Capacity Building for MSMEs in the Use of Emerging Technologies to Enhance Food Security

Final Report

APEC Policy Partnership on Science, Technology and Innovation

August 2026

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I. EXECUTIVE SUMMARY

Food security in APEC economies is increasingly conditioned by climate variability, disruptions in supply chains, rural connectivity gaps, an aging agricultural population, resource scarcity, and unequal access to innovation. In this context, micro, small, and medium-sized enterprises (MSMEs) play a key role in food production, processing, logistics, and market access. However, many of them face barriers that limit their ability to adopt emerging technologies on a scale. These barriers include limited digital infrastructure, high upfront costs, insufficient technical capabilities, fragmented data systems, regulatory uncertainty, and weak links between research, technology providers, and producers.

The evidence reviewed shows that emerging technologies, including artificial intelligence (AI), the Internet of Things (IoT), Big Data analytics, blockchain, digital platforms, robotics, drones, biotechnology, climate-smart tools, and traceability systems, can substantially improve agricultural productivity, input use efficiency, climate resilience, quality assurance, food safety, and market integration. Nevertheless, technology alone is not enough, as scaling depends on enabling ecosystems in which public policies, financing, digital infrastructure, data governance, technical assistance, standardization, and public-private collaboration converge.

The 2026 Workshop in Piura reinforced this conclusion. Presentations from Indonesia; Malaysia; Peru; Viet Nam, and other participants showcased concrete applications of emerging technologies for agricultural modernization, water management, genotype selection, climate monitoring, traceability, smart production, and territorial resilience; at the same time, the workshop showed that MSMEs need accessible technologies, practical training, connectivity, and financing mechanisms that reduce the risk of adoption.

II. CASE STUDIES AND IMPLEMENTATION LESSONS

The case studies allow us to analyze how APEC economies apply emerging technologies to strengthen food security and improve the productivity, resilience, and competitiveness of agri-food MSMEs. Next, scalability strategies and their success factors in APEC economies will be presented.

II.1 Analysis of successful scaling strategies and key success factors across APEC

In APEC economies, the cases analyzed show that the adoption of technologies such as IoT, artificial intelligence, blockchain, and Big Data has greater potential for scaling when they address specific operational problems affecting farmers and MSMEs. These challenges include water scarcity, pest pressure, variability in productivity, high input costs, food losses, limitations in traceability, and weak articulation with markets.

The strongest cases reviewed show that successful scaling does not depend solely on the incorporation of technology, but on a systemic approach. In this sense, technological solutions are integrated into broader models that encompass technical assistance, financing, data platforms, field validation, market access, and institutional support. This pattern is observed in both smart agriculture initiatives and the digitization of food chains, with reductions in losses, improvements in traceability, and strengthened food security.

Additionally, scalability depends on the ability to adapt technologies to local conditions. For MSMEs, modular and low-cost solutions are more viable than complex systems that require high initial investments and specialized personnel. That's why successful strategies combine affordability, simplicity, interoperability, and ongoing technical support. In addition, pilot projects are essential because they allow economies to test technologies in specific crops, territories, and value chains before expanding them through policy instruments, financing schemes, and extension services.

A common success factor is multi-stakeholder collaboration. Government institutions provide policy direction, infrastructure, and incentives; private companies provide technological solutions and implementation capacity; research institutions validate models and generate evidence; and MSMEs provide practical knowledge about field needs. This combination is particularly important in agriculture, where digital solutions need to be reliable, locally relevant, and technically sound to be adopted sustainably.

Public-private collaboration is also identified as a decisive scaling mechanism. Korea's Smart Farm Innovation Valley illustrates how public infrastructure can be combined with private sector innovation to support startups and MSMEs. The blockchain traceability experience for coffee producers in the Philippines shows how digital records can increase transparency, strengthen

product authenticity, and improve value capture. Japan's WAGRI platform demonstrates the value of a shared agricultural data infrastructure, while Kubota's demonstration project illustrates how robotics, IoT, automation, big data, and traceability can be integrated into replicable precision agriculture models. In Viet Nam, the Project for the Development of the Vegetable and Fruit Processing Industry for the years between 2021 and 2030, teaches us how partnerships between government, private companies, and producer organizations can introduce drones, precision irrigation, and integrated pest management to improve productivity and resource efficiency.

Overall, the most relevant scaling factors are: (i) solid policy alignment; (ii) affordable and modular technology; (iii) rural connectivity and interoperable data systems; (iv) technical assistance and extension services; (v) pilot-based validation; (vi) public-private partnerships; (vii) financing and risk-sharing mechanisms; (viii) trust, transparency and data governance; and (ix) integration of value chains that link technological adoption with productivity, food safety, traceability and access to markets.

Table No. 1. Key factors and implications for scaling

Key factors	Implications for scaling
Affordability	Low-cost devices, subscription services, shared team models, and staged investments.
Usability	Technologies should be simple, multilingual where appropriate, accessible by wireless devices and adapted to different levels of digital literacy.
Evidence and validation	Field trials, demonstration farms, and pilot projects provide evidence of performance prior to scale-up.
Infrastructure	Broadband, access to energy, sensors, data platforms and logistics systems are essential foundations for digital agriculture.
Institutional support	Policies, roadmaps and inter-agency coordination help align innovation with food security priorities.
Capacity building	Continuous training of farmers, technicians and extension workers is essential to ensure the sustained adoption of technologies.
Data governance	Interoperability, cybersecurity, privacy and the principles of responsible AI strengthen trust between producers and institutions.
Link to markets	Digital tools have greater potential for scaling when they facilitate access to buyers, strengthen certification and traceability, and contribute to better commercial conditions.

II.2 Lessons learned to enhance implementation

The following are the main lessons learned to improve the implementation of solutions based on emerging technologies, considering factors that favor their effective adoption, sustainability, and

scaling in the productive field. These lessons guide future interventions towards more relevant, applicable models aligned with the needs of MSMEs and food value chains.

The first lesson of implementation is that digital agriculture initiatives must start from concrete, clearly identified problems, not just from the availability of a technological solution. Adoption by MSMEs will be more viable when technology responds to the real needs of productive activity, such as improving efficiency in the use of water, controlling pests and diseases, optimizing fertilizers, reducing losses, ensuring food quality and safety, accessing price information, or improving logistics and connection with markets.

Therefore, the selection of technologies must be based on a prior diagnosis of the production context. This diagnosis must consider the demand of producers, the economic and social characteristics of the territory, the level of digital capabilities, connectivity conditions, implementation costs, and the main restrictions of the value chain. In this way, digital solutions can be designed or adapted to users' needs, increasing their chances of adoption, sustainability, and scaling.

The second lesson is that implementing emerging technologies must combine digital solutions with ongoing human support. The availability of sensors, platforms, mobile apps, artificial intelligence systems, or data analysis tools alone does not guarantee effective adoption, especially if users lack the capabilities to interpret the information and apply it to their production decisions. For this reason, practical training, demonstration farms, learning among farmers, the accompaniment of digital extension agents and continuous technical support are key elements to transform the data generated by technology into concrete decisions, such as adjusting irrigation, preventing pests, optimizing fertilizers, improving product quality or reducing losses. In this sense, capacity building should not be considered a complementary activity but a central condition for the adoption and sustainability of digital solutions, particularly in rural areas where connectivity gaps, lower digital literacy, and limited access to specialized technical assistance are common.

A third lesson is the need to build trust and ensure continuity throughout the implementation process. For MSMEs to adopt emerging technologies in a sustained manner, it is not enough to demonstrate that a tool works in a pilot phase; It is also necessary to generate confidence about its reliability, ease of use, data protection, operating costs, and concrete benefits for productive activity. Producers and small businesses must perceive that the digital solution delivers real value, whether through time savings, reduced losses, improved productivity, access to better markets, or greater traceability.

Continuity of technical support is also key. Many initiatives manage to generate initial interest but lose momentum when the accompaniment ends, funding is withdrawn, or there are no clear mechanisms for maintenance, updates, and subsequent support. Therefore, projects must

incorporate a monitoring strategy, financial sustainability, institutional support, and the gradual transfer of capacities during the design phase. Otherwise, short-term interventions may raise expectations but not necessarily consolidate effective adoption or sustainable scaling.

The fourth lesson is that data quality, interoperability, and information governance must be addressed from the initial stages of design and implementation. AI-based decision tools, supply chain monitoring systems, traceability platforms, and early warning applications depend on reliable, timely, complete, and comparable data. If the information used is incomplete, inconsistent, or does not respond to common criteria for recording, analysis, and updating, the recommendations generated by these technologies may lose precision and usefulness for producers, MSMEs, or institutions.

Interoperability is also essential to prevent digital solutions from operating in isolation. When platforms, databases, sensors, mobile applications, or institutional systems cannot exchange information adequately, the ability to generate integrated analyses, monitor the value chain, and scale solutions to other territories or productive sectors is limited. Therefore, data collection protocols, minimum quality standards, interoperability criteria, institutional responsibilities, and clear rules on access, use, protection, and updating of information must be defined from the outset.

In the absence of these elements, implementation can deteriorate progressively: reliability of the results decreases, user trust declines, efforts are duplicated, integration costs increase, and scaling becomes difficult. Therefore, data management should not be considered a secondary technical component, but an enabling condition for the sustainability, transparency, and effectiveness of digital solutions.

The fifth lesson is that public policies and market incentives must be articulated to promote sustainable technological adoption. MSMEs have greater incentives to adopt digital solutions when they not only address a productive need but also generate clearly identifiable economic, regulatory, or commercial benefits. For example, traceability systems can facilitate compliance with export and certification requirements; smart irrigation tools can reduce costs associated with water and energy use; and climate-smart systems can help reduce losses from climatic events, pests, or variations in productivity.

In this sense, technological adoption is strengthened when there is a clear connection between public policy priorities, market demands, and available technological services. It is not enough to promote digital tools in isolation; These need to be linked to support instruments, financial incentives, technical assistance, certification schemes, public procurement, market access, and mechanisms for recognizing the value generated. When these elements converge around a common value proposition, MSMEs perceive more clearly the benefits of technological investment and increase the likelihood of continuity, appropriation, and scaling.

The sixth lesson is that the implementation of emerging technologies must incorporate an inclusive approach, especially aimed at women and youth. Inclusive training, technical accompaniment, and support for entrepreneurship allow the benefits of digital agriculture to reach groups that often face greater barriers to accessing technology, financing, market information, and technical assistance. Actively including women producers, rural entrepreneurs, and young people linked to agriculture can improve the adoption of digital tools, strengthen local capacities, and generate new economic opportunities in food chains.

Likewise, the participation of young people is key to promoting generational change in the agricultural sector, especially in contexts where agri-food activity faces an aging workforce, rural migration, and limited appeal to younger generations. Digital technologies, such as mobile apps, sensors, data platforms, e-commerce, traceability, or climate-smart solutions, can make agriculture more attractive, innovative, and profitable for young people. Therefore, implementation programs must consider specific actions in digital training, mentoring, access to financing, entrepreneurship incubation, female leadership, and youth participation, ensuring that technological transformation also contributes to greater productive and social inclusion.

The seventh lesson is that pilots should be designed from the start with a clear path to scaling. Pilot interventions should not be limited to testing a technology solution on a small scale; they should generate sufficient evidence to decide whether the solution can be scaled up, adjusted, or discarded. To do this, we need to define a baseline, outcome indicators, implementation costs, expected benefits, user feedback mechanisms, and clear expansion criteria. This information enables assessment of whether technology is viable, sustainable, cost-effective, and adaptable to other territories, value chains, or groups of MSMEs.

Likewise, a scale pilot route must contemplate progressive stages of validation, adjustment, and expansion. This involves identifying the conditions that must be met before scaling, which actors will take responsibility, the resources needed, and the risks that could limit continuity. In this way, pilots are no longer isolated experiences but tools for learning, decision-making and planning for a broader and more sustainable implementation.

