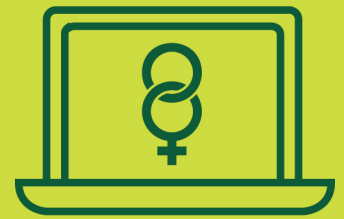




APEC GIFTS A⁺



Policy Toolkit on Promoting Gender Inclusion in Smart Agriculture

Policy Partnership on Women and the Economy





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Why a Policy Toolkit?

This paper will show that women's economic empowerment is critical to inclusive growth. The female share of agricultural labor force in Eastern and Southeastern Asia is around 50 percent (FAO, 2010). Smart agriculture which is defined as utilizing new technology in agricultural production to reduce the labor burden of women in agriculture. Smart agriculture will improve women's access to productive resources, financial capital, information, as well as market opportunities outside their locality.

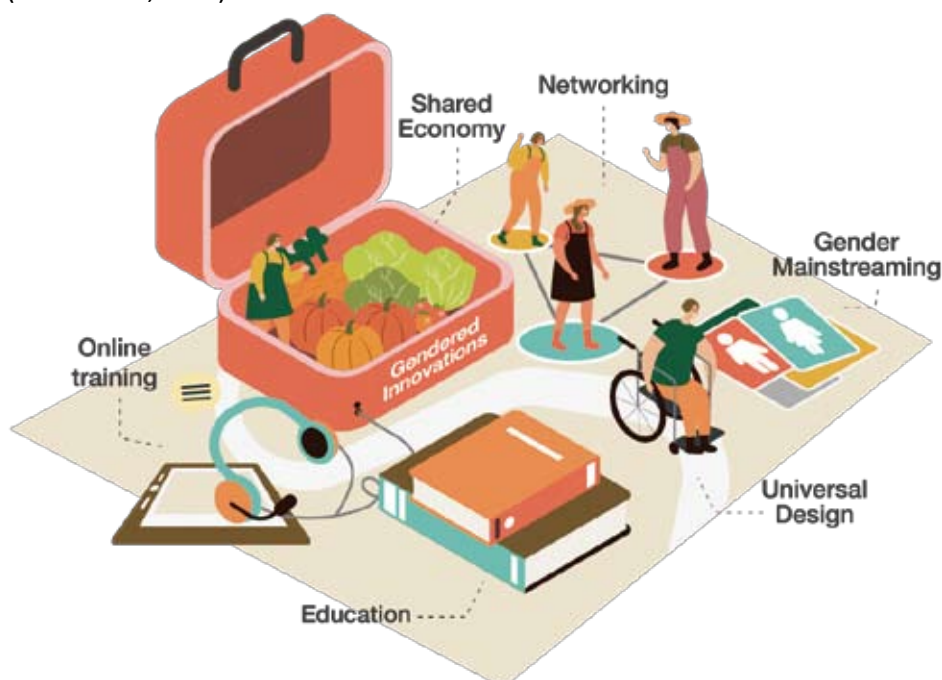
This policy toolkit has been created to encourage more women to participate in and to address the digital divide within the smart agricultural industry, which will allow public and private sector decision makers to utilize gendered innovation approaches to create an enabling environment for women.

Smart agriculture can also assist governments through digital platforms to gather data so that public services can be delivered more effectively to poor, marginalized, or geographically-isolated women. However, technical innovations are not always designed with women's needs in mind.

Whether smart agriculture reduces occupational segregation and income differences, or whether it instead creates a digital divide that exacerbates existing inequalities, will depend on policies and institutional changes governments make today. (FAO, 2010).

"New Thinking" is needed in the agricultural sector to encourage women's utilization of agricultural technology as well as their participation in green economies.

Smart agriculture can create innovative jobs and provide a more flexible environment for women to join the workforce (World Bank, 2009).



Linkage between Gendered Innovations and Smart Agriculture

What is Gendered Innovations?

Women play a vital part in the world economy and women's economic empowerment is an essential element in building a more inclusive society. The Organization of Economic Cooperation and Development (2004) found that, depending on which economy is studied, between 15 percent to more than 35 percent of business owners are women.

A more recent study by McKinsey (2015) found that closing the gender gap could add at least USD 12 trillion to the global GDP by 2025. It is therefore crucial to bridge the existing gaps by using digital tools which can be helpful in enabling more women to enter the global value chain and to join the global economy. However, many barriers persist to women's full economic participation. Addressing these barriers can have a tremendous social and economic impact.

To reduce the missed-opportunities for women and society as a whole, sex and gender analysis must be considered as a key method of policy making. **Gendered Innovations** is a research approach that harnesses the creative power of sex and gender analysis for innovation and discovery (Schiebinger et al., 2011). In the field of smart agriculture, it creates new opportunities to review the social aspects of the system and to identify the root causes that are restricting women's participation.

What is Smart Agriculture?

Smart agriculture is an approach that adopts intelligent technologies, including Information and Communication Technologies (ICT) throughout the agricultural value chain from production, post-harvest handling, processing, distribution to final consumption (FAO, 2014).

Mobile devices could speed up the way farmers in rural areas obtain, exchange, and utilize information. They could also help farmers interact with markets and consumers in cities. A variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers have been developed at local, economy and regional levels. The rapid decline in prices in various components of ICT makes it feasible for governments to target at a large scale ICT penetration into rural areas.

In addition, due to global warming, weather has become unpredictable. **Smart Agriculture** is also a cost-efficient approach for sustainable and resilient agriculture in the changing climate. In Asia-Pacific region, floods, typhoons and droughts have obstructed agriculture and food industries.

A vast amount of data such as weather information, soil mapping, crop yield, and animal health has been collected as solution providers, farmers and stakeholders of the entire food system are adopting **Climate Smart Technologies**.

When Gendered Innovations* meet Smart Agriculture

Gender issues in agricultural technology adoption have been investigated for a long time. The engagement of women towards new technologies is found to be a key element for adoption to occur, along with cultural, economic, technological and institutional factors. By integrating gender perspective, there is a bigger chance to succeed in the adoption of ICTs in the agricultural value by women.

Women could also benefit from smart agriculture in the changing forms of work, and improve their employment conditions as well as quality of life within households, or even as an individual.

However, several factors hinder women's potential to utilize smart agriculture technology: (1) lack of awareness of ICT; (2) lack of financial resources to access technology; (3) lack of access to information and resources. It is necessary for us to look deeper into the root causes embedded in the legal and social environment, education system, or simply the design of smart agriculture equipment itself.

The smart agriculture industry will never be gender neutral without sufficient sex-disaggregated data and analysis that identifies the difference between men and women in the agricultural value chain. Gendered Innovation Approaches are aimed at utilizing gender analysis method to create new opportunities of reviewing the social aspects of the smart agriculture system, and to identify and address the fundamental issues that are restricting women from participating in the agricultural value chain.



