APEC Workshop on Promoting Women-led MSMEs in Adopting Circular Agriculture

APEC Small and Medium Enterprises Working Group

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I. Introduction

On June 2024, the *"**APEC Workshop on Promoting Women-led MSMEs in Adopting Circular Agriculture**"* was held in Hanoi, Viet Nam. The project was led by Viet Nam and co-sponsored China; Indonesia; Malaysia and the Philippines. Speakers and participants came from the private sector, business associations, international organizations, research institutions, and APEC economies' relevant Ministries and government agencies.

Through sharing information, experiences, best practices, the "***APEC Workshop on Promoting Women-led MSMEs in Adopting Circular Agriculture***" aims to identify and address challenges that women-led MSMEs face as well as provide capacity building for APEC member economies, especially developing ones to promote circular agriculture through exploring and identifying resources, skills, and networks, enabling favourable environment to empower women MSMEs in adopting circular agriculture for sustainable and inclusive growth and development through sharing information, experiences, and best practices.

II. Background

It is believed by scientists and policy makers that circular agriculture could be an efficient way to diminish environmental pollution, loss and waste of natural resources while still ensuring food supply and security. According to the United Nations (UN), circular agriculture is more "suited to smallholder farming, anchored in organic, mixed and agroforestry practices" rather than large-scale businesses who focused more on "maximizing profit over the protection of the environment". In the transition from conventional to circular agriculture, women, accounting up to 48% of agriculture employment in low-income economies (according to FAO), and women MSMEs can play an important role to promote circular agriculture. However, they are supposed to face challenges in accessing productive resources and services, technology, market information, financial assets, etc., (according to UN). This project aims to identify and address challenges that women MSMEs face in transitioning to circular agriculture as well as to provide capacity building to member economies in how to enable favorable environment to empower women MSMEs to adopt circular agriculture.

This project is in line with the Bangkok Goals on Bio-Circular-Green (BCG) Economy, which states one of its missions as to promote sustainable, and inclusive food systems and agricultural practices, reducing food loss and waste, including through encouraging environmentally-friendly policies and minimizing environmentally harmful ones, conversing agrobiodiversity, and enhancing the use of agricultural biotechnology, digitalization and other innovative approaches. The inclusion focus can be on MSMEs, women, and other groups with untapped economic potential such as those from remote and rural communities. It also contributes to the Bangkok goals of "Increasing cooperation to advance circular economy approaches, including through promoting circular business models as well as exchange policies and best practices, and sustainable production and consumption patterns". It is also aligned with the Putrajaya Vision 2024 (PV2040) that aims to "foster quality growth that brings palpable benefits and greater health and wellbeing to all including MSEMs, women and others with untapped economic potential" through "intensifying inclusive human development as well as economic and technical cooperation to better equip our people with the skills and knowledge".

The project is in line with the SMEWG's commitments to "support MSME-related capacity building activities through "promoting entrepreneurship and business development opportunities for youth and female entrepreneurs; as well as promoting green awareness for enhancing SMEs competitiveness to access international markets and GVCs. It is also in line with the SMEWG Strategic Plan 2025 - 2028 that the SMEWG will further promote the development of an enabling environment, foster capacity building, and enhance the inter-connectedness of MSMEs within the APEC region through the sharing of best practices among APEC economies and building on synergies with other APEC fora, the private sector and other stakeholders to promote the development and growth of MSMEs in the Asia-Pacific region.

The project will contribute to promote capacity building for the economies in how to empower women to adopt circular agriculture. In that sense, it contributes to APEC's capacity building goals of attaining sustainable growth and equitable development in the Asia-Pacific region as well as improving the economic and social well-being of the people (Appendix K of the Guidebook).

III. Key Issues

1. Overview of women-led MSMEs in adopting circular agriculture in the APEC region

Dr. Tzong-Ru Lee, Professor of Marketing Department, Chung Hsing University (NCHU); Advisory Board, AI Centre for Decision Analytics, University of Alberta (UoA); Fellow, International Association for Agricultural Sustainability (IAAS); Editor-in-chief, International Journal of Agriculture Innovation, Technology and Globalisation (IJAITG), Chinese Taipei: In this session, the speaker highlighted the current status, challenges, and success stories that showcase how women entrepreneurs are contributing to sustainable agricultural practices and rural development especially in the context of growing environmental concerns and increasing food insecurity

Agriculture is under intense pressure from climate change, resource scarcity, and population growth. Rising temperatures, irregular rainfall, and extreme weather events have reduced land productivity in major food-producing regions. According to UN projections, global food demand is expected to increase by 60%

by 2050, while arable land and natural resources continue to diminish. Additionally, water shortages, soil degradation, and biodiversity loss are exacerbating the environmental stress on agricultural systems. These challenges necessitate a fundamental shift in how agriculture is practiced, with a focus on sustainability, resilience, and innovation.

Women entrepreneurs are believed to play an important role in leading this transformation. Their traditional roles as caregivers often make them more attentive to health and safety, which aligns naturally with the principles of circular economy and sustainable agriculture. Women-led MSMEs tend to be localized, small-scale, and deeply embedded within their communities. This community orientation, combined with their sensitivity to environmental issues and concern for food safety, encourages them to adopt eco-friendly practices. These businesses frequently focus on flexible production models, organic and specialty products, and cooperative human resource strategies that emphasize shared prosperity.