The eighth lesson is that technological adoption requires enabling conditions of digital and operational infrastructure. In rural or remote areas, solutions based on sensors, mobile applications, digital platforms, artificial intelligence, traceability, or early warning systems can only work in a sustained manner if there are minimum conditions of connectivity, access to electricity, local maintenance, and resilient channels for data transmission. When these conditions are absent, technologies can experience interruptions, produce incomplete information, increase operating costs, and erode user confidence.

Therefore, digital agriculture projects must evaluate existing infrastructure gaps during design and provide alternatives adapted to the territory, such as offline solutions, community connectivity, solar energy, local technical support, decentralized maintenance, and backup information systems. In this way, implementation becomes more realistic, resilient, and sustainable in contexts with limited digital coverage.

III. POLICY PATHWAYS

III.1 Strategies and policies to facilitate technology adoption and scaling

Based on the findings of the workshop and relevant information from different programs, Government Funding Schemes, and policies from APEC economies, it is proposed that the scaling of emerging technologies (ET) requires key strategies to be identified, including:

- Integrated Policies and Innovation Infrastructure: Adopt a comprehensive policy strategy to guide the overall vision for food security, ensuring that high-level goals are effectively translated into practical farmer programs. This requires a "Double Transformation" approach: synchronizing central regulatory frameworks with regional execution to avoid the deployment of unsuitable technologies, while institutionalizing "Smart Farm Innovation Valleys" (based on the Sangju, Gyeongsangbuk-do, Republic of Korea model). These facilities serve as domestic testbeds where MSMEs and young farmers can experiment with advanced environmental control systems and integrated data platforms without incurring high upfront capital costs. Through the provision of state-supported infrastructure for technological validation and performance assessment in real operating conditions, these hubs reduce adoption risks and ensure that policy-backed R&D is directly validated in the field. Such integration ensures that MSMEs and smallholders transition from passive technology adopters to active owners of precision farming systems, securing long-term supply chain resilience. Ultimately, regional research units should be specialized by function (e.g., Viet Nam case: specific crop research vs. technology transfer).
- Regulatory Harmonization and Policy Synchronization: Prioritize the synchronization of central government mandates with regional execution to eliminate the recurring "policy misalignment" where the distribution of emerging technologies results in the "wrong tool for the wrong land". This requires aligning regional spatial planning with domestic smart farming zones and adapting technology deployment to specific local agro-ecological and climatic conditions. Technical implementation should be guided by a "One Data" (BRIN, Indonesia case) centralized database, integrated with soil types and weather history, to ensure that infrastructure and digital tools, such as drones and IoT sensors, are tailored to the unique requirements of each agricultural parcel. Furthermore, institutional empowerment of local governments is essential to monitor

distribution and ensure the technical suitability of advanced environmental control systems for MSMEs. By harmonizing these regulatory frameworks, economies can bridge the structural digital divide and ensure that precision farming interventions are commercially viable and effective at the field level.

- Innovation Ecosystem Approach: Strengthening the Research, Development, Commercialization, and Innovation framework to bridge the gap between laboratory prototypes and field-ready applications. This framework should be designed not only to boost internal productivity but also to position MSMEs and smallholders as competitive high-tech players in global markets. By fostering expertise in specialized niches—such as greenhouse technology or precision management—economies can enable small-scale producers to export technological solutions, transitioning them from technology consumers to global agritech innovators.
- Technology Demonstration and Validation: Prioritize the deployment of technology demonstration projects to showcase practical and cost-effective pathways for technological adoption. By testing innovative solutions under real operating conditions, these initiatives allow for a thorough assessment of technical performance and operational suitability—critical for adapting overseas technologies to local small-scale or tropical environments—before MSMEs and family farms commit significant capital investment (The Singapore Case). This strategic "de-risking" mechanism ensures that successfully demonstrated technologies can be subsequently supported through targeted funding frameworks, thereby bridging the gap between emerging tech availability and large-scale commercial implementation.
- Affordable Digitalization: Prioritize the deployment of low-cost, high-adoption digital tools that leverage existing, familiar communication platforms to bridge the demographic and digital literacy gap. A notable implementation is PaddyChat, an AI-driven support system from Malaysia, that operates entirely via WhatsApp to provide producers with instant, reliable expert advice. It is relevant to utilize Computer Vision (CV) for the diagnostic identification of pests and diseases from user-submitted photographs, and to incorporate Large Language Models (LLMs) for conversational technical assistance. The elimination of complex standalone applications and utilizing intuitive interfaces, this strategy ensures that emerging technologies remain accessible to MSMEs and aging farmer populations, facilitating real-time decision support and reducing response times to agricultural threats.

III.2 Public-private partnership[1] models and funding mechanisms

Recommended mechanisms include:

- Dynamic Financing Instruments: Implementing Peer-to-Peer (P2P) financing, equity crowdfunding, and specialized AgTech venture capital to mitigate the limitations of traditional banking for MSMEs. Economies could consider establishing Development Funds (e.g., Hong Kong, China model), which provide direct grants for projects that enhance farm competitiveness and finance technical support schemes to facilitate knowledge transfer to small-scale producers.
- Agri-Food Cluster Transformation Funds: Adopting co-funding models (Singapore Case) to provide direct financial support for local farms to adopt technologies, upgrade capabilities, and enhance resource efficiency.
- Low-Interest Modernization Loans: Providing credit facilities with preferential rates (e.g., Malaysia's 3% interest rate) specifically for the acquisition of smart farming hardware.

III.3 Recommendations on incentives, regulations, and capacity-building for MSMEs

- Strategic Tax Incentives: Grant tax exemptions for a period of 5 to 10 years for local AgTech (Indonesia case) startups and hardware manufacturers, such as those producing IoT sensors and drones, to reduce the high cost of technology adoption and the total cost of ownership for farmers. This policy aims to encourage the private sector and startups to localize production and decrease reliance on expensive imported machinery.
- Data Governance and Security Frameworks: Establish clear regulations on data privacy, ethics, and cybersecurity to foster a secure environment that builds trust among producers using Big Data and AI platforms. Implementation must prioritize a "One Data" approach for centralized database management that ensures data sovereignty and system stability, while ensuring that digital tools are used responsibly and effectively within the agrifood sector.
- Generational Renewal: Rebranding agriculture as a high-tech agrifood business to attract youth, supported by Technical and Vocational Education and Training in drone operations, IoT dashboard management, and predictive analytics, and specific "Training of Trainers" programs. These programs should utilize specialized funds to train family farmers in modern cultivation techniques, ensuring the continuity of small-scale agriculture.
- Market Access and Recognition Programs: Recognize food businesses in the hotel, restaurant, and catering sector that procure at least 15% (reference: SFA, Singapore) of locally farmed produce across specific categories. This should be complemented by digital B2B platforms that

[1] PPPs are the primary engine for operationalizing the 2030 Roadmap

aggregate demand for MSMEs, allowing them to participate in high-value supply chains and improve their commercial viability.

IV. WORKSHOP RESULTS AND STAKEHOLDER INSIGHTS

During the 2026 Piura workshop, relevant results were generated from technical presentations, group work, recommendations from participating economies, and surveys conducted before and after the event. These inputs made it possible to identify key findings, learnings, persistent gaps, and opportunities for regional cooperation, as well as to analyze the potential of emerging technologies (Internet of Things, artificial intelligence, Big Data, blockchain, sensors, drones, and digital platforms) to strengthen productivity, climate resilience, traceability, and decision-making in agri-food systems.

IV.1 Key findings and outcomes from the workshop

The workshop identified common challenges that limit the adoption and scaling of emerging technologies in the agri-food systems of APEC economies. Among the main challenges are climate change, connectivity and digital infrastructure gaps, financing restrictions, low digital literacy, limited access to reliable data, and the still-insufficient technical capacities of MSMEs to incorporate technological solutions into their production processes. These challenges directly affect productivity, resource efficiency, risk management, traceability, food safety, loss reduction, and market access.

A central finding of the workshop was that technology alone does not guarantee sustainable improvements in food security. The effective adoption of tools such as the Internet of Things, artificial intelligence, Big Data, blockchain, sensors, drones, remote sensing, and digital platforms requires enabling conditions. These include rural infrastructure, access to financing, specialized technical assistance, capacity building, data governance, institutional coordination, and public-private cooperation.

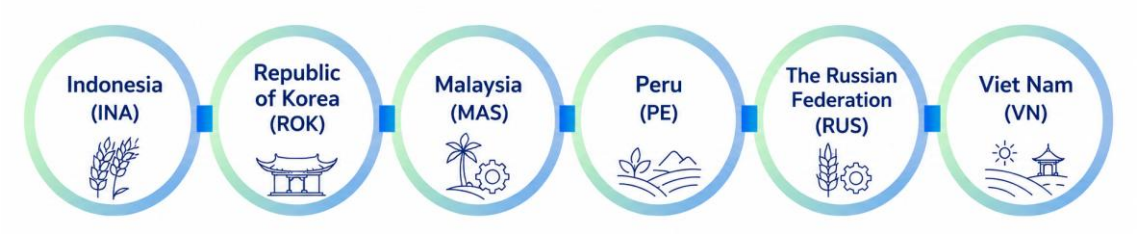
The technical sessions showed that emerging technologies can provide concrete solutions to different agri-food challenges. Regarding climate change, participants highlighted the relevance of resilient varieties, early warning systems, regenerative agriculture, efficient water management, and climate information tools to support decisions on planting, irrigation, harvesting, storage, and logistics. In the case of IoT, the use of sensors for smart irrigation, soil moisture monitoring, temperature and pH measurement, greenhouse control, cold chain management, plant health, and traceability were emphasized. In relation to Big Data and artificial intelligence, participants recognized their potential for pest monitoring, genotype selection, production forecasting, quality

analysis, risk detection, and the generation of agronomic recommendations adapted to the needs of MSMEs.

Likewise, the workshop evidenced the importance of adapting technological solutions to the real conditions of producers and smaller-scale enterprises. Tools should be affordable, easy to use, relevant to local contexts, and compatible with existing digital capabilities. In this regard, participants emphasized the need to prioritize practical and low-cost solutions with familiar interfaces to facilitate adoption and ensure sustainability over time.

The participating APEC economies are presented in Figure No 1.

Figure No 1. APEC economies participating in the workshop



The workshop had 37 participants, of which 33 attended in person and 4 participated virtually. The largest participation corresponded to Peru, with 29 participants: 26 in person and 3 virtual. Representatives from Indonesia; Republic of Korea; Malaysia; The Russian Federation; and Viet Nam also participated. This distribution enabled the collection of perspectives from diverse economies, combining the host economy's experience with regional insights on innovation, digital transformation, and food security.

In terms of gender, overall participation was relatively balanced**:** 59% men and 41% women. This result evidences significant female participation and reinforces the importance of promoting inclusion and gender equality in capacity-building activities related to science, technology, and innovation applied to food security.

Table No 2. Participants by gender and mode of attendance

		In-person	Virtual
Economy	Gender (M / F)	N° Participants	N° Participants
Indonesia (INA)	F	1	-
	M	1	-
Republic of Korea (ROK)	F	1	-
	M	-	-
Malaysia (MAS)	F	1	-
	M	1	-
Peru (PE)	F	9	2
	M	17	1
The Russian Federation (RUS)	F	-	1
	M	-	-
Viet Nam (VN)	F	-	-
	M	2	-
Total		**33**	**4**

The survey results further confirm the positive outcomes of the workshop. The post-workshop survey collected responses from 25 participants, showing strong gender balance among respondents, with 52% female participation and 48% male participation. Peru, as host economy, represented the largest share of survey respondents, while the participation of Indonesia; Republic of Korea; Malaysia; The Russian Federation; and Viet Nam reinforced the regional perspective of the workshop.

Another relevant outcome was the strengthening of participants' knowledge and skills. Average self-assessed proficiency increased from 3.48 before the workshop to 4.16 after the workshop, representing an improvement of 19.5%. This indicates that the workshop contributed to improving participants' understanding of smart agriculture, IoT, blockchain, artificial intelligence, Big Data, remote sensing, and other digital tools applied to the agri-food sector.