* Gendered Innovations is defined as the process that integrates sex and gender analysis into all phases of basic and applied research to assure excellence and quality in outcomes. Gendered Innovations enhance excellence in science, medicine, and engineering both in terms of knowledge and personnel; they lead to gender-responsible science and technology, and seek to enhance the lives of women and men globally. (Interdisciplinary Approaches to Achieving Gendered Innovations in Science, Medicine, and Engineering).

By adopting modern systems and digitized tools, less manual labor is necessary in order to carry out agricultural work. Women could therefore save more time doing productive work or can spend such saved time tending to their other roles.

Yet, while agricultural technologies are still in development, innovation must be created continuously with the effort of public, private sectors and the academies. We need to use all tools at our disposal to address this and policy must also play a role to dismantle barriers to women's participation in smart agriculture and adoption of the smart agriculture technology.

Developed and Developing Economies

In **developed economies**, smart agriculture tools are mostly used in precision farming as they play an important role in improving farming efficiency and help the farmers in increasing the crop yields.

The combined application of ICT solutions such as precision equipment, the internet of things (IoT), sensors and actuators, geo-positioning systems, big data, unmanned aerial vehicles (UAVs, drones), robotics, etc. can empower farmers with timely information about different crop varieties and their ability to withstand biotic stresses.

Yet the gender digital divide still exists, women may not have enough opportunities to reach out to the useful tools (FAO, 2019), which cost them more time on work or even restrict their participation in the advancing agriculture industry. Hence, it's critical to focus on the development of the education system, to reverse the gap by building stronger knowledge in younger generations.

In **developing economies**, women smallholder farmers face tradeoffs every day because of a lack of resources, financial credit, and other social and familial commitments. ICTs may transform agriculture by facilitating more access to markets and to problem solving information. Farmers will benefit from smart agriculture as the effectiveness of inputs such as seeds, labor and fertilizers will rise, resulting into more prospects for income.

However, many of these technological opportunities have not yet been realized. It is necessary that the governments invest in infrastructure to realize the modernization and industrialization of agriculture, and ensure the inclusion of more female farmers. The inclusion of millions of smallholder farmers in smart agriculture could also make a contribution to a reduced rural-urban divide. (Baumüller, 2017)

Policy Toolkit at a Glance

Who could benefit from the Policy Toolkit?

The primary beneficiaries are governments and policy makers in the APEC region who are planning to integrate Gendered Innovation approaches in their policies. While the Ministry of Agriculture and Women are identified as the main users of the toolkit, other Ministries (e.g., Ministry of Technology, Trade, or Economic Development) could also play a very crucial role of promoting smart agriculture with gender perspective. The toolkit can also be used as a reference to explore new approaches in project design, or to improve the enabling environment to support their actions.

The secondary beneficiaries of the toolkit are the rural and indigenous women, female farmers concerned with their productivity, and women entrepreneurs who need to maintain the viability of their agri-businesses in APEC member economies. The toolkit contains information to empower them by adopting smart technologies, which will help to build a better and more sustainable rural community.

How was the Policy Toolkit Developed?

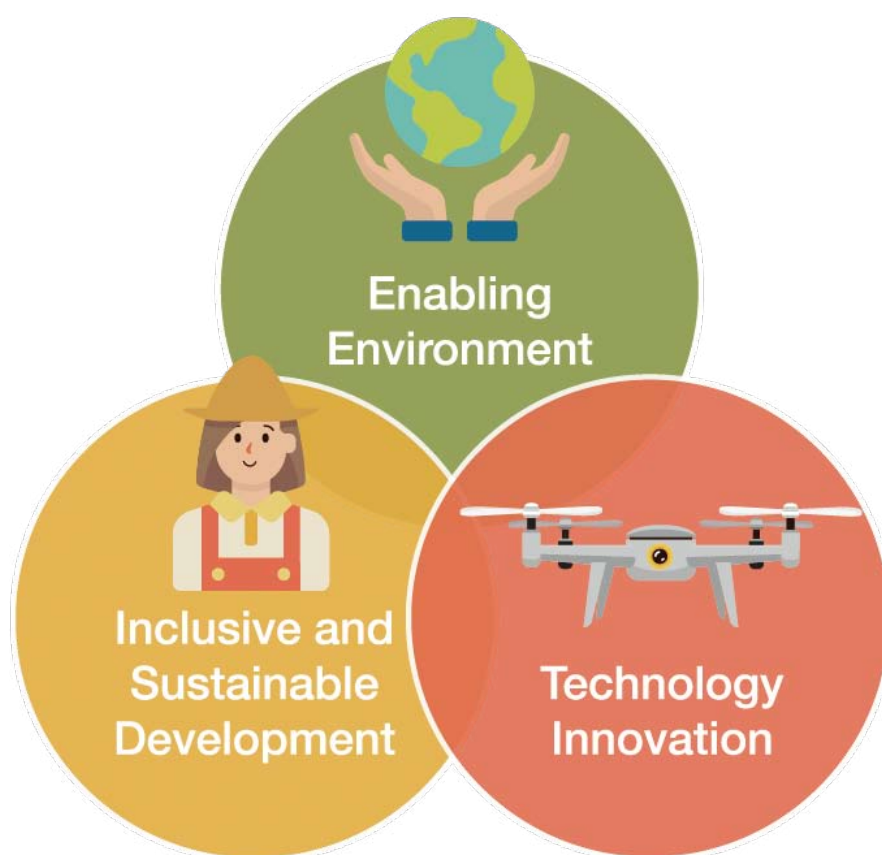
The drafting process of the policy toolkit was done through a cross-fora, cross-economy partnership with input from an experts group formed with Chile, the Philippines and Chinese Taipei. Chinese Taipei hosted a Seminar on Promoting Gendered Inclusion in Smart Agriculture on 22nd – 24th Oct., 2018 to gather ideas and suggestions from APEC economies on the challenges and opportunities women face when entering smart agriculture industry.

A set of data and practices collection was then made in cooperation with ATCWG, PPFS and PPWE economy members. Development of the policy toolkit was informed by the results of a literature review undertaken by Chinese Taipei, with APEC economies' involvement, which include Canada, Chile, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the Philippines, Thailand, United States and Vietnam.

The Policy Toolkit is organized in Three Clusters.

As we think of promoting women's participation in smart agriculture industry, several factors are affecting female farmers interactively and should be properly addressed.

The toolkit will start with the creation of an enabling environment in a smart agriculture pipeline, and then highlight the importance of inclusive and sustainable development to include the diverse communities in the APEC region, and end with harnessing our digital future by using gendered innovation approaches. In this context, APEC economies are guided to a pathway where smart agriculture is applied in the spectrum of green and inclusive agriculture.