In business operations, women-led MSMEs stand out for their innovative use of resources. From upcycling agricultural by-products to creating organic compost, these entrepreneurs infuse creativity into research and development. Their financial strategies are typically guided not just by profit, but by strong values, emphasizing social impact, sustainability, and long-term environmental health. Their approach reflects a deeper commitment to the well-being of both people and the planet.

Circular agriculture is a sustainable farming model that reintegrates waste and by-products into the agricultural cycle. It aims to reduce waste, optimize resource use, and foster ecological balance. This model includes plant-animal symbiotic systems, regenerative fertilizers and composting, water recycling systems, and soil regeneration practices. A traditional example is the rice-fish-duck system, where ducks control pests and fertilize fields while fish and rice are cultivated simultaneously, creating a mutually beneficial and high-yield system.

Composting technologies are also central to circular agriculture. By turning crop residues, food scraps, and manure into organic fertilizers, farmers can enhance soil structure and fertility, boost microbial activity, and reduce reliance on synthetic inputs. Similarly, water recycling systems enable farms to reuse irrigation water,

thereby conserving water and promoting sustainable production. Soil regeneration practices such as cover cropping, crop rotation, and the use of organic matter help restore soil health and increase resilience to climate change.

A crucial next step in supporting women-led MSMEs in circular agriculture is the integration of carbon footprint verification systems. These systems track greenhouse gas emissions across various scopes—direct, indirect from purchased energy, and indirect from supply chain and product disposal. Accurate measurement and reporting can not only help these enterprises reduce emissions but also strengthen transparency, improve traceability, and boost competitiveness in a low-carbon economy.

In conclusion, women-led MSMEs are vital actors in the transition toward a circular, sustainable agricultural future. Their practices are inherently aligned with the principles of the circular economy, and their leadership plays a key role in driving community-based, climate-smart innovations. Besides, collaboration across governments, academia, and the private sector is essential. These partnerships will be pivotal in building capacity, delivering technical support, and fostering inclusive green growth across the APEC region.

2. Identifying challenges and approaches to promote women-led MSMEs in adopting circular agriculture

Ms Febi Agil Ifdillah, Co-Founder & CTO, Elevarm, Indonesia: In the face of pressing challenges in agriculture and food security, Elevarm, an Indonesian agritech company, is revolutionizing the horticulture sector through innovation, inclusivity, and sustainability. Elevarm aims to empower smallholder farmers by connecting them to high-quality agricultural inputs, digital solutions, and robust support networks. The company's work is a direct response to the longstanding issues of low productivity, inconsistent input quality, and limited access to advisory services that have constrained Indonesia’s agricultural performance, especially in horticulture.

Indonesia’s horticulture sector, valued at approximately USD 18.8 billion and expected to grow steadily, remains underperforming in productivity compared to neighbour economies. For instance, Indonesian yields for crops like potatoes, chili, and tomatoes are significantly lower than those in China; Thailand; and Viet Nam.

This underperformance stems from reliance on traditional practices, lack of mechanization, and inadequate access to improved seeds and inputs. Elevarm addresses these bottlenecks by developing an integrated ecosystem that stretches from research labs to farmland and market access points, ensuring that every stakeholder in the value chain is equipped for success.

At the core of Elevarm's strategy is its investment in research and development. The company has established a dedicated Horticulture Research & Development Center to innovate superior seeds, improve plant protection technologies, and develop sustainable nutritional solutions. By facilitating knowledge exchange and scientific collaboration, Elevarm ensures that its agri-inputs align with the sustainability goals of the broader agricultural community. These innovations are complemented by a digital farming platform that provides real-time analytics, weather forecasts, harvest scheduling, and supply chain insights. Integrated with IoT devices and automation, this system enhances decision-making and operational efficiency for farmers and stakeholders alike.

Beyond technology, Elevarm recognizes that transformation must be inclusive and human-centered. It has built a strong farmer engagement model, where trust and accessibility are central. Farmers are supported through personalized advisory services, including "Klinik Tani" (Plant Clinics), which provide expert diagnostics and farming recommendations. The platform also ensures access to high-quality inputs such as vermicompost and improved seeds, addressing the problem of counterfeit or low-performance products in the market.

One of Elevarm's most significant contributions lies in its innovative approach to financing. Traditional lending mechanisms often exclude smallholder farmers due to lack of collateral or credit history. Elevarm's "productive financing" model moves beyond conventional lending by offering tailored financial products linked to input use and production cycles. This model improves farmers' liquidity while ensuring that financing directly supports yield-improving practices, creating a positive feedback loop that benefits both farmers and lenders.

The company's commitment to sustainability is reflected in its alignment with the UN Sustainable Development Goals (SDGs). Elevarm integrates environmental, social, and governance metrics into its operations and impact evaluations. From

reducing input waste to encouraging youth and women's participation in farming, the company is actively building a more equitable and resilient agricultural future. According to its Impact Report, Elevarm has supported over 15,000 farmers and covered more than 1,000 farmland areas, with significant improvements in both yield and income.