The project also received a high relevance score of 4.64 out of 5, equivalent to 92.8%, confirming that the workshop addressed topics aligned with participants' professional needs and with the strategic priorities of APEC economies. Participants highlighted the usefulness of the contents for their work, especially in relation to MSMEs, agricultural innovation, climate resilience, traceability, productivity, food safety, and market access.

Participant satisfaction was also high across the main evaluation categories. The survey showed 100% agreement that the objectives were clearly defined, the project achieved its intended objectives, the topics covered were relevant, the content was well organized, the facilitators were well prepared and knowledgeable, and the time allocated was sufficient. In addition, 96% of respondents considered the materials useful, while 92% agreed that gender issues were sufficiently addressed during implementation.

The feedback also shows that participants acquired new knowledge in several strategic areas. First, they strengthened their understanding of emerging technologies in agriculture and food security, particularly smart farming, IoT, blockchain, artificial intelligence, Big Data, remote sensing, and digital platforms. Second, they learned from digital projects, policy approaches, and MSME support experiences from other APEC economies. Third, the workshop broadened their understanding of the role of science, technology, and innovation governance in agricultural modernization and food security.

Beyond technical learning, the workshop generated a valuable space for regional cooperation and knowledge exchange. Participants highlighted the importance of sharing experiences, building professional networks, identifying potential partnerships, and promoting future collaboration among APEC economies. The exchange of good practices and practical examples was considered one of the most valuable elements of the workshop, particularly for supporting MSMEs and strengthening the adoption of emerging technologies in agri-food systems.

Participants also identified several ways to apply the knowledge gained in their own work. These include developing policy initiatives and regulations, preparing work plans and strategies, strengthening monitoring and evaluation systems, organizing training activities, designing tools for farmers and MSMEs, promoting pilot projects, and building alliances with public institutions, private actors, academia, and regional partners. These results suggest that the workshop generated practical value beyond the event itself and can support future APEC actions on food security and emerging technologies.

Finally, participants identified three areas to strengthen future initiatives: the inclusion of more region-specific data and case studies, deeper technical content, and more time for networking and collaboration. These suggestions provide useful guidance for future APEC activities aimed at moving from capacity building toward pilot implementation, technology transfer, and scalable cooperation mechanisms.

Taken together, the results show that agri-food digital transformation in APEC requires a combination of technological innovation, human capabilities, financing, institutional cooperation, data governance, public-private partnerships, and inclusive MSME-oriented approaches. The workshop therefore contributed not only to strengthening knowledge, but also to identifying practical pathways for cooperation, implementation, and scaling of emerging technologies to enhance food security across APEC economies.

IV.2 Perspectives from key stakeholders (industry leaders, policymakers, MSMEs)

The workshop allowed us to collect diverse perspectives from policymakers, technical and academic specialists, as well as MSMEs and producers in the agri-food sector. Although each group emphasized different priorities, they all agreed that the adoption of emerging technologies must respond to specific needs, be supported by enabling conditions, and be developed through sustained cooperation.

From the perspective of policymakers, the top priority is to create an enabling environment for technology adoption and scaling. Their interventions highlighted the need to strengthen rural connectivity, expand digital and productive infrastructure, develop adequate incentives, improve financing mechanisms, and promote regulatory frameworks that facilitate the safe and effective use of technologies such as IoT, artificial intelligence, drones, blockchain, and digital platforms.

The importance of standardization, data interoperability, and coordination between levels of government was also highlighted. For this group, technology only generates impact when it is inserted into coherent, articulated policies aimed at solving specific food safety problems. Policymakers emphasized that the digital transformation of the agri-food sector must align with domestic and regional strategies and with cooperation mechanisms among APEC economies.

From the technical and academic perspective, the emphasis was on data quality, scientific validation, and the adaptation of technological solutions to real field conditions. Experiences linked to the use of artificial intelligence for genotype selection, agri-food analytics, climate monitoring, and water stress management showed that emerging technologies require solid methodological bases, reliable information, and validation processes before their adoption on a larger scale.

The need to transform scientific knowledge into practical and operational solutions for producers, companies, and public entities was also highlighted. This implies not only generating research, but also turning it into accessible tools, relevant to the territory and useful for decision-making. From this perspective, technology transfer, technical assistance, and linkages between universities, research centers, the private sector, and producers are essential to closing the gap between research and productive application.

From the perspective of MSMEs, the main criterion for technological adoption is practical utility, with interest in solutions that improve productivity, reduce climatic and production uncertainty, optimize resource use, reduce costs, facilitate access to markets, and meet quality, safety, and traceability requirements.

In addition, technological novelty is not enough to justify adoption. The tools must be affordable, easy to use, compatible with existing capacities, and generate observable benefits in the short or

medium term. Consequently, the solutions with the greatest potential for adoption are those that address specific problems for the producer or the company, use simple interfaces, require a low initial investment, and offer technical support during implementation.

Despite their differences, the perspectives gathered converge on a common conclusion: the digital transformation of food systems in APEC economies must be collaborative, gradual, and results-oriented. No single actor can sustain the scaling of emerging technologies. Governments can create enabling conditions; academia and research centers can generate evidence, validate technologies, and support knowledge transfer; and MSMEs bring the practical experience needed to ensure that solutions are relevant and applicable.

For this reason, the workshop evidenced the relevance of strengthening cooperation models based on the triple helix, integrating government, academia, and the productive sector. Likewise, the need to create more permanent cooperation platforms among APEC economies was identified, aimed at exchanging experiences, developing joint pilots, harmonizing standards, strengthening capacities, and mobilizing financing for technological solutions applied to food security.

IV.3 Opportunities for regional collaboration, funding, and cross-economy projects

APEC cooperation can shift from an approach focused on the exchange of experiences to one more oriented towards joint implementation. The opportunities identified are concentrated in three complementary areas: regional collaboration, financing mechanisms, and inter-economic projects applied to food security and the adoption of emerging technologies by MSMEs.

a. Opportunities for regional collaboration

A first opportunity is to consolidate regional spaces to share good practices, technical evidence, and digital solutions applied to agriculture. These spaces could bring together experiences in IoT, artificial intelligence, Big Data, blockchain, sensors, drones, traceability, and climate-smart agriculture, prioritizing tools validated in real-world conditions and adaptable to the needs of MSMEs.

There is also potential to strengthen regional training networks aimed at producers, extension workers, public officials, researchers, and technology companies. These networks should focus on practical skills, such as the use of sensors, data interpretation, management of digital platforms, traceability, climate management, pest prediction, and information-based decision-making.

Another key opportunity is to advance the interoperability of data and digital standards. The adoption of emerging technologies requires common criteria on data quality, cybersecurity, privacy, traceability, ethical use of artificial intelligence, and cross-platform compatibility. APEC can

facilitate this process through guidelines, technical roundtables, and cooperation among economies with greater experience in digital agriculture.

The need to strengthen the articulation between governments, universities, research centers, companies, and producers is also identified. This cooperation would allow scientific research to become applicable, affordable, and relevant solutions for the productive sector, reducing the gap between technological development and its effective use in the field.

b. Funding Opportunities

The scaling of emerging technologies requires financial mechanisms that align with the realities of MSMEs. One opportunity is to promote innovation funds, co-financing schemes, and APEC regional calls aimed at technological pilots in food security. These instruments could prioritize low-cost, high-impact solutions with the potential to be replicated across different economies.

It is also pertinent to promote preferential credits, public guarantees, seed capital, AgTech funds, collective financing, and public-private partnerships that reduce the initial costs of adoption. These tools are especially relevant for producers and small businesses that face barriers to accessing traditional banking or making investments in sensors, smart irrigation systems, data platforms, digital traceability, or precision agriculture equipment.

Funding should not be limited to technology acquisition. It should include technical assistance, training, field validation, maintenance, digital support, and evaluation of results. In this way, investments would have a greater likelihood of being sustained over time and of generating verifiable benefits for MSMEs.

c. Opportunities for inter-economic projects

APEC has favorable conditions to promote joint projects in areas of common interest. A first line could focus on smart water management in territories vulnerable to climate change, using sensors, precision irrigation, climate monitoring, artificial intelligence, and early warning systems. This initiative would improve water efficiency and reduce production risks.

A second line corresponds to the development of regional early warning systems for pests, diseases, and extreme weather events. These projects could integrate satellite information, field data, predictive models, and mobile applications to support timely decisions by producers, authorities, and agri-food MSMEs.

Opportunities are also identified for digital traceability pilots in prioritized value chains, such as coffee, rice, fruits, vegetables, fisheries, or other products of regional relevance. The use of blockchain and digital platforms can improve transparency, safety, compliance with standards, and market access.

Another strategic line is cooperation in genetic improvement, conservation of genetic resources, and development of resilient varieties. The combination of gene banks, artificial intelligence, field trials, and local knowledge can help tackle droughts, floods, high temperatures, pests, and diseases.

Finally, it is recommended to promote laboratories, test benches, or agricultural innovation valleys where MSMEs, startups, young farmers, researchers, and companies can validate technologies before scaling. These spaces would enable reducing investment risks, demonstrating benefits under real conditions, and accelerating technology transfer.

Together, these opportunities show that regional cooperation can contribute to a more inclusive, digital, and resilient agri-food transformation. To do this, we will need to combine financing, technical evidence, public-private partnerships, capacity building, and pilot projects that can be replicated across APEC economies.

V. CONCLUSIONS AND FUTURE DIRECTIONS

The main conclusions and future directions derived from the findings identified are presented below, highlighting the advances, challenges, and opportunities to promote a more inclusive, sustainable, and resilient digital transformation, with special attention to the role of MSMEs, regional cooperation, financing, capacity building, and the articulation between government, academia, private sector, and producers.

V.1 Summary of key takeaways and expected impacts

The analysis confirms that emerging technologies represent a strategic opportunity to strengthen food security in APEC economies, especially when they address the needs of agri-food MSMEs. Tools such as IoT, artificial intelligence, Big Data, blockchain, sensors, drones, robotics, digital platforms, and traceability systems can improve productivity, optimize the use of resources, reduce losses, strengthen safety, and facilitate more timely decisions throughout the agri-food chain.

However, its adoption does not depend only on technological availability. MSMEs face barriers including limited connectivity, insufficient infrastructure, financing constraints, low digital literacy, limited technical capabilities, and difficulties accessing reliable data. Therefore, the impact will be greater when the solutions are affordable, easy to use, validated in the field, and accompanied by training, technical assistance, user support, financing, and articulation between government, academia, the private sector, and producers.

The technologies with the greatest potential are those that address specific problems in the agri-food system. In production, smart irrigation, soil and greenhouse monitoring, pest and disease detection, selection of resilient varieties, and predictive yield analysis stand out. In the supply chain,

the reduction of post-harvest losses, the strengthening of the cold chain, digital traceability, quality and safety control, and access to more demanding markets stand out.

The expected impacts are projected at the productive, business, institutional, and regional levels. Greater efficiency in the use of water, fertilizers, energy, and inputs is expected; a better ability to anticipate climate, health, and production risks; a strengthening of the competitiveness of MSMEs through information, traceability, quality, and logistics; and greater institutional capacity to design evidence-based interventions, promote technology pilots, and strengthen innovation ecosystems. At the regional level, cooperation among APEC economies can accelerate joint learning, technology transfer, capacity building, and the implementation of inter-economic projects.

Overall, the conclusions point to a gradual, inclusive, and results-oriented agri-food digital transformation. The expected impact is to move towards more efficient, resilient, sustainable, and competitive agricultural food systems, in which MSMEs actively participate in innovation and in strengthening food security in the APEC region.