Three Clusters

Enabling Environment

Enabling Environment

As agriculture is increasingly becoming knowledge-intensive, it is crucial for government to bridge the existing gender gaps in using smart technology tools. In reality, the type of technology that gets developed, the scientists who develop it, and the life the technology has after it is created are all embedded within a social and economic system (USAID, 2017).

Women cannot be excluded from the opportunities that smart economy offers. While people view farming as a gender neutral field, gender issues such as poor access to markets and financial services, low levels of human and physical capital, poor access to education and weak information flows, has enormously affected the way it has been developed. Relative to men, women bear greater responsibility for productive and household work and experience greater constraints on their time. A sound system must be instituted to build an enabling environment with equality de facto where each gender can fully realize their potential utilizing smart agriculture technology.

A sound system must be instituted to build an enabling environment with equality de facto where each gender can fully realize their potential utilizing smart agriculture technology.



An Enabling Environment starts with a fundamental influence of culture, on which a legal, education system and community is built. Education carries the great responsibility of providing quality STEM and ICT education to all, including women and girls.

When adopting smart agriculture technologies, it is also necessary that governments and legal systems support women or women-entrepreneurs for their specific needs, and ensure the accessibility of all the resources and information.

The cluster therefore will focus on the transformation of (1) Culture, and women's opportunities of access to (2) Quality Education, (3) Government, Legal and Policy Support, and (4) Information and Resources that could ease the burden of women's participation in smart agriculture.

Notably, APEC's goal is to encourage economic growth and prosperity of all member economies which include different levels of development. The evolution and the adoption path of smart agriculture could be different between developed and developing economies. Women in developing economies face challenges of access to transportation, infrastructure, sanitation, education, loans, and information while allocating limited resources. Hence, it is important to put emphasis on fundamental infrastructure and connectivity of female farmers. For developed economies, farmers have already adopted smart technologies, but women are still less likely than men to enter STEM profession. This could affect female farmers' opportunities to utilize the advanced tools on their farming work and might restrict their productivity. The emphasis should be on erasing the digital divide between male and female farmers.

Story of female farmer in enabling environment

In Yunlin, Jennifer Ya-Ping Hsiung, the president of Great Agriculture Co., Ltd (Chinese Taipei) with sparkle in her eyes said that “We need to break free from the restriction imposed by gender, only then can we really realize our potential and maximize productivity.”

Great Agriculture Co., Ltd is a company that owns 500 hectares of corn field. As a president of the company, Hsiung has echoed the “Agriculture 4.0” initiative launched by Council of Agriculture. She never think of her work as only “ Farming” but rather a form of “Business”, she has adopted “i-plant”, an agribusiness field management system designed by Innovation Incubation Center, Taiwan Agricultural Research Institute (Chinese Taipei) , to manage corn production. This attracts a lot of young farmers to join and try to boost productivity by using smart technology in agriculture.

Benefiting from the system, Hsiung’s employees and collaborative farmers now can not only improve their pests and diseases management greatly, but also trace the status of the soil of the whole filed more easily. The “i-plant” system helps Great Agriculture save a lot of time, labor and effort and boosts productivity, which has helped local farmers, female entrepreneur, as well as customers.

Hsiung, as an woman entrepreneur in agribusiness, not only gain great benefit from the friendly environment that enable her to join freely in smart agriculture industry, but also create an enabling environment herself, which include more young and local farmers.

(The content is provided by Chinese Taipei)



Executive Summary

Recognizing that the smart technologies are reshaping farm economies and food system in the APEC region, women cannot be excluded from the opportunities offered by the emerging technologies offer. Actions to consider include:

- Address female farmer's barriers in smart agriculture industry, such as gender stereotype, digital division or lack of access to resources and information ;
- Strengthen the capacity and funding to provide quality education and vocational training programs for enhancing the digital inclusion of women;
- Each economy may evaluate its related laws, policies and program to see if it covers the need of female farmers and develop appropriate guidance on integrating a gender-responsive perspectives;
- Ensure the information and resources from governments are available to all female farmers in accessible format.

Box1: Practice of building up role model

An example of P.13 "Need to build up role model".

In the Philippines, the Inter-agency Committee on Rural Women has published a program called Search for Outstanding Rural Women, an awards and incentive mechanism, to give due recognition to rural women who have shown excellence in their fields of endeavor, have contributed outstanding accomplishments in developing the agriculture, fishery, and natural resources sectors and made significant impact in the lives of the people in the rural areas; and to document the success stories of the awardees who showed the significance of committing to the right of individuals to food and serve as role models of women empowerment.

(The content is provided by the Philippines)

Enabling Environment

Issues	Actions	Implementers
<p>Need of family support</p> <p>Women are traditionally seen as the main person in charge of house chores. While family members fail to support female farmers on their work-related activities, burdens of unpaid care or domestic work may fall on them and restrict their opportunities on self-development.</p>	<p>Address attitudes, myths, and misperceptions (about gender stereotype in agriculture and technology industry), and other social norms that limit women's participation in smart agriculture.</p> <p>Follow the 3Rs to: (1) Reduce female farmers' burden on farming work and domestic work through technology; (2) Redistribute domestic division of labor through family-friendly policies, public services and various programs such as campaigns, workshops or public hearing; (3) Represent in official statistics the unpaid domestic work done by women and men(i.e. childcare, cooking, elderly care) through time-use surveys.</p>	<p>Ministries of Interior, Culture and Agriculture, local governments</p>
<p>Need to build up role model</p> <p>Women's potential of participating in non-traditional sectors are often underestimated by the society. Women and girls might be restricted due to the bias embedded in the society.</p> <p><i>Please see P.12 for example.</i></p>	<p>Work with civil society groups to allow women in leadership positions to share their experience of working in the agricultural sector and the barriers they face to enter.</p> <p>Cooperate with educators to increase opportunities for students to be more familiar to smart agriculture industry, by sharing the role models.</p>	<p>Ministries of Education and Labor in coordination with civil society organizations</p>
	<p>Conduct selection, award and accreditation to bring the outstanding female farmers into public spaces so that they will gain more recognition and confidence.</p>	<p>Ministry of Agriculture</p>