Inclusion and diversity are pillars of Elevarm's theory of change. The company actively creates opportunities for young and female farmers, recognizing that the future of agriculture must be shaped by all segments of society. Its efforts to widen access, bridge information gaps, and build capacity are transforming rural livelihoods and redefining what sustainable farming can look like in Southeast Asia.

Looking ahead, Elevarm's ambition is to become the largest upstream horticulture ecosystem in Southeast Asia by 2029. This vision includes expanding digital infrastructure, scaling R&D innovation, and forming partnerships that catalyze inclusive growth. In doing so, Elevarm not only advances productivity but also reshapes how agriculture contributes to economic development, food security, and climate resilience.

Dr. Tzong-Ru Lee, Professor of Marketing Department, Chung Hsing University (NCHU); Advisory Board, AI Centre for Decision Analytics, University of Alberta (UoA); Fellow, International Association for Agricultural Sustainability (IAAS); Editor-in-chief, International Journal of Agriculture Innovation, Technology and Globalisation (IJAITG), Chinese Taipei: In this session, the speaker focused on highlighting both the transformative potential and persistent challenges faced by women MSMEs in adopting circular agriculture within the APEC region. Women are believed to have advantages in promoting circular economy since their roles within families and communities give them an intuitive grasp of sustainability, enabling them to devise innovative solutions that are both environmentally responsible and economically viable. Women MSMEs show considerable promise in advancing circular agriculture, leveraging their deep community ties, holistic perspectives, and intrinsic motivation for care-driven business models.

Despite their strengths, women-led MSMEs face numerous structural challenges that hinder their full participation in the circular economy. One major barrier is limited access to funding. Women often struggle more than men to secure financial resources, constraining their ability to invest in technology and sustainable practices. This financial gap is compounded by a lack of access to technical knowledge and professional support, especially in high-tech sectors of agriculture. As a result, many women entrepreneurs find themselves at a disadvantage in implementing innovative circular strategies.

Marketing and branding also present significant hurdles. Many women-led enterprises lack access to research and development (R&D) resources, limiting their ability to develop unique products or expand into niche markets. Caregiving responsibilities often reduce the time and resources women can devote to learning market trends or pursuing cross-sector partnerships. Succession planning introduces further complexity, as value conflicts and communication barriers between generations often prevent a smooth transfer of leadership and vision in family-run businesses.

Cultural expectations and gender stereotypes exacerbate these challenges. Female successors are sometimes seen as temporary caretakers rather than long-term decision-makers. In conservative agricultural settings, there is often insufficient trust and institutional support to allow women to reform traditional business models. Moreover, rapid developments in smart agriculture and digital technologies create high entry barriers. Many women entrepreneurs find it difficult to keep pace due to inadequate market education and the financial burden of adopting new tools and systems.

The speaker also showcased some case studies of women entrepreneurs in adopting circular economy business models (CBM). One example is Ms. Ya-Hui Wang of Leadray Livestock Co., Ltd., who co-founded a business focused on native chicken farming. Her collaboration with academia, particularly in genetic innovation, enabled the company to export high-quality poultry products to Southeast Asia market. Her leadership exemplifies how women can blend resilience, innovation, and science to transform traditional sectors.

Another example is Ms. Hui-Lan Huang of the Siho Seafood Tourism Factory. After navigating intergenerational challenges in her family business, she modernized the seafood processing operation and turned it into a tourism hub. By creating a clean, eco-conscious facility and introducing community-centered programs, she not only preserved local fishing traditions but also empowered the next generation to take pride in sustainable agriculture.

These examples underscore the capacity of women entrepreneurs to reshape agricultural economies. However, to fully realize their potential, strategic action is necessary. Efforts must be made to improve access to finance and technology, support inclusive leadership development, and enhance carbon management capabilities. Building partnerships across sectors—government, academia, and industry—is crucial to providing the resources and recognition women need.

3. Promoting innovation to promote circular agriculture

Mr Bui Van Tung, Researcher, Northwest Agriculture and Forestry Research Center-Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI), Viet Nam: The Northwest Highlands (NWH) of Viet Nam encompass six provinces with a combined area of 5.6 million hectares, representing over 10% of the economy's natural land. This remote and mountainous region, located several hours from Hanoi, is home to approximately 4.7 million people, who rely heavily on agriculture for their livelihoods. Around 85% of the population lives in rural areas, and 80% depend on agriculture, particularly cash crops, livestock, and forestry. However, small-scale farming in this region is constrained by low productivity, limited market access, and environmentally harmful practices such as mono-cropping on sloping lands, which contributes to soil erosion. Poverty rate in the Northwest region remains prevalent, ranking one among the poorest regions in Viet Nam (together with the central highland). Women, who play a vital role in agricultural labor (76.4%), face additional burdens due to traditional gender norms that assign them more domestic responsibilities than men.

To address these challenges, several projects, notably ADAM, ASSET and ALiSEA network, have introduced circular agriculture interventions aimed at increasing sustainability, productivity, and resilience. A core strategy involves

transitioning from traditional slash-and-burn agriculture to more sustainable practices such as intercropping with legumes, using grass strips, and rotating crops. These approaches are supported by agroecology training and field trials that demonstrate the benefits of diversified cropping systems on sloping land. One notable outcome is the transformation of monoculture maize plantations into diversified fruit tree systems, contributing to improved soil health and farm incomes.

