equal access to agricultural technology. Government and private sector partnerships, as well as other agricultural institutions, must work together. Thus, a gender-responsive EAS is required in strengthening women preparedness to participate in future agriculture.

CONCLUSION

Utilizing digital technology in agriculture with the IoT can bring precision in agricultural practices thereby leading to sustainable agriculture. Sustainable agriculture requires three pillars of technology, people and institutions. If the farmers are unprepared, especially women farmers food security cannot be realised. Presently EAS in digital technology is gender unresponsive withs sporadic cases of success which are driven by private players like Digital green, Srijan and SWEA.

Efforts are required to create gender responsive extension advisory services that includes access to technology, training, gender-based apps. EAS and its stakeholders like government and private organisations needs to acknowledge women's importance in agriculture. Digital agriculture-based EAS must align its strategy for incorporating gender into their actions. Further, more studies are required to address ethical concerns in digital agriculture using responsible research and innovation (RRI) approach.

REFERENCES

Agarwal, B. 2021. The Invisible Farmers. Outlook India https://magazine.outlookindia.com/story/india-news-the-invisible-farmers/304184. Place Published.

Aryal, J. P., C. R. Farnworth, R. Khurana, S. Ray, T. B. Sapkota and D. B. Rahut. 2020. Does women's participation in agricultural technology adoption decisions affect the adoption of climate-smart agriculture? Insights from Indo-Gangetic Plains of India. Review of Development Economics.

Ayre, M., V. Mc Collum, W. Waters, P. Samson, A. Curro, R. Nettle, J.-A. Paschen, B. King and N. Reichelt. 2019. Supporting and practising digital innovation with advisers in smart farming. NJAS - Wageningen Journal of Life Sciences, 90-91: 100302.

Baby, D. 2014. Plight of women agricultural labourers in Vallakulam Panchayat, Sivagangai District. Online International Interdisciplinary Research Journal, 4: 93-98.

Balanarayanan, S., K. Kalaichandran and K. Vetrivel. 2011. Women empowerment through shgs in Tamil Nadu: A case study. International Journal of Business Economics and Management Research, 2: 131-41.

Barber, J., E. Mangnus and V. Bitzer. 2018. Harnessing ICT for agricultural extension. Europe, 91: 31.5.

Buehren, N., M. Goldstein, E. Molina and J. Vaillant. 2019. The impact of strengthening agricultural extension services on women farmers: Evidence from Ethiopia. Agricultural Economics, 50: 407-19.

Chand, P., S. Rao, S. P. Subash and L. Malangmeih. 2018. Non-Farm Employment and Implication on Agriculture Sector in Rural India. Indian Journal of Economics and Development, 14: 287.

CIWA. 2019. CIWA-Vision 2050.pdf - Google Drive. https://www.drive.google.com/file/d/18H7Xie-OtzVD1igP3Ucq5bl6coQnF8mZ/view. Place Published.

Conti, M. and A. Passarella. 2018. The Internet of People: A human and data-centric paradigm for the Next Generation Internet. Computer Communications, 131: 51-65.

Cook, B. R., P. Satizábal and J. Curnow. 2021. Humanising agricultural extension: A review. World Development, 140: 105337.

Danso-Abbeam, G., D. S. Ehiakpor and R. Aidoo. 2018. Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. Agriculture & Food Security, 7.

Dohmwirth, C. and M. Hanisch. 2017. Women and collective action: lessons from the Indian dairy cooperative sector. Community Development Journal: 1-19.

Eastwood, C., L. Klerkx, M. Ayre and B. Dela Rue. 2017. Managing Socio-Ethical Challenges in the Development of Smart Farming: From a Fragmented to a Comprehensive Approach for Responsible Research and Innovation. Journal of Agricultural and Environmental Ethics, 32: 741-68.

FAO. 2011. The role of women in agriculture. ESA Working Paper No. 11-02, March 2011. Agricultural Development Economics Division. Rome: The Food and Agriculture Organization of the United Nations. Place Published.

———. 2020. Realizing the potential of digitalization to improve the agri-food system: proposing a new International Digital Council for Food and Agriculture. A concept note. Rome. http://www.fao.org/3/ca7485en/ca7485en.pdf . Place Published.

Florey, C., J. Hellin and J. Balié. 2020. Digital agriculture and pathways out of poverty: the need for appropriate design, targeting, and scaling. Enterprise Development and Microfinance, 31: 126-40.

Fraser, A. 2021. 'You can't eat data'?: Moving beyond the misconfigured innovations of smart farming. Journal of Rural Studies.

GFRAS. 2016. Module 12: Gender in Extension and Advisory Services. This module was developed as a part of the New Extensionist Learning Kit. Available at http://www.g-fras.org/fr/652-the-new-extensionistcore- competencies-for-individuals.html. Place Published.

Jafry, T. and R. Sulaiman V. 2013. Gender-Sensitive Approaches to Extension Programme Design. The Journal of Agricultural Education and Extension, 19: 469-85.

Jain, R., U. R. Ahuja and A. Kumar. 2012. ICTs and farm women: Access, use and impact. Indian Journal of Agricultural Economics, 67: 385-94.

Janc, K., K. Czapiewski and M. Wójcik. 2019. In the starting blocks for smart agriculture: The internet as a source of knowledge in transitional agriculture. NJAS - Wageningen Journal of Life Sciences, 90-91: 100309.

Jarial, S. and P. Mehta-Bhatt. 2013. Reminding women's contribution in livestock sector. Agriculture Today.

Karthick, V. and S. Madheswaran. 2018. Access to Formal Credit in the Indian Agriculture: Does Caste matter? Journal of Social Inclusion Studies, 4: 169-95.

Keelery, S. 2020. India - number of internet users by region 2017-2020. Statista. https://www.statista.com/statistics/751060/number-of-internet-users-by-region-india/. Place Published.