Culture

Quality Education

Government, legal and policy support

Information and resource

Enabling Environment

Issues	Actions	Implementers
<p>Need for quality STEM and ICT courses within education system</p> <p>Knowledge on STEM and ICT is extremely important while one is developing their career in smart agriculture. Even the educational pipeline has been improved, according to APEC Women and the Economy Dashboard, female graduates in science programs still represent less than 50 percent of graduates in 12 economies.</p>	<p>Continue regular and verifiable sex-disaggregated statistics on early education, secondary school, TVET and higher education enrolment, achievement, graduation, and progression, following the agenda of APEC Women and the Economy Dash board.</p> <p>Provide affordable and open access to STEM and ICT education to all students, such as online/ offline open courses and e-learning platform.</p> <p>Work with educators to prioritize girls' participation in STEM and ICT studies at the increasing rate and level of attainment as boys.</p> <p>Encourage girls to pursue available opportunities in calculus, physics, chemistry, computer science, and engineering.</p> <p>Support private sectors with social events and networking activities to help integrate female students into STEM and ICT education.</p> <p>Be aware of the technology trend and continuously renew the curriculum with new knowledge, e.g., AIoT, Big Data, Machine Learning and Blockchain.</p>	<p>Ministry of Education and Labor</p>

Enabling Environment

Issues	Actions	Implementers
<p>Need for renewing knowledge on utilizing digital resources</p> <p>Smart agriculture is recognized as a field with emerging technology that brings efficiency into the labor-intensive work. As the new technology being developed, innovative application could happen in smart agriculture industry. Thus, continuous training must be done after education system.</p>	<p>Design in-service training program on smart agriculture and digital resources to increase the knowledge of public servants, so as to understand the trend of the industry and equipped them to provide better consulting services.</p>	<p>Ministries of Agriculture and Technology in coordination with NGO and private sectors</p>
	<p>Recognize the critical role of community and local farmers group in empowering community members to reach out to the resources and training services from agricultural public sectors.</p> <p>Educate beneficiaries about the importance to embrace new technology and show them the business case of integrating smart farming system</p> <p>Explore methods for recognition and accreditation of smart farming skills, including big data analysis, knowledge on IoT system, smart watering system etc.</p>	<p>Ministries of Agriculture and Technology in coordination with farmers groups and associations</p>

Culture

Quality Education

Government, legal and policy support

Information and resource

Enabling Environment

Issues	Actions	Implementers
<p>Need for integrating gender perspective into smart agriculture policies</p> <p>Evidence and data are not yet available in the APEC region on addressing gender-related issues in applying smart technologies to increase agricultural productivity and reducing poverty in the rural communities.</p> <p>There is a tendency for women to not be counted in agricultural statistics when their roles are seen as mere extension of their domestic or household work. Thus, the notion that “agriculture is gender-neutral” may be partly due to the inability to collect or insufficiency of data on women and men in the various phases of the agricultural value chain.</p>	<p>Promote high level political commitment by policy makers to stimulate the progress of promoting gender inclusion in smart agriculture.</p> <p>Expand related laws (include but not limited to: agriculture, technology, succession and finance) and develop programs to cover female farmers and address the intersectional discrimination.</p> <p>Develop an appropriate guidance on integrating a gender-balanced or gender-responsive perspective into smart agriculture for project planners and business.</p> <p>Train public servants in agricultural sectors pre- and in- service of basic gender knowledge and the awareness of women’s needs in smart agriculture</p> <p>Collect sex-disaggregated data on numbers of people employed in the smart agriculture industry</p> <p>Conduct needs surveys to identify appropriate measures to accelerate women’s participation in smart agriculture</p> <p>Analyze the increase of productivity the improvement of rural livelihood caused by smart agriculture</p>	<p>Personnel administrations, Ministries of Agriculture and Technology</p>

Enabling Environment

Issues	Actions	Implementers
<p>Need for financial resources arrangements</p> <p>Without drawing attention to female farmers' needs in policy implementation plan, they may get fewer resources due to the gender bias hidden in policies.</p>	<p>Allocate governments' resources to promote women's agriculture, economic and participation and gender equality through the budget process.</p> <p>Train public servants to recognize the importance of integrating gender perspective into financial arrangements. Continuously collect sex-disaggregated data to review the budget allocation of government financial source.</p>	<p>Budget and personnel administrations, Ministry of Agriculture</p>
<p>Need for measures to improve women's access to land and natural resources if necessary</p> <p>Structural gender inequalities are still embedded in our society. Even if there is no direct discrimination in laws and regulations in agriculture and technology, women may not have equal access to and control over resources and land because of existing gender stereotypes in their families or communities.</p>	<p>Create Gender Impact Assessment system to incorporate a monitoring system in smart agricultural policy-making procedures, needs identification and objective setting, beneficiary, participation mechanism, resource assessment and result evaluation must be taken into consideration</p> <p>Draft Policy Proposal with collecting sex-disaggregated data for analysis and consulting gender and agriculture experts about integrating gender perspectives into the drafting of policy proposal.</p> <p>Build up a review system by central government to evaluate all the policies and projects. Stakeholders must be invited to the discussion. (e.g. female and local farmers must be considered in the evaluation to see the direct outcome)</p>	<p>Ministries of Agriculture and Technology</p>

Culture

Quality Education

Government, legal and policy support

Information and resource

Enabling Environment

Issues	Actions	Implementers
<p>Need to access information and resources through multiple channel</p> <p>As communication system has evolved and demassified the society, female farmers may be neglected if their habitual consuming channel wasn't considered for policy promotion.</p>	<p>Identify the target audience of the policies and projects and try to understand their usage habit and barriers through user survey or interview.</p> <p>Use the exact multichannel communications to reach out to female farmers via their preferred channel, whether it be on paper, a smartphone, laptop or other device.</p>	<p>Economy-level and local governments</p>
<p>Need to consider different needs of the audience</p> <p>With different education level and culture background, female farmers might have different habit on collecting, exchanging and utilizing information.</p>	<p>Research on and consider the various needs of female farmers with different education level and intersectional identity.</p> <p>Ensure the information and resources are available to all in accessible format, which include minority languages, sign language or simplify version.</p> <p>Equip the promoting personnel with gender awareness to provide resources without differential treatment.</p>	<p>Economy-level and local governments</p>

Enabling Environment

Issues	Actions	Implementers
<p>Need for financial services</p> <p>According to APEC Women and the Economy Dashboard, in 2015, all 21 economies reported that married women and men had equal rights to property. However, access to financial services is still highly unequal due to the geographical or gender issues, with poor people – and particularly poor women – frequently the least served by existing institutions and systems.</p> <p>Without financial services, female farmers might not be able to start their agri-business.</p>	<p>Provide financial services, including agricultural credits, loans and insurance targeted to women farmers and ensure their access to such services without discrimination by creditors on the basis of sex and/or marital status.</p> <p>Raise awareness of financial resources through educational campaigns, local farmers' communities, and various channels that are appropriate for different segments of population.</p>	<p>Ministries of Finance, Economics, Agriculture, Labor in coordination with farmers and other civil society groups</p>
<p>Need to build up networking system</p> <p>Even though women in APEC region participate equally in agriculture, according to the survey of Worldwide Study, over 60% of the respondents still said that they've faced discrimination during work. A group with common experience and shared interest might increase their retention rate.</p>	<p>Create local farmers' community where female farmers could exchange information and resources with one another.</p> <p>Create online farmers' community on social media or other internet platform to break the geography limitation.</p>	<p>Farmers groups and local agriculture governments</p>