In addition to crop-based solutions, integrated livestock systems have been promoted, especially the forage–silage–compost model. Beginning with just four pilot villages in 2022, this approach expanded to 42 villages involving 400 households by 2024. The initiative, supported by both Viet Nam's programs and ASSET incentives, has led to increased adoption of intercropping with Macadamia, fruit tree and coffee systems and forages, silage production, and composting. Technical support included the introduction of forage-chopping and compost pelletizing equipment, helping farmers optimize on-farm waste. Training sessions and cross-border knowledge exchanges with partners in Laos and Cambodia further enhanced the impact of these practices.

Another significant intervention focuses on sustainable waste management in coffee production. In Son La, where 21,000 hectares are devoted to coffee cultivation, ALiSEA supported the development of pilot systems to treat wastewater and convert coffee husks into microbial organic compost. These initiatives not only reduce environmental harm but also align with the economy's policies on organic fertilizers and greenhouse gas reduction.

Despite these successes, several barriers hinder the large-scale adoption of circular agriculture. These include limited financial incentives, the delayed visibility of benefits such as soil health improvements, labor shortages, and the logistical challenges posed by sloping terrain and remote farmland. Moreover, market access for intercropped products like rice bean remains weak, and many farmers lack the knowledge and confidence to implement innovative techniques.

From these experiences, several lessons have emerged. Training should use simple, locally understandable language to better engage farmers. Policies and incentives must align with actual farmer needs and realities. A combination of

technical support, marketing assistance, and peer learning is essential to foster adoption. Lastly, strong communication and experience-sharing platforms are critical for scaling up success.

Mrs Wachira Faijaroenmongkol, Director of Community Enterprise Promotion Division, Department of Agricultural Extension (DOAE), Thailand: The Department of Agricultural Extension (DOAE) in Thailand plays a crucial role in promoting agricultural sustainability through innovation, community empowerment, and the integration of local wisdom. As one of fifteen departments under the Ministry of Agriculture and Cooperatives, DOAE has been operational since 1967, transferring appropriate agricultural technology, supporting farmer organizations, and promoting community enterprises. The core mission of DOAE is to support the development of agricultural production and management systems while fostering self-reliance and economic well-being in rural communities.

Community enterprises (CEs) in Thailand are grassroots organizations that operate on the principles of utilizing community resources, collective ownership, and step-by-step learning processes to promote self-reliance. These enterprises encompass a variety of sectors, including agricultural production, product processing, agro-tourism, handicrafts, and community stores. Notably, over 53% of the more than 72,000 CEs are women-led, particularly in the area of agricultural product processing.

A key initiative undertaken by DOAE is to promote the establishment and management of bio-based agricultural enterprises and the preservation of local wisdom. This initiative aligns with Thailand's Bio-Circular-Green (BCG) economic model and aims to transform agricultural products and services using bio-based innovations. The project targeted 77 community enterprises, one from each province, all led by women. These enterprises received support in business planning, production and marketing skills, and product development with a focus on sustainability and innovation.

The project yielded significant outcomes, particularly in enhancing the value of agricultural by-products and waste. For example, the CE in Nonthaburi processed lemon peels, typically discarded during juice production, into dehydrated lemon using osmotic dehydration technology. In Kamphaeng Phet, rice bran residue from

oil extraction was converted into a protein-rich drink through enzyme and spray-drying technologies. This product was particularly notable for being allergen-free and estrogen-free. Other examples include crispy puffed rice snacks made from broken rice in Kalasin and cosmetic products such as sleeping masks and body lotions made from agricultural waste like sea holly leaves and pomelo flowers in Surat Thani and Chai Nat provinces.

Household items and clothing innovations also emerged from this project. In Prachuap Khiri Khan, tie-dye fabric was produced using natural dyes from coconut shells and marigold flowers. In Songkhla, mango peels were turned into natural fabric dyes. Meanwhile, rice straw was used to make handwoven fabric in Ayutthaya, and corn waste was transformed into charcoal odor absorbers in Saraburi. These innovations not only added value to agricultural waste but also helped reduce environmental pollution and showcased the integration of modern technology with traditional knowledge.

Thailand also partnered with the Food and Agriculture Organization (FAO) to support MSMEs reduce food waste. This project aimed to build capacity among food processors to measure, monitor, and reduce food loss across key stages of the supply chain. One case study focused on a women-run banana chip enterprise in Ban Ko Ket. The team analyzed production processes and identified critical points of waste. Through improved practices—such as controlling oil temperature during frying and using advanced sealing machines—the enterprise reduced food waste significantly and saved approximately THB 1,400 per week.

Ms Mijin Kwon, CEO of AgUni; Korea: The speaker outlined a visionary approach to agriculture that redefines the concept of circular farming through the lens of advanced technology, ecological integration, and social impact. AgUni introduces an intelligent circular system that is not only sustainable but also resilient to external shocks. This model connects every aspect of the agricultural ecosystem—climate, seeds, soil, crops, bees, labor, and technology—into a unified, climate-independent infrastructure. Central to this innovation are AgDome and Growide, two core technologies that transform farming into a controlled, data-driven operation with significantly increased productivity and minimized environmental impact.