V.2 Strategic policy recommendations

- Institutionalization of AI-Driven Early Warning Systems: It is proposed that APEC economies prioritize a strategic policy action to integrate precision climate forecasting with farm-level IoT sensors, such as meteorological stations and soil moisture probes, to provide real-time decision support for critical operations including irrigation, planting, and pest control; this initiative directly supports the Sustainability and Resilience Pillar of the APEC Food Security Roadmap Towards 2030 by emphasizing the adoption of innovations to mitigate climate change impacts and protect the livelihoods of small-scale producers against environmental shocks like El Niño.
- Development of Regional E-Traceability and Interoperability Standards: It is proposed that APEC economies establish a regional framework for blockchain-based traceability and standardized data protocols to ensure that MSMEs can seamlessly meet international food safety and quality standards; this policy action directly aligns with the Digitalization and Innovation Pillar of the APEC Food Security Roadmap Towards 2030, which aims to foster open, transparent, and productive food systems through digital transformation, enhanced supply chain traceability, and the significant reduction of food loss and waste across the region.

V.3 High-potential innovations with long-term transformative opportunities

APEC economies have been promoting various technological innovations to strengthen the productivity, sustainability, and resilience of agri-food systems. Table No. 3 presents high-potential innovations that enable the identification of long-term transformative opportunities across different productive contexts in the APEC region.

Table No 3 High-potential innovations with long-term transformative opportunities in APEC economies

Innovation	Economies and Cases	Key Technologies	Long-term transformative opportunity
Digital platforms for technical assistance and connection with markets	• Brunei Darussalam – Agronect • Malaysia – PaddyChat	Mobile applications, immersive tools, generative artificial intelligence, computer vision, digital learning resources, and advisory platforms.	They make it easier for producers and MSMEs to access technical knowledge, timely recommendations, and business opportunities through simple, low-cost tools.
Smart agriculture for strategic crops	• Indonesia – Smart Farming • Malaysia – DX Paddy 2025 • United States – smart agriculture for smallholders	Mobile applications, immersive tools, generative artificial intelligence, computer vision, digital learning resources, and advisory platforms.	It enables improved productivity, more efficient use of water and inputs, agricultural planning, and response to climatic or production risks.
Real-time agricultural monitoring and local data processing	• Thailand – HandySense B-Farm • Viet Nam – Agricultural IoT based on Edge Computing	IoT sensors, edge computing, real-time analytics, AI for plant health, smart fertigation, and environmental automation.	It reduces reliance on always-on connectivity and enables quick decisions about irrigation, nutrients, temperature, humidity, and disease control.
Water management and climate resilience in vulnerable areas	• Peru – Tacna case	Humidity, flow, and microclimate sensors; Big Data dashboards; AI for irrigation and fertigation; climate models and warning systems.	It contributes to transforming agricultural management in water-stressed territories, reducing losses and improving adaptation to climate change.
Artificial intelligence for agricultural research and variety selection	• Peru – INIA Germplasm Bank • Viet Nam – Variety Breeding	Machine learning, analysis of genetic and agronomic data, predictive modeling, biotechnology, and recognition of productive traits.	It accelerates the identification of varieties with higher yields, greater climate tolerance, enhanced pest resistance, and improved nutritional value, thereby strengthening long-term food security.

Innovation	Economies and Cases	Key Technologies	Long-term transformative opportunity
Non-invasive agri-food analysis for quality and safety	Peru – AI applications in agri-food analytics	Machine learning, deep learning, RGB imaging, multispectral and hyperspectral imaging, NIR/FTIR spectroscopy, and photonics.	Improve quality and safety control through fast, accurate, and non-destructive assessments, reducing the risk of fraud, contamination, and post-harvest losses.
Digital traceability and transparency in value chains	Canada; / the Philippines; / United States – blockchain traceability for coffee; APEC applications in safety and markets	Blockchain, digital records, origin verification, quality traceability, and supply chain platforms.	It strengthens trust, facilitates compliance with standards, and improves access for small producers to markets that value origin, quality, and sustainability.
Agricultural data platforms and interoperable digital services	• Japan – WAGRI • Chinese Taipei – agro-digital services and smart farms	Big Data, climate data, maps, sensors, growth models, AI, RTK networks, digital twins, and shared machinery platforms.	It enables integrating public and private information to deliver digital agricultural services, productive recommendations, and shared solutions for producers and MSMEs.
Automation, robotics and intelligent machinery	• Australia – digital and precision agriculture • Japan – Kubota demonstration project	Robotics, automation, IoT, Big Data, remote analytics, intelligent machinery, and automated monitoring.	It can reduce dependence on labor, improve operational efficiency, and accelerate the modernization of rural cooperatives, producers, and MSMEs.
Sustainable production and efficient use of inputs	Viet Nam – sustainable potato production; experiences on regenerative agriculture and bioproducts	Drones, precision irrigation, fertigation, integrated pest management, biological products, and technologies for optimizing water and inputs.	It improves the productivity and sustainability of specific agricultural chains by reducing water consumption, chemical input use, and production costs.

VI. ANNEXES

Annex N°1. Survey Pre Workshop

Annex N°2. Survey Pre Workshop Results

Annex N°3. Survey Post Workshop

Annex N°4. Survey Post Workshop Results

Annex N°1. Survey Pre Workshop

APEC Survey on Capacity Building for MSMEs in the Use of Emerging Technologies to Enhance Food Security

Strengthening food security across APEC economies remains a complex challenge, requiring coordinated action, inclusive capacity building, and the effective use of emerging technologies. At the same time, climate variability, supply chain disruptions, and evolving market and regulatory requirements can rapidly reshape risks and opportunities —especially for micro, small, and medium enterprises (MSMEs) operating across diverse agricultural and food systems.

This survey, which is part of the APEC PPSTI 208 - 2024A project "Capacity Building for MSMEs in the Use of Emerging Technologies to Enhance Food Security" aims to gather participants' baseline perspectives and needs prior to the sessions. Your responses will help us understand how well participants currently perceive food security challenges in their economies, how familiar they are with emerging technologies in agriculture and food systems (e.g., IoT, Big Data/AI, blockchain, and traceability tools), and what barriers and enabling factors affect adoption—particularly for MSMEs. The findings will be used to tailor the content of Sessions 1–7, select the most relevant case studies, and inform the development of practical and actionable recommendations for APEC economies.

The survey should take approximately 12–15 minutes to complete. If you are interrupted, you may return and complete it later (depending on your browser and form settings). We kindly ask you to complete the survey before February 26th, 2026, to ensure your input can be reflected in the workshop discussions.

Your insights are highly valuable for shaping an evidence-based, MSME-focused capacity-building agenda on emerging technologies and food security in the APEC region. We sincerely appreciate your time and contribution.

* Indicates required question

1. Name *

2. E-mail *

3. Gender *

   Mark only one oval

   - ◯ Male
   - ◯ Female

4. Economy *

Mark only one oval

- Australia (AUS)
- Brunei Darussalam (BD)
- Canada (CDA)
- Chile (CHL)
- People's Republic of China (PRC)
- Hong Kong, China (HKC)
- Indonesia (INA)
- Japan (JPN)
- Republic of Korea (ROK)
- Malaysia (MAS)
- Mexico (MEX)
- New Zealand (NZ)
- Papua New Guinea (PNG)
- Peru (PE)
- The Republic of the Philippines (PH or PHL)
- The Russian Federation (RUS)
- Singapore (SGP)
- Chinese Taipei (CT)
- Thailand (THA)
- United States (US or USA)
- Viet Nam (VN)

5. Affiliation/Company *

_____

6. Position *

_____

7. Company type *

Mark only one oval

- Government / public sector
- Private sector (company)
- MSME (micro, small, or medium enterprise)
- Academia / research
- NGO / civil society
- International organization
- Other _____

8. What experience do you have that is relevant to emerging technologies and food security? *

Mark only one oval

- Less than 2 years
- 2-3 years
- 6-10 years
- More than 10 years

9. Attendance mode? *

Mark only one oval

- In person
- Online/virtual

10. If applicable: MSME size *

Mark only one oval

- Micro
- Small
- Medium
- Not an MSME/Not applicable
- Prefer not to say

11. What is your role? *

Mark only one oval

- ◯ Policy / regulation
- ◯ Technical specialist (data/IT/engineering)
- ◯ Agriculture / production
- ◯ Operations / supply chain / logistics
- ◯ Food safety / quality assurance
- ◯ Business development / finance
- ◯ Research / academia
- ◯ Other _____

12. What is the value chain focus? (choose all that apply) *

- ◯ Production (farm/aquaculture)
- ◯ Aggregation / storage
- ◯ Processing
- ◯ Logistics / cold chain
- ◯ Wholesale / retail / markets
- ◯ Import/export
- ◯ Inspection / regulation
- ◯ Technology / service provider
- ◯ Other _____

13. Which best describes your organization/MSME? *

Mark only one oval

- ◯ Mostly manual processes
- ◯ Basic digital tools (email, spreadsheets)
- ◯ Some digital systems (apps, simple databases)
- ◯ Integrated systems (dashboards/BI, cloud tools)
- ◯ Advanced digital (automation, AI/analytics pilots)

14. What is the current state of connectivity? *

Mark only one oval

- ◯ Reliable broadband
- ◯ Variable connectivity
- ◯ Mostly mobile connectivity
- ◯ Limited connectivity
- ◯ Very limited / none

15. Food Security & Emerging Technologies *

Mark only one oval per row

	None	Basic	Intermediate	Advanced	Expert
How well do you understand the food security challenges in your economy?	◯	◯	◯	◯	◯
How familiar are you with using emerging technologies (e.g., IoT, AI, blockchain) in agriculture / food systems?	◯	◯	◯	◯	◯

16. What are the priority food security issues? (choose up to 5) *

- ☐ Low productivity / inefficient input use
- ☐ Water scarcity / irrigation efficiency
- ☐ Post-harvest losses
- ☐ Cold chain gaps
- ☐ Food safety and contamination risks
- ☐ Limited traceability / market requirements
- ☐ Price volatility / weak market information
- ☐ Climate shocks disrupting production/supply
- ☐ Limited MSME access to finance
- ☐ Limited digital skills / talent
- ☐ Data access/quality issues
- ☐ Regulatory or standards barriers
- ☐ Other _____

17. What are the perceived barriers to improving food security? (choose up to 4) *

- [ ] Limited financing/investment
- [ ] Limited skills/capacity
- [ ] Weak digital infrastructure (connectivity/power)
- [ ] Data availability/quality issues
- [ ] Fragmented supply chains / informality
- [ ] Regulatory constraints / unclear standards
- [ ] Low trust in technology providers / solutions
- [ ] Lack of incentives from buyers/markets
- [ ] Coordination challenges (public/private)
- [ ] Other _____

18. What are the perceived barriers to improving food security? (choose up to 3) *

- [ ] Improve productivity and resource efficiency
- [ ] Reduce post-harvest losses / improve logistics
- [ ] Strengthen early warning and forecasting
- [ ] Improve food safety and traceability
- [ ] Improve market access for MSMEs
- [ ] Increase climate resilience
- [ ] Improve transparency and trust in supply chains
- [ ] Other _____

19. What you want from this workshop? (choose up to 4) *

- [ ] Practical case studies and lessons learned
- [ ] Guidance to design pilots (scope, KPIs, costs)
- [ ] Tools/templates for MSMEs
- [ ] Policy/standards recommendations
- [ ] Partnership opportunities
- [ ] Financing pathways for technology adoption
- [ ] Other _____

20. In 2–4 sentences, describe one concrete food security problem in your context that you hope this workshop can help address. *

21. **Session 1: Establishing the Food Security Context in APEC** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
What is my current understanding of the APEC food security landscape (context, challenges, opportunities)?					