Culture

Quality Education

Government, legal and policy support

Information and resource



Three Clusters

Inclusive and Sustainable Development



Inclusive and Sustainable Development

As technology being evolved in the past decades, opportunities of development has been brought to both developing and developed economies. Smart agriculture has been gradually adopted by the local farmers to reduce working hours and increase the productivity. Yet, if the legal system and the environment wasn't fully constructed to reflect the changes in the society, **adverse impacts might happen on people who are using the technology, especially marginalized communities with intersectional identity**. For example, inadequate information can increase the risk of adopting non-sustainable practices or planting expensive seeds that may not survive or produce poor yields.

Intersectionality is a framework for conceptualizing a person, group of people, or social problem as affected by a number of discriminations and disadvantages (YW Boston, 2017). As women are already underrepresented in the tech sector and have less access to technical tools and information, it is not unimaginable that women with intersectional identity, including rural, indigenous and young women, are disproportionately affected by the lack of resources.

Inclusive Development

- Need to identify women's specific needs
- Need of projects for women

Sustainable Development

- Need for gender-sensitive response to climate change
- Need to integrate female farmers into Climate-Smart Agriculture(CSA) Initiatives

In recent years, climate change threatens our ability to ensure global food security, eradicate poverty and achieve sustainable development (UNDP, 2019). It has both direct and indirect effects on agricultural productivity including changing rainfall patterns, drought, flooding and the geographical redistribution of pests and diseases. As ICT has been making remarkable progress in agricultural industry, it is important that we adopt smart agriculture as an approach to reduce poverty and increase food and nutrition security.

However, climate change has a greater impact on those sections of the population, in all economies, that are most reliant on natural resources for their livelihoods and/or who have the least capacity to respond to natural hazards, such as droughts, landslides, floods and hurricanes. Many people are excluded from mainstream development because of their gender, ethnicity, age, sexual orientation, disability or poverty. Women, particularly indigenous, rural, migrant, elder and young women, commonly face higher risks and greater burdens from the impacts of climate change in situations of poverty, and the majority of the world's poor are women (UNFCCC, 2019).

Inclusive and sustainable development is an approach that benefit all stakeholders - including marginalized groups - in addressing social and economic development issues. It promotes transparency and accountability, and enhances development cooperation outcomes through collaboration between civil society, governments and private sectors. This cluster provides the guidance of (1) identifying different needs of women with intersectional identity and (2) integrating gender perspective into climate-smart agriculture.



Story of female farmer in inclusive and sustainable development

In Hualien, Tipus, Xiu-lian Su said with a proud smile after breaking down the stereotypes people have seen on her, “People thought we wouldn’t succeed while we first started to establish Pangcah, and it’s because I’m an indigenous person and also a woman.”

Tipus, Xiu-lian Su is an indigenous woman from Amis tribe. She rented a follow land to set up her own organic farm after a typhoon severely damaged her tribe in 2008. The farm was named Pangcah, which represents who she is and her tribe. Su believed that if everyone was committed to organic farming, there will be less pollution and it would be better for our environment. Her farm then passed the organic certification in 2012 and has gradually expanded to 16 hectares in following years.

After the natural disaster, Su found her way to response to the mother land. It has become her mission to devote herself into organic farming. To manage such a large and organic farm, Su employs more single mothers, middle-aged women, and women with disabilities in the tribe and the working hours are suitable for these women to take care of their children. Sue’s management strategies not only help women in the tribe to have stable sources of income, but promote organic farming to more families and communities as well.

(The content is provided by Chinese Taipei)



Executive Summary

As climate change exacerbates the impacts of disasters, its effects on agricultural productivities often leads to the threats to farmers' livelihoods, especially to marginalized group of women. By mainstreaming gender in agriculture and climate change, we are not only eliminating the disproportionate vulnerability of women, rather we are also empowering them to become effective agents of change and ultimately drive the agriculture sector towards growth and development. Approaches must be taken to benefit all stakeholders to ensure inclusive and sustainable development, actions to consider include:

- Encourage APEC members to conduct sound research to identify the needs of female farmers, especially those with intersectional identity;
- Encourage public-private partnerships to design gender- and age-responsive initiatives of smart agriculture, and ensure the initiatives are accessible for the target audience;
- Increase female farmers' participation in rural and developing communities and networks to ensure they can benefit equitably by adopting smart agriculture technology;
- Work with APEC's Emergency Preparedness Working Group and promote disaster education and training programs to equip female farmers with knowledge on emergency response.

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to identify women's specific needs</p> <p>Women's specific needs are often neglected in the discussion of agricultural projects on promoting or adopting smart technologies.</p>	<p>Build up complete set of indicators to measure women's participation, position and situation in agriculture to help relevant agencies to recognize women's need more explicitly.</p> <p>Consider gender statistics as an useful tool for monitoring progress towards gender equality goals</p> <p>Set up business case for private sectors, help them see the value of gender analysis</p> <p>Engage more women in public sectors to gain a more balanced perspective in the design and implementation of laws and projects.</p>	Ministries of Agriculture, Technology, Labor and Economy
	<p>Design tailored initiatives and monitor progress towards a more equitable work place.</p> <p>Report on gender statistics to demonstrate that gender equality and women integration are viewed as a priority, which is an increasing concern among consumers.</p> <p>Promote diversity and inclusion in the workplace to access to a wider pool of talent.</p>	Private sectors (local farmer's communities, agri-businesses)

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need of projects for women</p> <p>Public-funded projects in the field of smart agriculture are often designed to be gender neutral, yet women might be excluded on account of systematic gender bias.</p>	<p>Routinely collect sex-disaggregated data and conduct gender-based research and analysis to see the fundamental difference of men and women in agriculture sector.</p> <p>Further collect data with diverse factors, including sex, gender, race, region, and financial resources etc.</p> <p>Interview women with diverse identity to collect qualitative data for more specific understanding.</p> <p>Design gender-responsive programs to equip women with skills, confidence and know-how to lead and contribute in agricultural sectors. The difference between women from different communities must be considered.</p> <p>Create multiple channels for women to easily assess the resources needed, especially by cooperating with local farmers' groups</p>	<p>Ministry of Agriculture and research institutions</p>

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to integrate young farmers</p> <p>Continuously aging of agricultural population of farmers pose a threat to the future of agriculture in Asia Pacific region, hence new and innovative concepts that draw young farmers back to the land is necessary.</p>	<p>Build the pipeline from school to agriculture industry and integrate gendered perspective into fundamental education system.</p> <p>Create real business opportunities to attract more young generations with economic niche.</p> <p>Promote the importance of research and development in developing green economy, attract young farmers with a sustainable vision.</p> <p>Assist them into market, credit and corporate insurance with smart technologies and policies.</p> <p>Held innovative events to include more young female farmers, such as Agriculture Hackathon and Creative Agriculture workshop.</p>	<p>Ministries of Agriculture, Education, Labor and Economy</p>

Box2: Practice of integrating young farmers

Korea launched the Smart Farm Expansion Policy to promote domestic and overseas market expansion by nurturing young talent, innovating technologies through joint R&D with companies, fostering upstream and downstream industries and facilitating scale-up and integration with the Smart Farm Innovation Valley at the center of the policy.