Klerkx, L. 2021. Digital and virtual spaces as sites of extension and advisory services research: social media, gaming, and digitally integrated and augmented advice. The Journal of Agricultural Education and Extension, 27: 277-86.

Klerkx, L., E. Jakku and P. Labarthe. 2019. A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda. NJAS - Wageningen Journal of Life Sciences, 90-91: 100315.

Klerkx, L. and D. Rose. 2020. Dealing with the game-changing technologies of Agriculture 4.0: How do we manage diversity and responsibility in food system transition pathways? Global Food Security, 24: 100347.

Majumder, J. and P. Shah. 2017. Mapping the Role of Women in Indian Agriculture. Annals of Anthropological Practice, 41: 46-54.

Mamgain, R. P. 2021. Understanding labour market disruptions and job losses amidst COVID-19. Journal of Social and Economic Development.

Mittal, N., R. Puskur, R. Sulaiman V and O. VT. 2021. Training-Module-on-Designing-and-Delivering-Gender-Responsive Extension Advisory Services. Place Published.

Munjal, S., A. Sharma, P. Kataria and M. Kumar. 2012. Women empowerment through it enabled services. International Journal of Business Economics and Management Research, 3: 1-8.

Naresh, R. K., P. K. Singh, A. K. Lalit Kumar and M. S. C. Shivangi. 2021. Role of IoT Technology in Agriculture for Reshaping the Future of Farming in India: A Review. International Journal of Current Microbiology and Applied Sciences, 10: 439-51.

Navulur, S., A. S. C. S. Sastry and M. N. Giri Prasad. 2017. Agricultural Management through Wireless Sensors and Internet of Things. International Journal of Electrical and Computer Engineering (IJECE), 7: 3492.

Norr, J. L. and K. F. Norr. 1992. Women's status in peasant-level fishing. Society & Natural Resources, 5: 149-63.

Ochilo, W. N., H. Ruffhead, A. Rumsey, F. Chege, C. Lusweti, M. Oronje and W. Otieno. 2019. Can You Ensure that ICT for Development Apps Are Downloaded and Used? A Case Study of the Plantwise Data Collection App for Plant Health in Kenya. Journal of Agricultural & Food Information, 20: 237-53.

Ogra, M. V. and R. Badola. 2015. Gender and climate change in the Indian Himalayas: global threats, local vulnerabilities, and livelihood diversification at the Nanda Devi Biosphere Reserve. Earth System Dynamics, 6: 505-23.

Omvedt, G. 1986. "Patriarchy:" the Analysis of Women's Oppression. Insurgent Sociologist, 13: 30-50.

Pankaj, P. K., M. K. Gaur, G. Nirmala, V. Maruthi, Pushpanjali, J. Samuel and K. S. Reddy. 2020. Diversification and Land Use Management Practices for Food and Nutritional Security Under the Climate Change Scenario in Arid and Semi-arid Regions of India. Springer International Publishing. Place Published. pp.281-309.

Raghunathan, K., S. Kannan and A. R. Quisumbing. 2019. Can women's self-help groups improve access to information, decision-making, and agricultural practices? The Indian case. Agricultural economics (Amsterdam, Netherlands), 50: 567-80.

Rijswijk, K., L. Klerkx, M. Bacco, F. Bartolini, E. Bulten, L. Debruyne, J. Dessein, I. Scotti and G. Brunori. 2021. Digital transformation of agriculture and rural areas: A socio-cyber-physical system framework to support responsibilisation. Journal of Rural Studies, 85: 79-90.

Sati, M. C. and R. P. Juyal. 2008. A Gender Approach to Sustainable Rural Development of Mountains. Mountain Research and Development, 28: 8-12.

Savath, V., D. Fletschner, A. Peterman and F. Santos. 2014. Land, Assets, and Livelihoods: Gendered Analysis of Evidence from Odisha State in India. SSRN Electronic Journal.

Sharma, A. 2012. Feminism in agriculture: A study of gender bias in Indian agriculture. YKA. Available at https://www.youthkiawaaz.com/2012/07/feminismin-agriculture-a-study-on-gender-bias-in-indianagriculture/. Place Published.

Singh, K. M., M. S. Meena, A. Kumar and R. K. P. Singh. 2013. An Overview of Gender Issues in Agriculture. SSRN Electronic Journal.

Stenchly, K., T. Feldt, D. Weiss, J. N. Andriamparany and A. Buerkert. 2019. The explanatory power of

silent comics: An assessment in the context of knowledge transfer and agricultural extension to rural communities in southwestern Madagascar. PloS one, 14: e0217843-e43.

Tatge, J. 2016. Data is the New Cash Crop: Understanding the Market for Farm Data. The Dirt.

Thaker, J. and M. Dutta. 2016. Millet in Our Own Voices: A Culturally-Centred Articulation of Alternative Development by DDS Women Farmers' Sanghams. Springer Singapore. Place Published. pp.131-44.

Tiwari, S. P. 2008. Information and communication technology initiatives for knowledge sharing in agriculture. Indian journal of agricultural science, 78: 737-47.

UNDP. 2021. Progress towards the Sustainable Development Goals. https://unstats.un.org/sdgs/. Place Published.

Van Campenhout, B., S. Vandevelde, W. Walukano and P. Van Asten. 2017. Agricultural Extension Messages Using Video on Portable Devices Increased Knowledge about Seed Selection, Storage and Handling among Smallholder Potato Farmers in Southwestern Uganda. PloS one, 12: e0169557-e57.

Zuboff, S., N. Möllers, D. Murakami Wood and D. Lyon. 2019. Surveillance Capitalism: An Interview with Shoshana Zuboff. Surveillance & Society, 17: 257-66.