22. What you most need from Session 1? *

Mark only one oval

- Shared definitions and baseline framework
- APEC trends and benchmarking
- MSME opportunities and business models
- Priority-setting framework for interventions
- Enabling environment (policy/standards) overview

23. Which APEC-wide issues would you like to see addressed? (choose up to 3) *

- Differences across economies (developed/developing)
- Agriculture vs. fisheries/aquaculture challenges
- Supply chain resilience and trade disruptions
- Affordability and access to nutritious food
- Food safety pressures and compliance
- Data gaps and digital divides
- Other _____

24. What would “success” look like for you after Session 1? *

25. **Session 2: Climate Change and Food Security** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
What is my current understanding of the implications of climate change for food security in my economy					

26. What are the climate risks most relevant to you? (choose up to 4) *

- [ ] Drought / water scarcity
- [ ] Floods / storms
- [ ] Heat stress / changing seasons
- [ ] Pests and diseases
- [ ] Logistics/infrastructure disruption
- [ ] Food safety risks linked to climate
- [ ] Price/availability shocks
- [ ] Other _____

27. What current climate/data tools are being used? (choose all that apply) *

- [ ] Weather forecasts
- [ ] Historical climate records
- [ ] Satellite/remote sensing
- [ ] Farm/production records
- [ ] Market/price data
- [ ] Early warning systems
- [ ] Crop/impact models
- [ ] None / limited access
- [ ] Other _____

28. What are the key climate-smart priorities? (choose up to 3) *

- [ ] Efficient irrigation / water management
- [ ] Soil health / regenerative practices
- [ ] Diversification of crops/sources
- [ ] Protected agriculture / controlled environments
- [ ] Risk financing (insurance, contingency funds)
- [ ] Digital early warning & advisory services
- [ ] Other _____

29. What is one climate-related decision you want to improve (e.g., planting, irrigation, storage, logistics), and what information would help? *

30. **Session 3: Leveraging IoT for Food Security** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
My current understanding of IoT applications in agriculture/ food supply chains.					

31. Most valuable IoT use cases? (choose up to 4) *

- [ ] Smart irrigation / water monitoring
- [ ] Soil and nutrient monitoring
- [ ] Pest/disease monitoring
- [ ] Greenhouse monitoring/automation
- [ ] Cold chain temperature/humidity monitoring
- [ ] Storage/silo monitoring
- [ ] Fleet/logistics tracking
- [ ] Livestock/aquaculture monitoring
- [ ] Other _____

32. Current adoption status (multiple choice) *

- [ ] No IoT use today
- [ ] Exploring options
- [ ] Small pilot underway
- [ ] Scaling a solution
- [ ] IoT in regular operations

33. Main implementation barriers (choose up to 3) *

- [ ] Connectivity
- [ ] Power/energy availability
- [ ] Upfront cost
- [ ] Maintenance/technical support
- [ ] Data integration/platform lock-in
- [ ] Cybersecurity concerns
- [ ] Lack of skilled staff
- [ ] Vendor trust / procurement complexity
- [ ] Other _____

34. KPI (Key Performance Indicator) priorities for an IoT pilot (choose up to 3) *

- [ ] Reduced water use
- [ ] Reduced fertilizer/pesticide use
- [ ] Increased yield/productivity
- [ ] Reduced spoilage/losses
- [ ] Improved cold chain compliance
- [ ] Reduced energy cost
- [ ] Improved traceability data quality
- [ ] Other _____

35. Describe an IoT pilot you would consider in the next 6–12 months (where, what is measured, and what success looks like) *

36. **Session 4: Big Data & AI for Predictive Analytics** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
My current understanding of Big Data and AI for predictive analytics in agriculture/ food security					

37. Data maturity (multiple choice) *

- [ ] Very limited / mostly unstructured
- [ ] Basic (spreadsheets/manual records)
- [ ] Some structured databases
- [ ] Integrated data systems/BI
- [ ] Already using predictive models

38. Data sources you have (choose all that apply) *

- [ ] Production/yield records
- [ ] Input use (water/fertilizer/feed)
- [ ] Sales/transactions
- [ ] Inventory/warehouse data
- [ ] Logistics/shipping data
- [ ] Quality/food safety test results
- [ ] Weather/climate data
- [ ] Satellite/remote sensing
- [ ] IoT sensor data
- [ ] Market/price data
- [ ] None/limited
- [ ] Other _____

39. Priority predictive use cases (choose up to 3) *

- [ ] Yield/production forecasting
- [ ] Demand/consumption forecasting
- [ ] Price volatility / market shock prediction
- [ ] Climate risk early warning
- [ ] Logistics optimization / loss reduction
- [ ] Food safety risk detection
- [ ] Fraud/adulteration anomaly detection
- [ ] Other _____

40. Concerns about AI/analytics (choose up to 3) *

- [ ] Data privacy/confidentiality
- [ ] Bias/fairness
- [ ] Explainability/trust
- [ ] Data-sharing permissions
- [ ] Cybersecurity
- [ ] Legal/regulatory constraints
- [ ] Cost of tools/compute
- [ ] Other _____

41. If you could deploy one predictive model in 6–12 months, what would it do, who would use it, and what data would be needed? *

42. **Session 5: Collaborative Approaches Across APEC** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
My current understanding of cross-border collaboration to strengthen food security across APEC economies					

43. Your collaboration experience (multiple choice) *

- [ ] None
- [ ] Some participation in cross-border initiatives
- [ ] Active involvement in regional working groups/projects
- [ ] Leading regional initiatives

44. Priority collaboration areas (choose up to 3) *

- [ ] Data sharing and early warning systems
- [ ] Standards/interoperability for traceability
- [ ] Joint MSME pilots and scaling support
- [ ] Shared training/certification programs
- [ ] Harmonized food safety approaches
- [ ] Resilient logistics/trade facilitation
- [ ] Financing mechanisms for MSMEs
- [ ] Other _____

45. Biggest obstacle to collaboration (multiple choice) *

- [ ] Regulatory/policy misalignment
- [ ] Lack of trust or data-sharing agreements
- [ ] Technical interoperability issues
- [ ] Limited funding
- [ ] Limited capacity/skills
- [ ] Competing priorities
- [ ] Other _____

46. Propose one realistic APEC initiative (12–24 months): what it is, who should be involved, and what outcome it should deliver. *

_____

_____

_____

_____

_____

_____

47. **Session 6: Recommendations and Way Forward** *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
My current ability to contribute to actionable recommendations (policy + technology + capacity building) for food security	◯	◯	◯	◯	◯

48. Most feasible actions in 6–12 months (choose up to 4) *

- [ ] Launch MSME pilots (small scale)
- [ ] Provide training/toolkits for MSMEs
- [ ] Develop data-sharing guidance
- [ ] Develop/align standards and interoperability
- [ ] Strengthen partnerships with tech providers
- [ ] Mobilize financing instruments
- [ ] Strengthen monitoring & evaluation (KPIs)
- [ ] Other _____

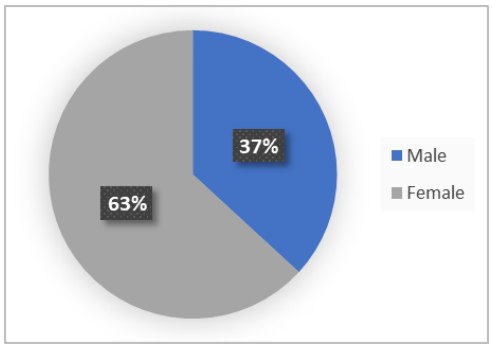
49. Success indicators (choose up to 3) *

- [ ] Reduced post-harvest losses
- [ ] Increased productivity/efficiency
- [ ] Improved food safety outcomes
- [ ] Faster incident/recall response
- [ ] Better market access for MSMEs
- [ ] Improved resilience to climate shocks
- [ ] Better price transparency/stability
- [ ] Other _____

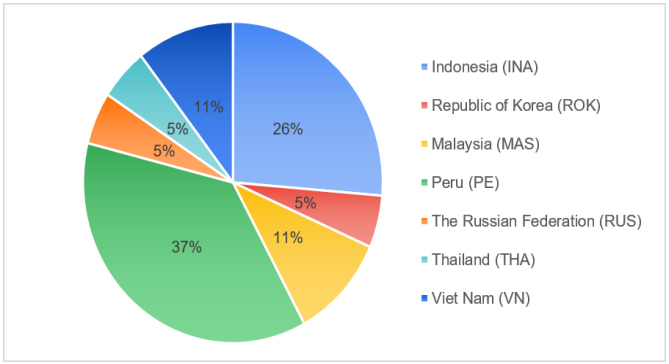
50. Please provide up to three recommendations to advance food security in the APEC region through emerging technologies, with a focus on MSMEs. *

Annex N°2. Survey Pre Workshop Results

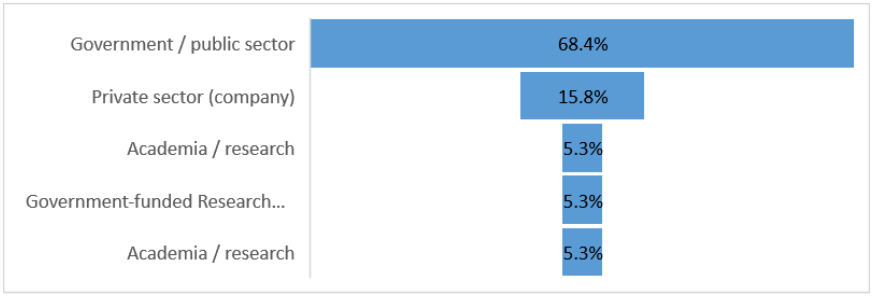
1. Gender



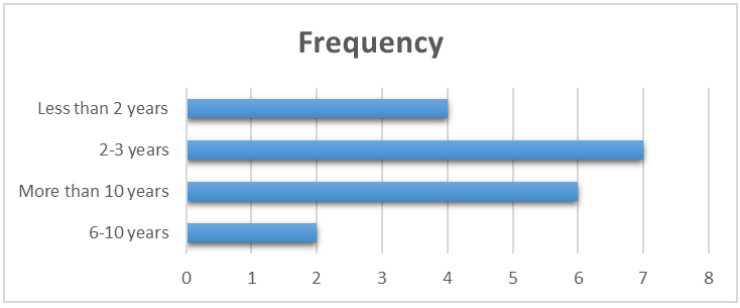
2. Economy



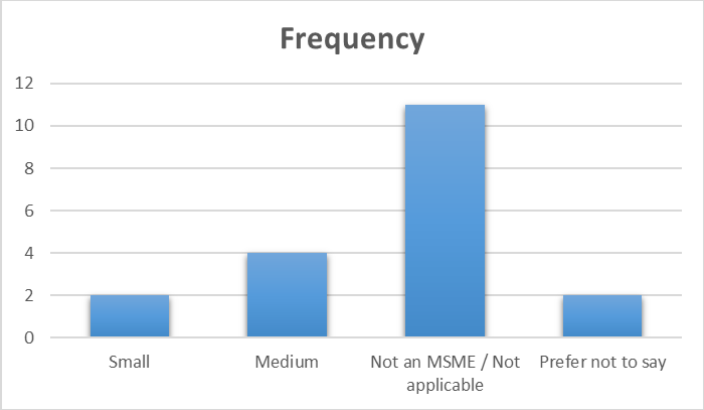
3. Company type



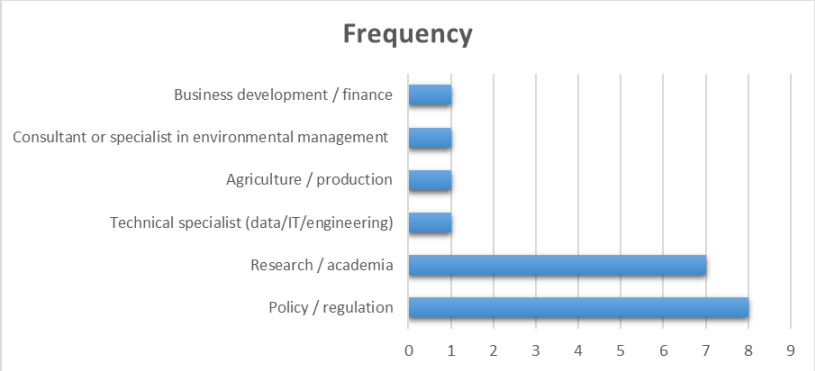
4. What experience do you have that is relevant to emerging technologies and food security?