(*Smart Farm Innovation Valley: A base where farmers, businesses and research institutions create synergy through integrated smart farms, young start-ups, R&D and expanded markets.)

(The content is provided by Korea)

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to integrate women from rural and developing area</p> <p>Women continue to reap less benefits from employment in agriculture than men in rural areas, and the recent global financial and food crises have slowed down progress towards gender equality in farming-related labor</p>	<p>Understand a rural systems' context of agricultural infrastructure, services and find solutions based on local knowledge both male and female farmers' experience.</p> <p>Address women's needs specifically with qualitative and quantitative data collection and analysis method.</p> <p>Develop a gender-responsive and rural-centric framework to enable governments to make policy decision more accurate.</p> <p>Create programs to boost women's business in rural areas through enterprise development, social transformation and policy advocacy interventions.</p>	<p>Ministry of Agriculture, Local governments in cooperation with local farmers communities</p>



Box3: Practice of integrating women from rural and developing area

In least developed economies 79% of women list agriculture as their main economic activity. Women represent 43% of the agricultural labor force in developing economies yet gender differences in laws and services affect women in all region. Canada launched the Canada's Feminist International Assistance Policy with following actions to help the growth that works for everyone:

- (1) Support local woman-led agricultural businesses, including local women's cooperatives and associations, which are best placed to support food security and economic sustainability at the local level.
- (2) Encourage lending to woman entrepreneurs through Canada's Development Finance Institute.
- (3) Support training that opens up new opportunities, encourages greater entrepreneurship and gives women the financial literacy they need to succeed
- (4) Promote the importance of women's economic participation at high-level forums and other international gatherings

(The content is provided by Canada)

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to integrate Indigenous women</p> <p>Indigenous women are disproportionately affected by discrimination because of their intersectional identities that make them more disadvantaged than other groups in the society.</p>	<p>Promote the application of indigenous knowledge and practices on food production and preservation, and include women's organizations in related projects.</p> <p>Train indigenous women in farming to understand how to run trust or incorporation, and to have skills and confidence to contribute more to the business based on supportive environment.</p>	<p>Ministries of Indigenous People and Agriculture</p>

Box4: Practice of integrating indigenous women

In New Zealand, the Wāhine Māia, Wāhine Whenua (WMWW) program was established by the Agri-Women's Development Trust and is funded by the Red Meat Profit Partnership (New Zealand). The program is designed especially for whenua Māori involved in sheep and beef farming, Wāhine Māia, Wāhine Whenua helps participants better understand how their whānau, trust or incorporation farm is run. Skills and confidence to contribute more effectively to the business are built in a supportive environment with other like-minded wāhine.

(The content is provided by New Zealand)

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to consider the needs of elderly farmers</p> <p>Due to the aging process, hearing loss, declining vision, lessened reflexes and other changes may affect farmers in their late year. While female farmers are having different health condition with male, their needs should be specify.</p>	<p>Cooperate with medical institution to collect legal and valid gender- and age-responsive data to identify the general health condition of elderly female farmers. (please note that it is vital to ensure that the data are acquired with individual consent)</p> <p>Develop appropriate guidance to manage risks related to elderly female farmers (e.g., breast cancer, broken bones)</p> <p>Design appropriate equipment and training courses that help to ease their workload, e.g., wearable assist suit, understandable design</p>	<p>Local government in cooperation with local farmers communities</p>
<p>Need to consider the needs of migrant female workers</p> <p>With increasing number of migrant workers, many of them have devoted themselves to agriculture, an industry where youth labor is dropping. The migrant female workers in agriculture industry should also be able to access agricultural technology to boost the productivity and also become irreplaceable.</p>	<p>Expand related laws and implement programs to cover migrant female farmers' rights.</p> <p>Raise awareness of local farming employers to create an environment without discrimination.</p> <p>Raise awareness of migrant female farmers to understand their rights as migrant workers.</p> <p>Develop smart agriculture training courses that are accessible and available, which recognize the language and culture difference.</p>	<p>Ministries of Immigration, Labor and Agriculture</p>

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need for gender-sensitive response to climate change</p> <p>While female farmers account for 45 – 80 percent of all food production in developing region, it is essential to address their specific vulnerability and responsibility.</p>	<p>Understand the effects of climate change on female farmers in the fields of food security, biodiversity, water resources and health services, especially those with intersectional identities.</p> <p>Incorporate gender perspectives into their policies, action plans and other measures on sustainable development and climate change.</p> <p>Develop flexible financial service according to female farmers' priority and needs, for example relax the restriction of collaterals or guarantors.</p> <p>Allocate government resources to climate change initiatives and ensure that female farmers' needs are properly considered.</p> <p>Involve female farmers in the development of climate change responsive technology to ensure if it's user-friendly, affordable, effective and sustainable.</p>	<p>Ministries of Environment, Finance, Agriculture, Technology and Indigenous People</p>

Inclusive and Sustainable Development

Issues	Actions	Implementers
<p>Need to integrate female farmers into Climate-Smart Agriculture(CSA) Initiatives</p> <p>Female farmers are not just the victims of climate change, with the support of agriculture technologies, they could also be part of the solution to the problems posed by climate change and become the contributors to build climate resilience.</p>	<p>Understand and systematically engage with complexities and variability of gendered roles and resources in agriculture, based on better data and evidence.</p> <p>Establish training courses on CSA technology that equip women with climate change knowledge and step by step guidance towards ICT based solutions.</p> <p>Develop frameworks, tools, approaches and guidance that help local female farmers' groups to contribute to climate change.</p> <p>Support local women-led agro-enterprises to engage in climate change related initiatives to integrate the local resources.</p> <p>Involve women as active participants while designing or implementing sustainable agricultural policies, programs and projects.</p>	<p>Ministries of Agriculture, Technology and Environment, local governments</p>