AgDome functions as a fully enclosed, climate-controlled plant factory that maintains stable conditions for plants, bees, and humans alike. With positive air pressure, thermal circulation, and geothermal systems, it protects against pests, contamination, and extreme weather. Growide complements this by offering a vertical, soil-based cultivation system designed for high-value crops. These technologies enable year-round cultivation, boost crop yields by up to 200%, and reduce water usage by 38% while eliminating the need for chemical pesticides. The system's integration of artificial intelligence and real-time monitoring ensures that each growth phase is optimized, offering scalability and adaptability to different environments.

What distinguishes AgUni's model further is its ability to combine seed breeding and beekeeping in one closed-loop environment. Traditionally, pollination and honey production are seasonal and vulnerable to contamination and climate variability. Within the AgDome ecosystem, however, bees can pollinate continuously, and honey can be harvested all year round. This innovation results in a dramatic increase in productivity, turning every day into a harvest day and enabling the efficient, sustainable production of both seeds and functional honey. This closed-loop cycle extends from breeding to cultivation and distribution, allowing for precision agriculture that meets market demands with high-value, health-oriented products.

According to the speaker, Viet Nam emerges as a strategic location for implementing this model due to its status as a top honey exporter and its rapidly growing market for functional foods. The economy's diverse floral resources and agricultural potential make it ideal for expanding into premium segments such as ginseng-infused or herbal honey. Moreover, if integrating AgDome systems into Viet Nam's highland farming zones, AgUni expects to create a self-sustaining ecosystem that not only enhances food production but also generates local employment and strengthens regional economies. This aligns with AgUni's vision of fostering job creation, particularly for women and youth, while embedding circular economy principles at the community level.

Looking forward, AgUni's ambition extends beyond agriculture to include digital health integration. The platform envisions a future where personalized nutrition crops, functional foods, and medicinal plants are cultivated based on individual

health data. With blockchain-powered traceability systems, AgUni ensures full transparency and quality assurance, building trust among global consumers and institutional stakeholders. This commitment to environmental, social, and governance (ESG) values AgUni as a scalable and inclusive solution for climate-resilient development.

Ultimately, Ms. Gwon highlighted that AgUni remains not merely as a farming innovation but as a holistic development platform that bridges technology, ecology, and human well-being. Through this model, agriculture becomes a driver of both sustainability and social transformation, offering a compelling blueprint for the future of food systems worldwide.

Dr. Florence C Ginibun, Deputy Director of Agriculture Extension Division, Department of Agriculture, Malaysia (DOA): In Malaysia, MSMEs are a vital part of the economy, contributing over 39% to the economy's GDP. Within this segment, agriculture plays a significant role, supported by sub-sectors such as rubber, oil palm, livestock, and fishing. Employment generated by MSMEs grew to 7.86 million in 2023, demonstrating their resilience and importance. Among these, women-led agrifood initiatives are increasingly gaining traction, particularly in food crop production and agro-based entrepreneurship.

The Department of Agriculture (DOA) in Malaysia oversees thousands of registered agro-entrepreneurs, including over 87,000 women. Of the 6,023 total agro-based entrepreneurs, 98.8% are involved in food processing industries, which include biscuits, cordials, noodles, and snacks. Smaller portions engage in crafts, services like agrotourism and cosmetics, and compost fertilizer production. Recognizing the necessity to shift toward sustainable practices, the government has adopted strategic policies such as the Agrofood Policy (NAP 2.0) and aligned them with international frameworks like the United Nations Sustainable Development Goals (SDGs). Key focuses include reducing food loss along the value chain and promoting sustainable consumption and production.

Circular agriculture in Malaysia is built on principles of reducing, recycling, and reusing agricultural inputs. This model emphasizes nutrient recycling through composting organic waste, optimizing water use via rainwater harvesting, enhancing biodiversity through crop rotation, and integrating livestock with crop

production to close nutrient loops. These practices help reduce synthetic input dependency, enhance soil and water conservation, and improve resilience to climate change.

To embed circular agriculture in communities, Malaysia launched the Community Agriculture Development Program. This initiative encourages urban and rural households to grow food sustainably, reduce ecological footprints, and support local food security. An example of this is the 3R Raised Bed initiative, which recycles domestic and agricultural waste into nutrient-rich planting mediums.

Innovation extends to other solutions like the rainwater harvesting system and the Petani 1.0 model, a 1-square-meter vertical farming unit tailored for urban spaces. Meanwhile, fertigation systems and the recycling of biomass further demonstrate the economy's commitment to agricultural sustainability. Malaysia also leverages agricultural biomass by recovering energy and nutrients through technologies such as anaerobic digestion, fermentation, and composting, and regenerates natural resources through soil and water conservation.

Malaysia also focuses on product development from agricultural waste. The coconut industry demonstrates how nearly every part of the fruit can be transformed into food, fuel, skincare, and industrial products. Banana peels are repurposed into gluten-free premixed flour, addressing food waste while offering healthier, locally sourced alternatives to wheat flour. Meanwhile, jackfruit, often underutilized, is being explored for its inedible parts. Innovations include turning jackfruit straw into powder for baking and converting seeds into gluten-free noodles. Young jackfruit, due to its texture, is now used in plant-based meat alternatives such as burgers and floss, responding to the growing demand for sustainable diets, etc.