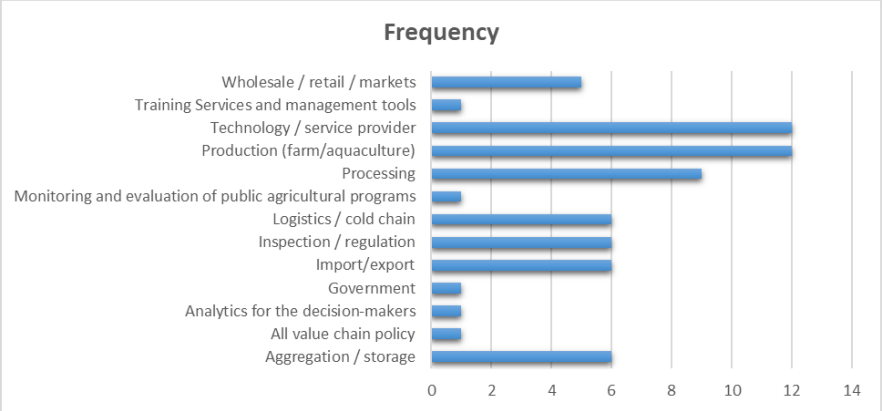
5. If applicable: MSME size



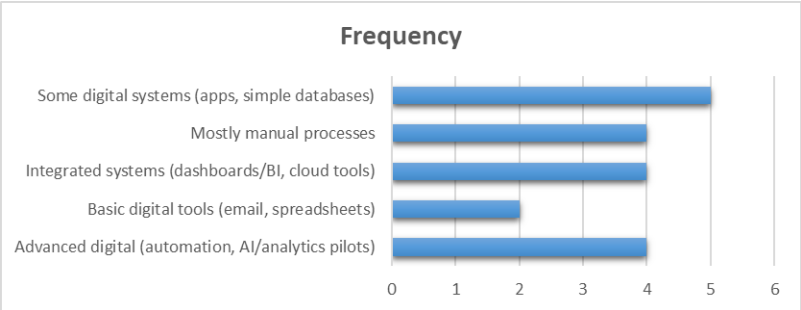
6. What is your role?



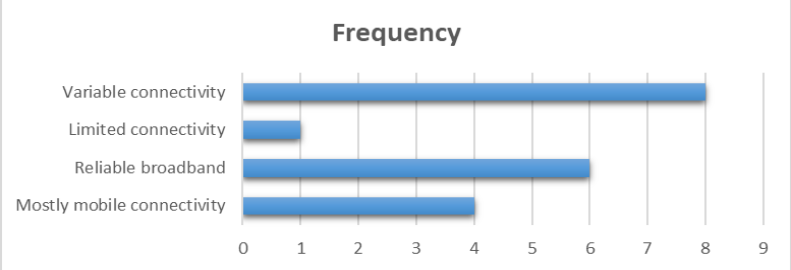
7. What is the value chain focus? (choose all that apply)



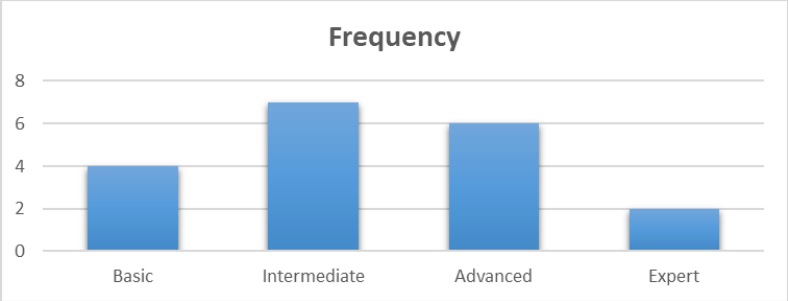
8. Which best describes your organization/MSME?



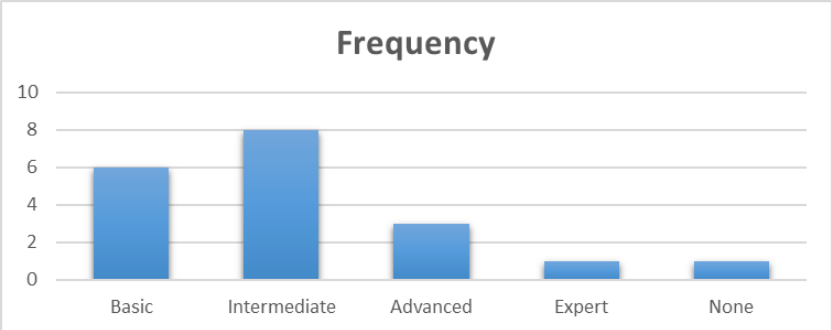
9. What is the current state of connectivity?



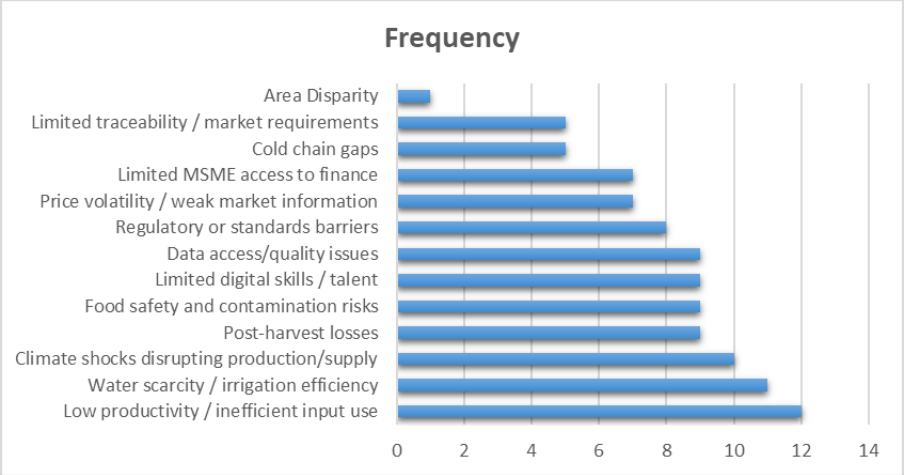
10. How well do you understand the food security challenges in your economy?



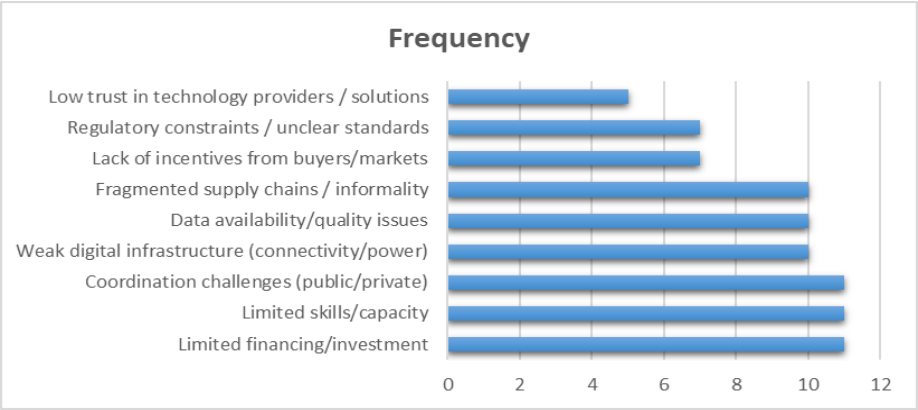
11. How familiar are you with using emerging technologies (e.g., IoT, AI, blockchain) in agriculture/food systems?



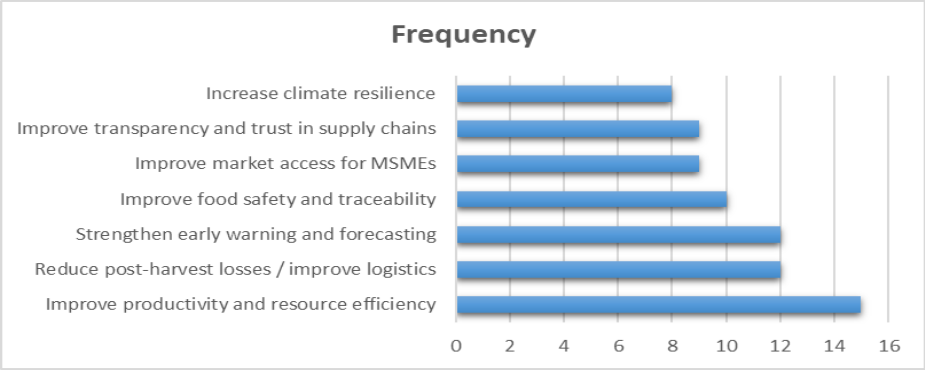
12. What are the priority food security issues? (choose up to 5)



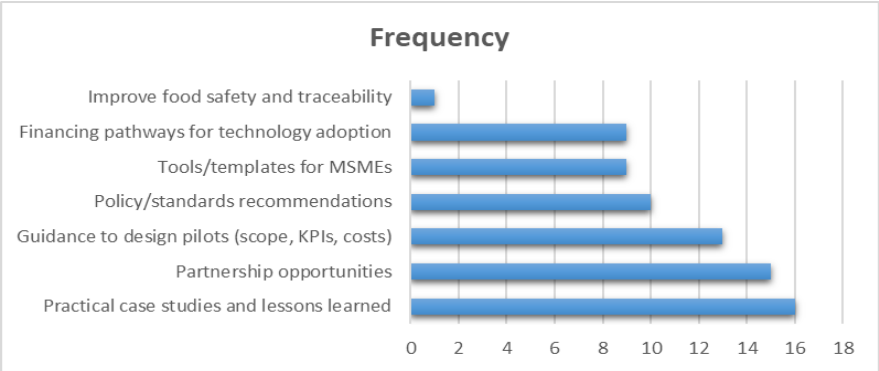
13. What are the perceived barriers to improving food security? (choose up to 4)



14. In which areas could emerging technologies help the most? (choose up to 3)



15. What you want from this workshop? (choose up to 4)

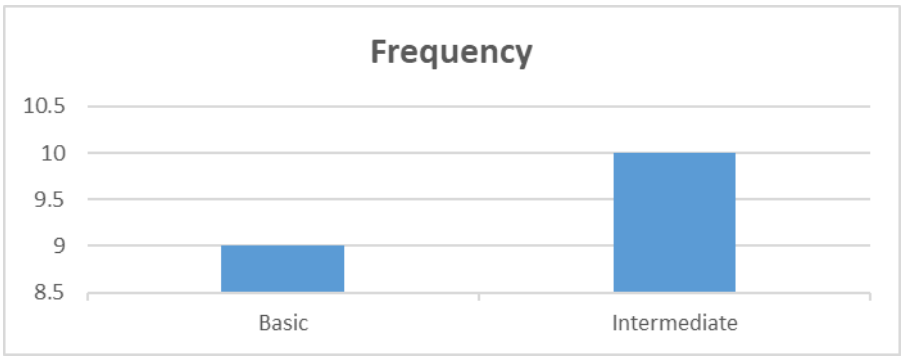


16. In 2–4 sentences, describe one concrete food security problem in your context that you hope this workshop can help address.