Three Clusters

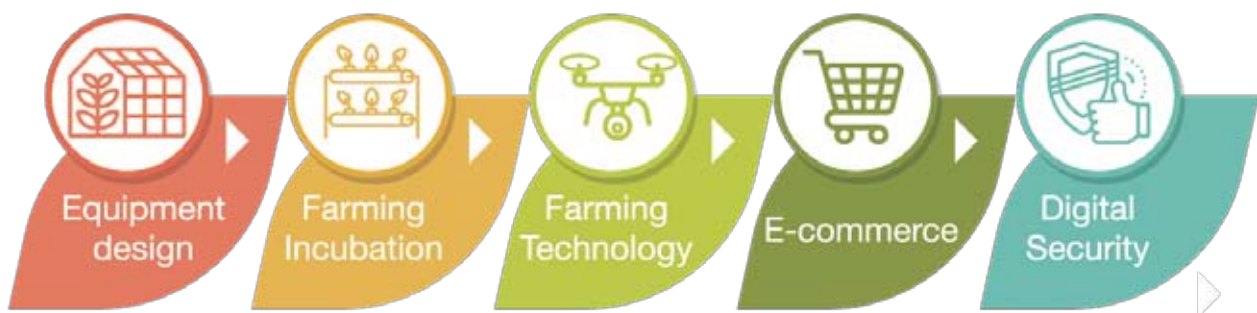
Technology Innovation

Technology Innovation

To reduce costs and enhance the efficiency of agricultural labor; sensors, electronic measurement algorithms and drones are being used to collect data on targeted inputs such as soil moisture and crop health. The collected data is stored on a server or on the Cloud and can be easily accessed by farmers via the internet with tablets and mobile phones to enable intelligent and remote wireless control over the agricultural production process (Lee, 2018).

However, women in South Asia are 26% less likely to own a mobile than men and 70% less likely to use internet due to accessibility and affordability problems (ITU, 2018). This impede women's ability to accrue the benefits of smart agriculture.

Also, technology design and dissemination reflects the current priorities, perceptions, and norms about both agricultural systems and about gender. While the development community no longer uses the terms "farmer" as a synonym for "man," and photos of women farmers grace the covers of virtually every development organizations' agricultural report, attention to women farmers is not so obviously reflected in traditional priorities (USAID, 2018).



To achieve **technology innovation** that includes women, it is necessary to understand their different needs and barriers. Not only sex and gender should be prioritized before designing programs and/ or products, also gender analysis bring us innovation which benefits both women and men.

This cluster follows the concept of **gendered innovations** and will introduce several approaches that could engender the production chain of smart agriculture, which include equipment design, farming incubation, farming technology, e-commerce and digital security.

Agricultural Technologies can help reduce the price and save time of food production. Consumers could benefit from these improvements, regardless of whether they live in developing or developed economies.

However, the development level of the economies might correspond to people's educational level. It would be harmful if local farmers could not understand that there are two sides of every coin.

While accessing the open resource, their personal data could be acquired easily by other people with bad intentions. Local farmers must be equipped with the above-mentioned knowledge so that they could benefit from agricultural technologies with less adverse impacts.

Story of female farmer in technology innovation

In Chiayi, Jia-Cih Yang confidently explain to us that “Women think they can’t cope with the work, but this is a stereotype, if we use smart management systems, then it’s not necessarily true that women can’t do the job just as well.”

Jia-Cih Yang has funded Telome Seedlings Co., Ltd (Chinese Taipei) in 2013, with the support of National Chung Hsing University (Chinese Taipei). The company is now developing a new form of seed that can resist Panama disease, a fungi infection that infects banana plants, leading by Yang. Benefiting from their works, the local farmers could now grow bananas with less risks and more revenue. Yang mentioned that, tissue development of plant seeds has a higher technology requirement, so she prioritize the employment of local women. After they learn about the technology, their work will no longer be replaceable. Yang was once challenged by her family, they thought that they raised their daughter to be a scientist, not a farmer. Yet she broke the stereotype and show them that she can be both.

Yang was once challenged that she is too young to participate in smart agriculture, as well as start her own business. Yet she broke the stereotype and prove that it is possible for a girl to utilize technology and conduct research in agriculture and even build up her own agribusiness.

(The content is provided by Chinese Taipei)



Executive Summary

Technology innovation will not only lessen the risk of agricultural production and distribution, but also effectively reduce the labor cost in the agriculture industry, which at the same time will provide female farmers with more flexibility.

Actions to consider include:

- Promote the awareness of smart agriculture technology and its importance for women to adopt within families and communities;
- Encourage enterprises to recognize that gender bias is embedded in technologies during the process of designing and producing agricultural equipment;
- Encourage APEC members to invest in infrastructure in order to provide female farmers access to education, training, social services and financial services;
- Encourage research institutions to consider “Gendered Innovations” to design smart equipment and infrastructure that facilitates women’s participation in e-commerce and digital security;
- Encourage agri-businesses to consider e-commerce and multiple marketing channel while selling products.

Technology Innovation

Issues	Actions	Implementers
<p>Need for Proper Design of the equipment</p> <p>Some of the traditional farming equipment do not fit women properly, which may cost women more time on their work or even stop them from joining agriculture industry.</p>	<p>Conduct gender-based research to analyze the fundamental gender difference of utilizing smart technologies in agriculture sector.</p> <p>Learn more about the challenges female farmers face through interviews, focus groups or workshops.</p> <p>Adopt and broadcast the idea of 'Universal Design' so that the equipment and infrastructure would be flexible, simple, accessible and affordable.</p>	<p>Ministries of Agriculture and Technologies, research institutions</p>
	<p>Utilize gendered innovation approach to determine the relevance of sex and gender when designing the smart technology equipment and infrastructure.</p> <p>Specify the equipment or infrastructure needed to apply universal design.</p> <p>Describe the target audience of the certain designed service.</p> <p>Involve people with diverse characteristic, especially women with intersectional identity.</p> <p>Integrate others' best practice within the production.</p> <p>Plan the accommodation and consider the accessibility of your target audience.</p> <p>Evaluate the designed service periodically.</p>	<p>Public and Private Sectors (when trying "universal design")</p>

Equipment design

Farming Incubation

Farming Technology

E-commerce

Digital Security

Technology Innovation

Issues	Actions	Implementers
<p>Need to improve access to smart agriculture related resources</p> <p>Resources may include, but are not limited to, large farming devices, IoT system, drones, open data etc. Digital divide and other gender norms may indirectly hinder women's opportunity and access to innovation design or resources.</p>	<p>Assess barriers to women's access to smart agriculture related resources and develop a comprehensive plan to address the barriers, including geography, a weak resource delivery network, and inconvenient operating hours.</p> <p>Invest in infrastructure to provide female farmers access to education, training, government services and financial services.</p> <p>Provide time and public service to support women's access to education and training resources.</p> <p>Reduce financial barriers that prevent women from accessing services and supplies (e.g., financial aid and loan)</p> <p>Adopt and broadcast the concept of sharing economy to ease the pressure of individual farmers.</p> <p>Build up online or offline platforms to gather resources provided by the government, including data and geographic data.</p>	<p>Ministries of Agriculture, Transportation and Finance, local government in coordination with farmer groups and associations</p>