Looking forward, Malaysia's Department of Agriculture plans to scale these efforts through expanded research and development, capacity-building programs, and strategic funding under the upcoming 13th Malaysia Plan (2026–2030). The goal is to unlock the full potential of crop residues and non-edible plant parts for the growing plant-based economy. Women farmers and entrepreneurs are seen as key actors in this transition, and their involvement will be crucial for driving

innovation, reducing environmental impacts, and enhancing Malaysia's global standing in sustainable agriculture.

Through circular agriculture, Malaysia is not only minimizing waste but also creating new economic opportunities, promoting food security, and preparing for the challenges of climate change. These efforts underline the importance of sustainable practices and inclusive innovation in shaping the future of the agrifood industry.

Ms. Xu Xiaomei, General Manager of Chengdu Muyun Environmental Technology Co., Ltd., China: The speaker shared the inspiring story of her own Muyun Environment enterprise in pursuit of circular agriculture through innovating foam fertilizers and collaborative models. Dedicated to circular agriculture, the organization focuses on translating advanced green technologies into scalable, environmentally responsible solutions. A key innovation pioneered by Muyun Environment is the development of hydrogel-based foam fertilizers, which integrate micro-nano bubble technology with controlled-release mechanisms. This advancement addresses the critical inefficiencies and environmental challenges associated with conventional fertilizers—such as nutrient leaching, soil degradation, and greenhouse gas emissions. Foam fertilizers substantially improve nutrient utilization rates (by 40–45% for synthetic and 30–40% for natural variants) and demonstrate superior water retention capabilities. Field trials have indicated a 15% increase in crop yield and a 30% reduction in water usage, highlighting the practical impact of this technology. In parallel, Muyun Environment promotes innovative agricultural models that reinforce the principles of circularity. Notable initiatives include the use of ozone water as a pesticide alternative—offering effective pest control without chemical residues—and integrated farming systems that transform waste into resources. Another example involves the integration of pig waste treatment and citrus orchard irrigation, resulting in reduced fertilizer usage, significant water savings, and increased income for local farmers, particularly women-led cooperatives. Looking forward, Muyun Environment aims to refine its technologies by exploring biodegradable hydrogel materials, optimizing gas applications, and expanding regional collaboration. The enterprise calls for the creation of an APEC-wide green technology platform, enhanced support for

women entrepreneurs, and the integration of synergistic "technology + model" solutions into agricultural policy frameworks.

4. **Exploring mechanism to promote women-led MSMEs' adoption of circular agriculture**

Pham Thi To Oanh, Director, Viet Nam Cooperative Alliance (VCA): In the presentation, the speaker emphasized the central role of cooperatives in driving sustainability, the importance of supportive policies, and the growing participation of women in leading this transformation.

Viet Nam's cooperative system plays a pivotal role in agricultural production and rural development. Across the economy, thousands of cooperatives are operating in various sectors, particularly in agriculture, forestry, and fisheries. These cooperatives are increasingly adopting circular models, which not only promote environmental protection but also improve productivity and income. Examples of such models include integrated farming systems like garden-pond-barn (VAC), rice-fish, and rice-shrimp farming. These systems optimize resources, reduce waste, and contribute to a healthier ecosystem while producing clean, high-quality products.

Awareness among women about circular agriculture and green product development has grown significantly. As women play a central role in agricultural cooperatives and production, their orientation toward sustainability, health, income generation, and family well-being make them natural leaders in circular practices. Cooperatives such as Thanh Ha and Chuc Son in Hanoi have shown how female participation contributes to cleaner production and better environmental stewardship.

The policy environment in Viet Nam has become increasingly favorable to circular agriculture. Landmark legal frameworks, including Environmental Law (2020), the Cooperative Law (2023), and the commitments of the government made at the COP26, demonstrate their strong commitment to a green economy. Additional directives and decisions—such as Resolution 55-NQ/TW and Decision 749/QĐ-TTg—support energy transition, digital transformation, and sustainable rural development. In particular, Decision 1804/QĐ-TTg and Resolution 20-NQ/TW

emphasize support for the cooperative economy as a key element in achieving green and circular development.

Numerous cooperative-led models across Viet Nam exemplify the successful integration of circular principles. In regions like Nam Dinh and Kien Giang, “fragrant rice–clean shrimp” and “fragrant rice–clean fish” models reduce pesticide and antibiotic use while protecting the environment and enhancing food safety. Cooperatives in Thai Nguyen and Vinh Phuc are producing OCOP-standard green tea and rice while managing wastewater effectively. In Dak Nong, Hoang Nguyen Cooperative has developed an organic pepper model certified to international standards, exporting to high-demand markets like the U.S. and Europe, etc.

A critical component of Viet Nam’s circular agriculture journey is digital transformation. Cooperatives are increasingly adopting digital tools for branding, traceability, and market access. Platforms such as websites, social media, livestream commerce, and e-marketplaces like Shopee and Lazada are enabling cooperatives to reach broader audiences. Barcodes and QR codes provide consumers with reliable product information, enhancing transparency and trust.