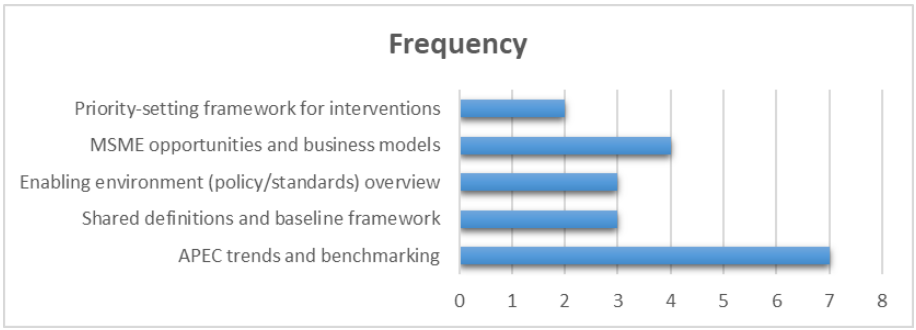
Economy	Main food security problem(s) described	Underlying theme(s)
Indonesia (INA)	(1) Archipelagic geography creates food-security equity challenges and uneven productivity across regions. (2) Limited adoption of digital technologies by farmers and need for appropriate technologies. (3) Instability of food access for low-income urban households due to climate-driven supply-chain disruptions and price volatility. (4) Need to learn from other economies' experiences.	Territorial inequality; low digital/tech adoption; climate-driven access and price risks; knowledge-sharing gaps.
Republic of Korea (ROK)	Heavy dependence on imports for key grains (wheat, corn, soybeans), creating high vulnerability to global price volatility and supply-chain disruptions.	Import dependence and exposure to external shocks.
Malaysia (MAS)	(1) Lack of real-time field monitoring and data-driven decision support at farm level. (2) Need to democratize access to precision-agriculture technologies, learning from other economies.	Limited digitalization at farm level; unequal access to advanced technologies.
Peru (PE)	(1) Disconnect between local food production and vulnerable groups' access to nutritious, culturally appropriate diets. (2) Limited use of digital tools for pest/disease monitoring and for reducing harvest/post-harvest losses. (3) Difficulties in data sharing to establish a Food Security Observatory. (4) Need to democratize opportunities and AI technologies, improve diffusion of case studies, and strengthen producer associativity and governance.	Access and nutrition gaps; low digital adoption; data-governance challenges; weak dissemination of good practices; governance issues in producer organizations.
The Russian Federation (RUS)	Low economic accessibility of high-quality food for low-income populations; need to involve MSMEs.	Affordability and inclusion of MSMEs.
Thailand (THA)	Climate extremes and high import prices make it harder for farmers to produce affordable food; need regional cooperation on digital tools and smart policies.	Climate and price shocks; need for digital innovation and cooperation.
Viet Nam (VN)	(1) Climate change (extreme weather, salinity intrusion) reducing yields and food quality. (2) Need for better post-harvest technology support and access to international markets for local products.	Climate risk to production; weak post-harvest systems and market access.

Session 1: Establishing the Food Security Context in APEC

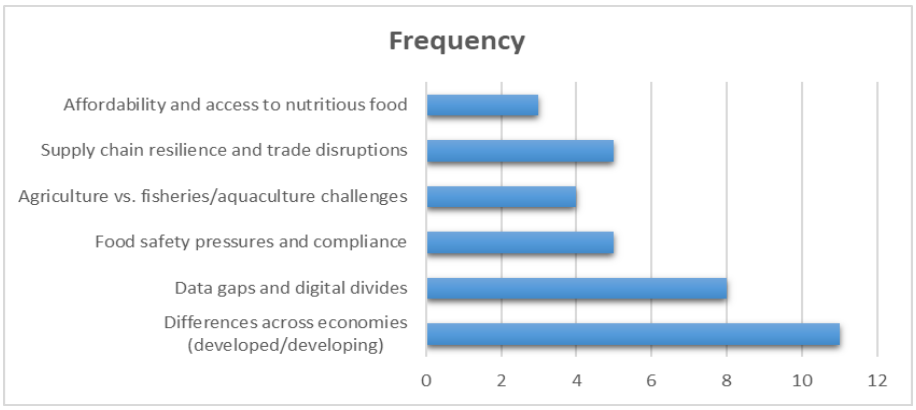
17. What is my current understanding of the APEC food security landscape (context, challenges, opportunities)?



18. What you most need from Session 1?



19. Which APEC-wide issues would you like to see addressed? (choose up to 3)

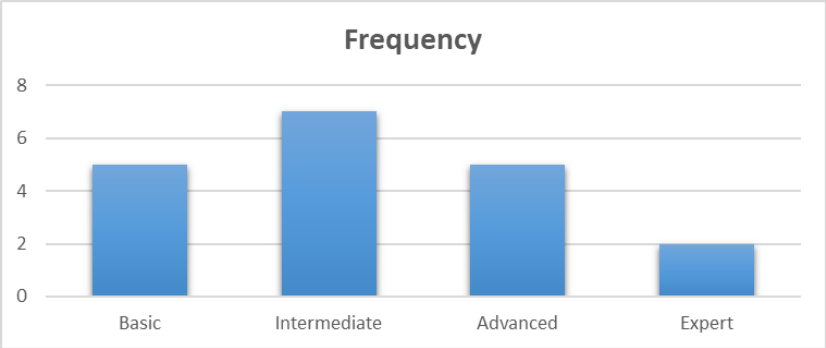


20. What would “success” look like for you after Session 1?

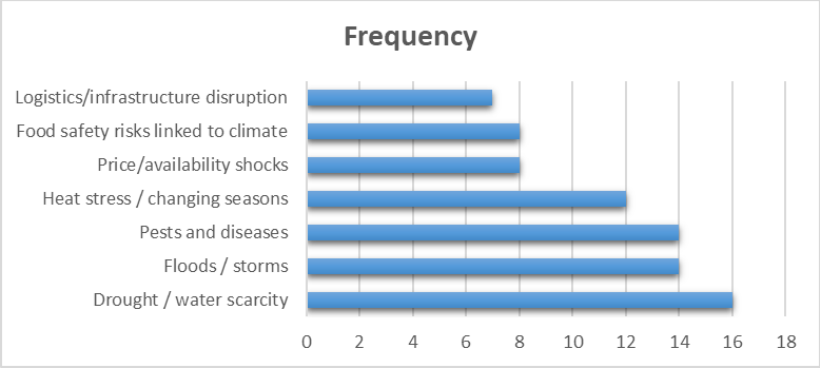
    Success after Session 1 is mainly understood as achieving a clear, shared and evidence-based picture of the APEC food security landscape, including key gaps, critical challenges and differences across economies. Participants expect to exchange information and practical experiences**,** gain new ideas and approaches from other economies, and identify concrete opportunities for cooperation—such as working networks, partnerships, technology solutions and research initiatives. It would also mean leaving the session with priorities, leverage points and next steps clearly defined, so that subsequent sessions can move directly into strategic action.

Session 2: Climate Change and Food Security

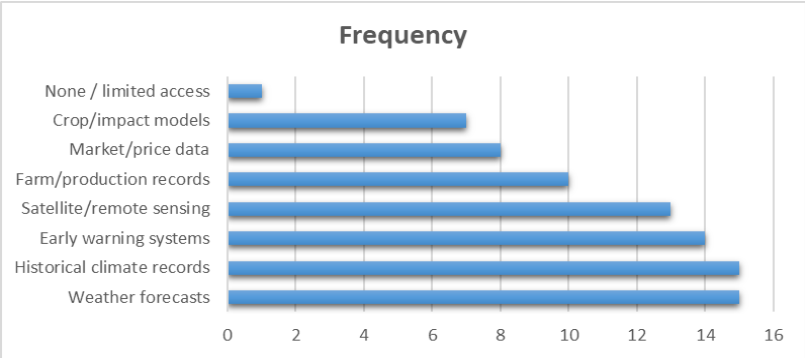
21. What is my current understanding of the implications of climate change for food security in my economy?



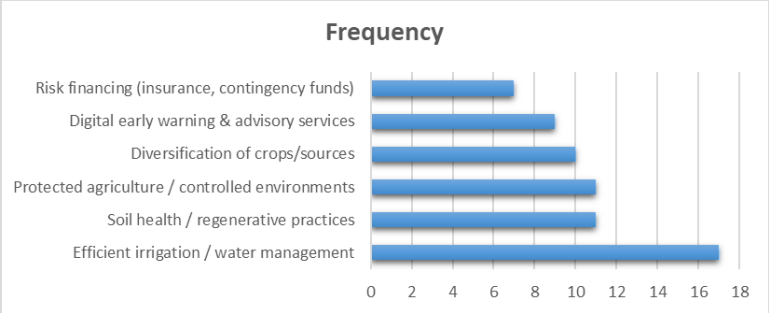
22. What are the climate risks most relevant to you? (choose up to 4)



23. What current climate/data tools are being used? (choose all that apply)



24. What are the key climate-smart priorities? (choose up to 3)

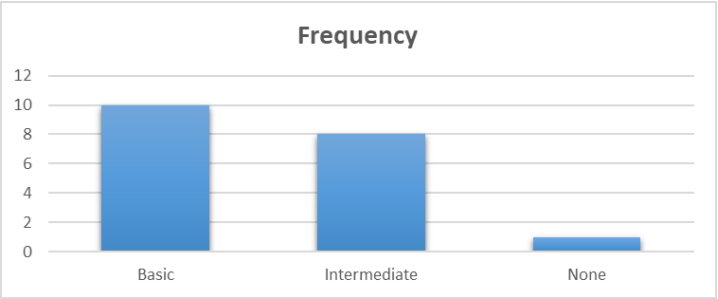


25. What is one climate-related decision you want to improve (e.g., planting, irrigation, storage, logistics), and what information would help?

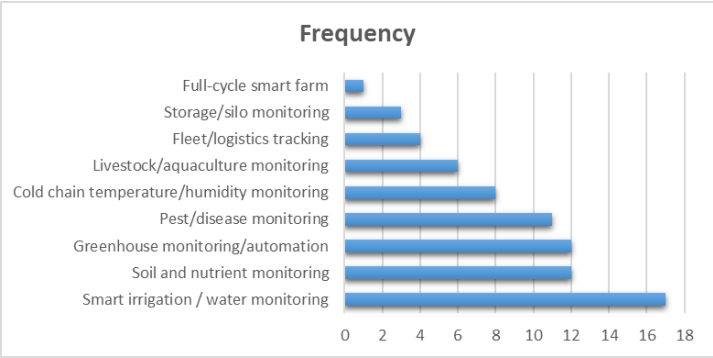
    Participants want to improve climate-sensitive decisions mainly around water and crops—irrigation and precision irrigation, planting strategies, crop/variety choice and seed systems—plus logistics in food supply chains and some fisheries management choices. To do so, they ask for better localized climate and environmental information (forecasts, soil/rainfall/ocean data), along with real-time logistics and market alerts, and practical best-practice and governance models to guide implementation of climate-smart technologies and policies.

Session 3: Leveraging IoT for Food Security

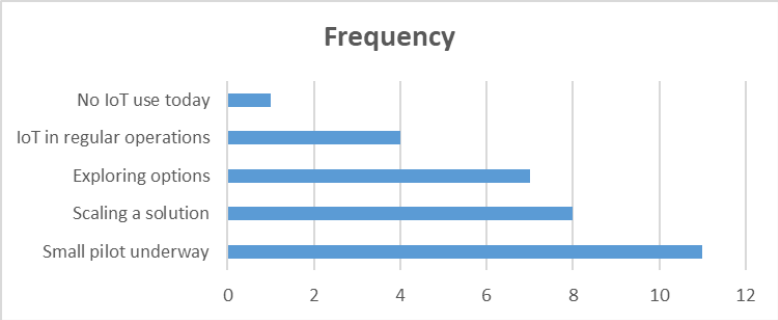
26. My current understanding of IoT applications in agriculture/food supply chains.