Equipment design

Farming Incubation

Farming Technology

E-commerce

Digital Security

Technology Innovation

Issues	Actions	Implementers
<p>Need to recognize and prevent the gender bias in agricultural technology</p> <p>Agricultural Technology has become more and more broadly used in smart agriculture industry, the core techniques are mainly formed with big data and AIoT. However, With the embedded gender bias in the society, the technology was designed to favor men more than women.</p>	<p>Recognize that the algorithms used within agricultural technologies are not gender neutral, ranging from human bias embedded in training data to unconscious choices in the algorithm design.</p> <p>Also recognize that as the smart agriculture industry is evolving, the language used in agricultural research is not gender neutral.</p> <p>Develop mechanisms to ensure that policies related to technology development and transfer take into account the different roles and needs of local farmers, and target female farmers accordingly, e.g., consult and involve female farmers during the design.</p> <p>Hold activities, initiatives or training courses to build the capacity of female farmers to identify and articulate their information and technology needs, and to access information and services provided by government institutions.</p> <p>Establish impact assessment from a gender perspective whenever the technology, project or policies is being introduced to local farmers.</p>	<p>Ministries of Agriculture and Technology, academic and research institutions, women's and farmers organizations</p>

Equipment design

Farming Incubation

Farming Technology

E-commerce

Digital Security

Technology Innovation

Issues	Actions	Implementers
<p>Need to develop innovative marketing channel</p> <p>As technology has evolved through the past decades, new online marketing channel has been developed, which lead to more chances for female farmers to reach out to their customers.</p>	<p>Provide educational events, seminars, webinars, conferences and teleclasses via government websites and social media platforms to equipped female farmers with knowledge on e-commerce platform.</p> <p>Encourage female farmers to develop innovative marketing and financing channel, such as crowding funding.</p> <p>Cooperate with enterprises to launch initiatives that encourage female farmers to utilize e-commerce resources, e.g., #SheMeansBusiness.</p> <p>Establish awards and accreditations to recognize the achievements of female farmers' utilization of e-commerce.</p>	<p>The public and private sectors, women and farmers organizations</p>

Equipment design

Farming Incubation

Farming Technology

E-commerce

Digital Security



Technology Innovation

Issues	Actions	Implementers
<p>Need for cybersecurity in smart agriculture</p> <p>As smart agriculture depends hugely on big data, it is necessary to balance between open resources and data ownership. The vulnerability assessment is needed, and participation of women and civil society organizations in the policy-making process is crucial.</p>	<p>Address the issues of agricultural data ownership, e.g., laws on agriculture, technology or privacy to further monitor the data contracts between producers and agribusinesses.</p> <p>Do more research to look at the benefits and costs of making public and private data sets more available, and also consider how to preserve individual privacy and control over data use.</p> <p>Cooperate with agribusinesses and local farmers organizations to understand the application of data in practice.</p> <p>Enhance the knowledge of female farmers on the terms on how their data is being used and to whom the data is providing.</p>	<p>Ministries of Agriculture and Technology in coordination with farmers groups and associations</p>

Equipment design

Farming Incubation

Farming Technology

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References

- Burgstahler, S., 2015. Universal Design: Process, Principles, and Applications. Available at <https://www.washington.edu/doit/universal-design-process-principles-and-applications>.
- Baumüller, H., 2017. Towards Smart Farming? Mobile Technology Trends and their Potential for Developing Country Agriculture. Chapter 8 in Handbook for ICT in developing countries: 5G perspectives, eds., Editors: Skouby, K.E., I. Williams and A. Gyamfi, River Publishers, pp.191-201.
- Department for International Development) (DFID), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). 2013. Promoting Women's Financial Inclusion: A Toolkit. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/213907/promoting-womens-financial-inclusion-toolkit.pdf
- file:///D:/APEC/2019/Policy%20Toolkit/FPJ-Autumn-2018_Wiseman.pdf
- <https://farmingfirst.org/2018/08/10-ways-precision-agriculture-is-transforming-farming/>
- Food and Agriculture Organization of the United Nations (FAO), 2010. Gender dimensions of agricultural and rural employment: Differentiated pathways out of poverty, FAO Rome, Italy. Available at <http://www.fao.org/3/i1638e/i1638e00.htm>
- , 2013. Climate Smart Agriculture Sourcebook. FAO Rome, Italy. Available at <http://www.fao.org/3/a-i3325e.pdf>.
- , 2017. Information and Communication Technology (ICT) in Agriculture-A Report to the G20 Agricultural Deputies, FAO Rome, Italy. Available at <http://www.fao.org/3/a-i7961e.pdf>.
- McKinsey Global Institute. 2015. The Power of Parity: How Advancing Women's Equality Can Add \$12 Trillion to Global Growth. Available at: <https://www.mckinsey.com/featured-insights/employment-and-growth/how-advancing-womens-equality-can-add-12-trillion-to-global-growth>
- Schiebinger, L., Klinge, I., Sánchez de Madariaga, I., Paik, H. Y., Schraudner, M., and Stefanick, M. (Eds.) 2011-2018. Gendered Innovations in Science, Health & Medicine, Engineering and Environment. Available at: genderedinnovations.stanford.edu/
- World Bank. 2009. Gender in Agriculture Sourcebook. Available at openknowledge.worldbank.org/handle/10986/6603
- Margarat, M., Samuel, K. 2015. Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. Available at: <https://pdfs.semanticscholar.org/8e9b/28e14286f65a9168738a97c74a256bc8e4c3.pdf>
- Asia Pacific Economic Forum (APEC) 2017. Women and the Economy Dashboard. Available at: <https://www.apec.org/Publications/2017/09/The-APEC-Women-and-The-Economy-Dashboard-2017>

Acknowledgement

APEC GIFTS A+ Working Group

Chile, the Philippines, Chinese Taipei

Co-sponsoring Economies

Chile, Japan, Republic of Korea, Mexico, New Zealand, Papua New Guinea, Peru, The Philippines, Viet Nam

Consulting Economies

Those who attend the Seminar on Promoting Gender Inclusion in Smart Agriculture or submit the survey with practices.

Canada, Chile, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the Philippines, Thailand, United States and Vietnam



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Note

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