However, the journey toward full adoption of circular agriculture is not without obstacles. Cooperatives require better access to finance, information, and training. There is a strong need for policy refinement that supports innovation while remaining sensitive to the social and cultural context. It is also essential to promote knowledge exchange between traditional producers and modern practitioners to build a resilient and inclusive agricultural sector.

Mr Seungho Park, Senior Deputy Director of International Cooperation and Trade Division, Ministry of SMEs and Startups, Korea: The speaker shared insights into Korea’s efforts to support women entrepreneurs, with a special focus on agricultural technology. His presentation provided a comprehensive overview of Korea’s legal frameworks, institutional policies, and key outcomes in promoting gender-inclusive economic growth.

Women entrepreneurs are recognized as key drivers of innovation and economic resilience in Korea. As of recent years, women-owned businesses have come to represent a growing share of Korea’s entrepreneurial ecosystem. Acknowledging

this, the Korean government has taken steps to establish a robust support structure for female entrepreneurs. Central to these efforts is the “Act on Support for Female-Owned Businesses,” which was enacted to ensure gender equality. This act aims to increase women's participation in business, facilitate startup activities, and elevate the role of women in the economy.

Korea’s policy approach toward empowering women entrepreneurs is built around four main pillars: startup support, market access, human capital development, and global growth facilitation. For startups, the government offers access to physical infrastructure like office and meeting spaces, and provides consulting services, information platforms, and intellectual property support. Women-led startups are further empowered through targeted funding, such as the Innovative Startup Commercialization Fund, and by participating in coaching programs and economy-level competitions that offer mentorship.

In terms of market access, Korea has introduced certification programs and established channels that help women-owned businesses participate in public procurement processes. These measures are designed to lower entry barriers and encourage fair competition. Human capital development is another cornerstone of Korea’s strategy. Through mentoring networks, education initiatives, and next-generation leadership platforms, the government cultivates entrepreneurial skills and builds strong community support systems for aspiring businesswomen.

Global growth is equally prioritized. Korean women entrepreneurs are given access to training, coaching, marketing, and market-entry programs to support their expansion into international markets. These programs are instrumental in enabling women to scale their businesses and tap into global value chains. The positive results of these efforts are evident. According to a 2024 survey, women-led enterprises in Korea are showing measurable improvements in stability, productivity, profitability, exports, R&D investment, and capital turnover.

However, challenges remain. Female entrepreneurs continue to face difficulties balancing work and family responsibilities, and often lack access to innovation ecosystems and professional networks. The pressures of globalization add another layer of complexity, demanding that businesses continuously adapt to shifting markets and technological advancements.

The speaker emphasizes that a well-structured policy framework—one that includes legal backing, financial resources, capacity-building, and internationalization strategies—can effectively promote women's entrepreneurship. By fostering inclusive innovation in sectors like agriculture, Korea not only empowers women but also strengthens its broader economic and social fabric.

5. **Identifying resources to strengthen capacity building and skills development**

Ms Nguyen Huong Tra, International M&E Expert, Viet Nam: The speaker shared her experiences when conducting a project advancing circular agriculture in Papua New Guinea (PNG) with a focus on the capacity, skills, and resource requirements for women-led micro, small, and medium enterprises (MSMEs). Her presentation highlighted the immense potential of circular agriculture (CA) in rural economies, especially when driven by the leadership and innovation of women entrepreneurs.

PNG is one of the most rural and diverse economies in the South Pacific, home to more than 850 languages and a population exceeding 10 million. Agriculture contributes significantly to its economy, providing livelihoods for over 85% of the population and contributing 22% of GDP. Traditional farming systems in PNG already embody many principles of circular agriculture, such as agroforestry and organic recycling. However, these practices face modern challenges, including climate change, land degradation, and limited infrastructure.

Women in PNG play a central role in agriculture, comprising nearly half of the population. They are heavily involved in both subsistence farming and informal market economies, often producing staple crops and contributing to cash crops like cocoa, coffee, and vanilla. Despite their contributions, women face systemic barriers including limited land ownership, financial exclusion, and restricted access to decision-making roles. Only around 10% of rural women in PNG own land, limiting their ability to invest or scale their operations.

The presentation showcased several key circular agriculture initiatives in PNG. One notable project, under the EU-STREIT PNG program, integrates cocoa and vanilla farming with livestock systems. By transforming agricultural waste such

as cocoa pod husks and vanilla cuttings into compost and combining it with animal manure, farmers enrich their soils while reducing dependence on chemical fertilizers. These projects also include farmer training, enabling them to manage composting and livestock practices more effectively.

In another initiative, sustainable vanilla farming incorporates agroforestry systems that use native shade trees to improve biodiversity and soil health. Vanilla cuttings are composted and reused, and farmers receive training in hand pollination and pest control to reduce chemical inputs. These efforts increase yields, protect ecosystems, and open access to premium organic markets. Similarly, a landscape management project is converting monoculture farms into agroforestry systems, improving habitat quality, reducing erosion, and enhancing resilience to climate impacts.

Women-led MSMEs have been at the forefront of these efforts. Their leadership in sustainable vanilla cultivation and biodiversity conservation has demonstrated the transformative potential of women in agriculture. Programs that certify organic practices have opened premium markets, increased incomes and encouraged environmentally responsible farming.

However, several obstacles remain for scaling up circular agriculture in PNG. Infrastructure limitations, inadequate access to finance, and insufficient training hinder growth. For women, these challenges are compounded by cultural norms and systemic inequalities in land rights and financial services. While opportunities like organic certification and agroforestry offer high potential, realizing them requires structural reforms and targeted support.

To address these issues, it is recommended that more efforts should be made to promote gender-responsive land policies, expand financial services tailored to women-led MSMEs, strengthening market linkages for sustainable products, and invest in infrastructure such as storage and transport systems, etc. Additionally, there is a need for ongoing capacity building in technical, business, and leadership skills, with a particular focus on local languages, visual learning, and integrating traditional knowledge into modern practices.

Ultimately, women-led MSMEs can be powerful agents for agricultural transformation in PNG and beyond. With the right combination of policy support,

training, and resources, these enterprises can lead the shift toward sustainable, circular agriculture while improving livelihoods and fostering inclusive rural development. The future of agriculture in PNG, as illustrated, lies in empowering its women to take the lead in innovation, resilience, and ecological stewardship.

Dr Pham Thi To Oanh, Director, Viet Nam Cooperative Alliance (VCA): Cooperatives are increasingly embracing models that reduce waste, recycle resources, and integrate sustainable production systems. These circular approaches are particularly relevant in the context of climate change and the need to build resilient agri-food value chains. The principles of the circular economy—such as environmental protection, waste minimization, and resource regeneration—are becoming embedded within cooperative operations, especially in rural and agricultural communities.

Several case studies illustrate the dynamic ways in which cooperatives are integrating these principles. One notable example is the Toan Thuong Agricultural Cooperative in Lang Son Province, where farmers cultivate rose hips across 2,000 hectares of land. This cooperative has implemented a circular model that incorporates aquaculture, waste treatment, and product processing within a closed-loop system. Leveraging livestreaming and digital marketing platforms, the cooperative has expanded its market reach significantly, is expected to increase its production value from VND 10 billion in 2024 to a projected VND 40 billion by 2026.

Another successful example is the Ta Thu Huong Bamboo and Bamboo Conical Hat Cooperative in Thanh Oai, Hanoi. This cooperative utilizes renewable materials to produce traditional handicrafts while supporting local employment and sustainable tourism. Similarly, the Ha Thai Lacquer Cooperative, led by Director Nguyen Thi Hoi, exemplifies how local artisans can combine cultural heritage with environmental responsibility by using natural materials and safe processing methods.

Capacity building remains a key challenge but also opportunity in the cooperative sector. Strengthening skills in digital transformation, market communication, environmental management, and technical production is essential to enable cooperatives to scale their impact. Viet Nam is pursuing strategies that promote

education, technical training, and financial access. These efforts aim to transform cooperatives into engines of innovation and sustainability within rural economies.

In conclusion, by investing in capacity development and fostering inclusive participation, especially of women, cooperatives can generate both social and environmental returns. Their success stories demonstrate the power of collective action, local leadership, and strategic policy support in building a more resilient and sustainable agricultural future.

IV. Discussion, Recommendations and Conclusions

Through the active sharing of information and experiences at the Workshop, speakers and participants exchanged views on how to promote women-led MSMEs to adopt circular agriculture. Recommendations are summarized as below:

1. Recommendations for women-led MSMEs

- Raise awareness for manufacturing MSMEs of the importance and benefits of adopting circular economy.
- Promote access to finance green loans and grants to facilitate their adoption of circular economy models.
- Raise specific requests as well as seek support for technical support and innovation technical assistance, especially customized programs for manufacturing enterprises.
- Promote market access and networking market platforms.
- Promote strategic marketing and branding to increase awareness of circular agriculture and its branding to improve access to market.

2. Recommendations for APEC member economies/governments

- Promoting gender-responsive land policies.
- Expanding financial services tailored to women-led MSMEs (e.g.: green microfinance/credit guarantees, etc.,).
- Investing in infrastructure such as storage and transport systems, etc., to support MSMEs in general, women-led MSMEs in particular in practicing circular agriculture in an efficient manner.

- Enhance circular economy capacity through enhancing carbon management.
- Promote collaborative partnerships, including but not limited to promoting multi-stakeholders, institutional collaboration, R&D investment, models such as cooperatives alliance, etc.,
- Promote ongoing capacity building programs/activities in technical, business, and leadership skills, with a particular focus on local languages, visual learning, and integrating traditional knowledge into modern practices.
- Promote digital platforms for digital skills/traceability/biotech as well as harness women-led MSMEs to take advantages of e-commerce to enhance access to markets, strengthening market linkages for sustainable products.

3. Recommendations for APEC as a whole

- Foster green trade initiatives and common eco-certification within APEC.
- Support technology and technical cooperation in APEC (e.g.: APEC green tech platform); empower women entrepreneurs through promoting funding or incubation for tech ventures); and so on.
- Promote capacity building for APEC member economies through providing training/workshop/seminars, etc., to support women entrepreneurs in practicing circular agriculture

Hereinabove are some recommendations from the workshop's participants and speakers that require further thoughts and discussions at the upcoming SMEWG meetings to transform into more concrete and practical activities.