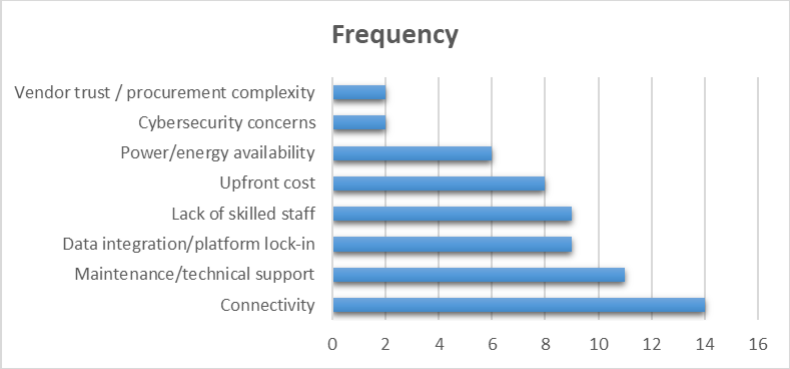
27. Most valuable IoT use cases (choose up to 4)



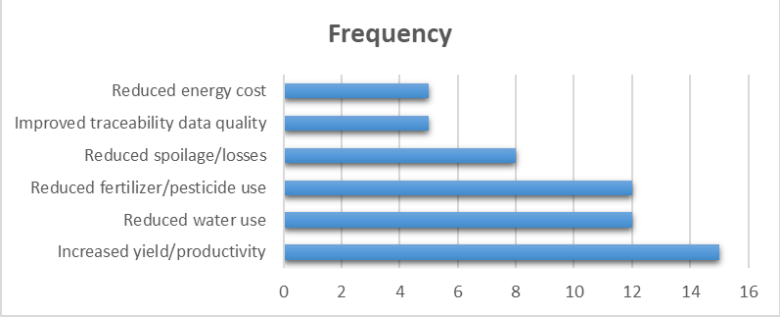
28. Current adoption status (multiple choice)



29. Main implementation barriers (choose up to 3)



30. KPI (Key Performance Indicator) priorities for an IoT pilot * (choose up to 3)

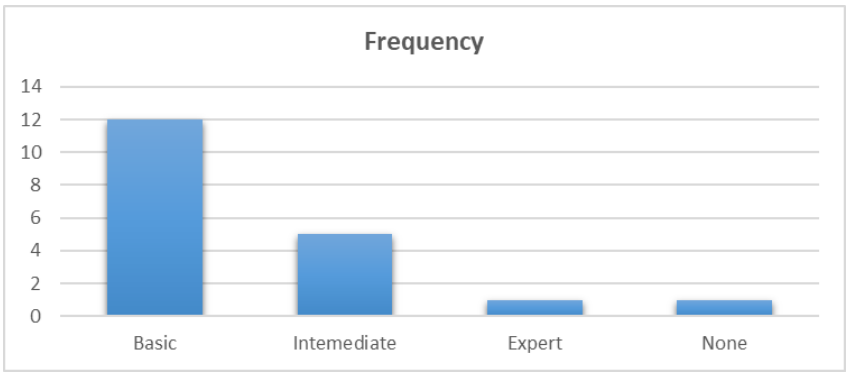


31. Describe an IoT pilot you would consider in the next 6–12 months (where, what is measured, and what success looks like)

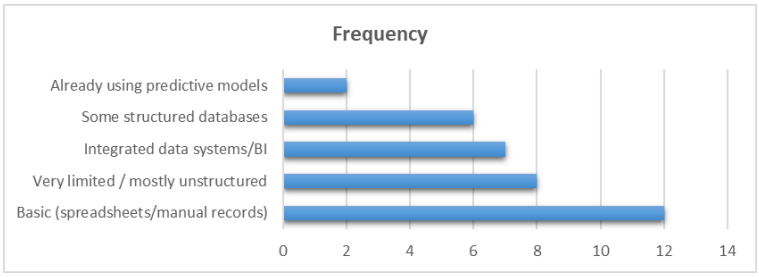
Economy	Summary of proposed IoT pilot(s)	Main variables measured / data sources	What success looks like
Indonesia (INA)	Climate monitoring system combining satellite data and agricultural surveys; smart irrigation and pest/disease-prediction system; pilots on climate-resilient seedlings/varieties; occupancy-aware HVAC/IAQ and predictive-maintenance system in buildings.	Satellite climate data, agricultural survey data; irrigation flows, pest/disease indicators; seed/variety performance; occupancy, indoor air quality, equipment status.	Better climate-smart agriculture decisions, more efficient irrigation and pest management, improved choice of varieties under climate change, and higher energy efficiency/comfort in buildings.
Republic of Korea (ROK)	Smart-farming IoT model to cope with aging farmers and labor shortages.	Farm-level production, labor inputs, quality and productivity indicators.	Lower labor input, higher productivity and quality, and measurable increases in farm income via precision agriculture.
Malaysia (MAS)	IoT monitoring in agriculture farms and paddy fields (e.g. Kelantan) to optimize soil and water management.	pH, EC, soil moisture, temperature; water levels/flows in paddies.	Increased yields, reduced production costs and post-harvest losses through more efficient water and input management.
Peru (PE)	Coastal IoT ocean-monitoring network; climate monitoring for banana/mango in Sullana–Tambo Grande; digital/IoT systems to replace fragmented reporting; predictive models & validation app; pilots in highland agrobiodiversity zones; water management and cold-chain monitoring.	Sea temperature, DO, pH, chlorophyll-a, biomass; local climate variables; farm and value-chain data; cold-chain conditions.	Earlier detection of marine heat stress and better fishery management; more reliable and integrated data; reduced water use; preservation of biodiversity; improved field water management and cold-chain compliance.
Thailand (THA)	IoT soil-moisture and water-level sensors in central rice paddies for precision irrigation.	Soil moisture, water level in paddies.	Optimized irrigation decisions, improved water efficiency and yields.
Viet Nam (VN)	Smart irrigation in climate-vulnerable rice/fruit areas (e.g. Mekong Delta) and a smart farm pilot in Hanoi for pest control.	Soil moisture, salinity, localized weather data, pest incidence.	15–20% water savings with stable or higher yields, reliable real-time data for decisions, and ~80% effectiveness in pest control.

Session 4: Big Data & AI for Predictive Analytics

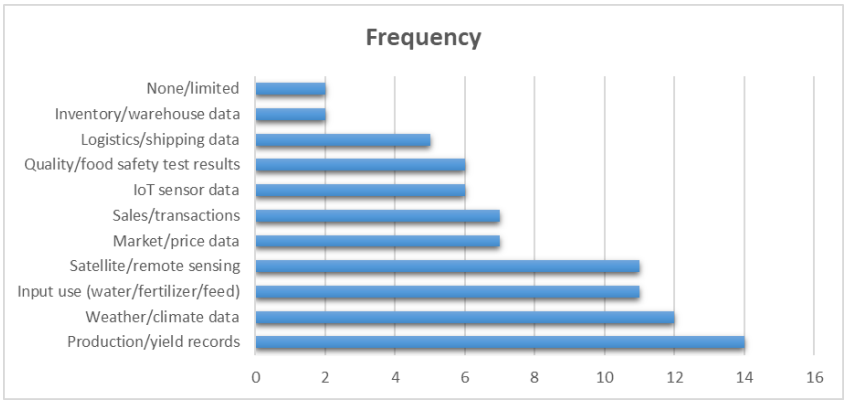
32. My current understanding of Big Data and AI for predictive analytics in agriculture/food security



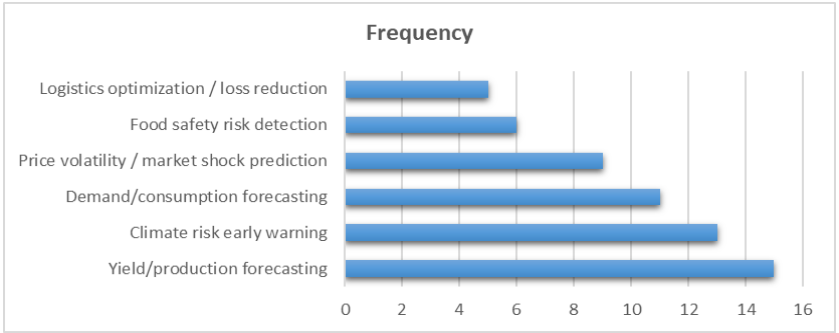
33. Data maturity (multiple choice)



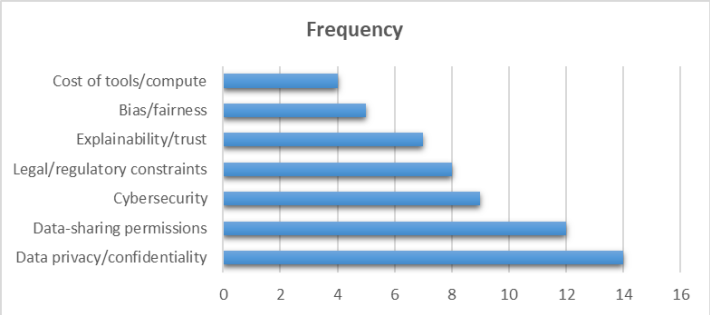
34. Data sources you have (choose all that apply)



35. Priority predictive use cases (choose up to 3)



36. Concerns about AI/analytics (choose up to 3)

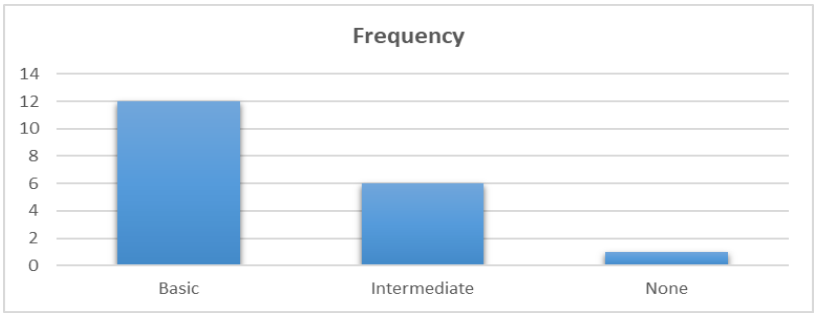


37. If you could deploy one predictive model in 6–12 months, what would it do, who would use it, and what data would be needed?

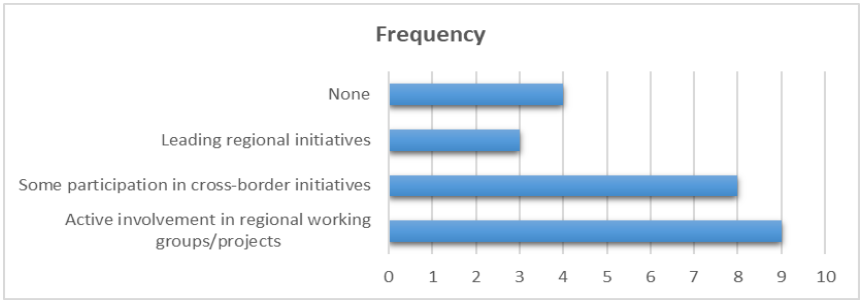
Economy	Predictive model focus	Main users	Key data needed
Indonesia (INA)	Mobile climate-risk early warning with varietal advice; occupancy-aware HVAC optimization; broader climate-risk/forecasting tools.	Farmers; building and facility managers; sustainability and policy units.	Weather & seasonal forecasts, crop/variety and pest data, HVAC energy and equipment logs, occupancy, CO_2, temperature, humidity, building schedules.
Republic of Korea (ROK)	Real-time AI yield and disease prediction for open-field horticulture.	Farmers, extension, ag authorities.	High-resolution weather, IoT field sensors, satellite imagery, historical cultivation, yield and price data.
Malaysia (MAS)	Pest & disease detection; improved weather and pest early-warning for farm planning.	Farmers, extension services.	Pest/disease images and records, rainfall and weather data, basic crop & management info.
Peru (PE)	Climate-driven fish-stock and productivity model; classifier of family-farming categories; tools for mango, water/logistics and local predictive info.	Fisheries managers, cooperatives, social programs, farmer leaders, food-security units.	Ocean and catch data, climate forecasts, producer income & capacity data, vulnerability indicators, field humidity/salinity, logistics and official stats.
Thailand (THA)	3-month rolling forecasts of staple-crop yields and price spikes, including cross-economy climate impacts.	Policymakers, market and food-security analysts.	Yield and price series, climate/weather forecasts, trade and import data, climate-event info.
Viet Nam (VN)	Climate-risk early warning and yield forecast for staple crops; AI pest-detection model.	Farmers, local gov't, policymakers, researchers.	Historical yields, weather & seasonal forecasts, soil/salinity, satellite data, market prices, pest images/labels.

Session 5: Collaborative Approaches Across APEC

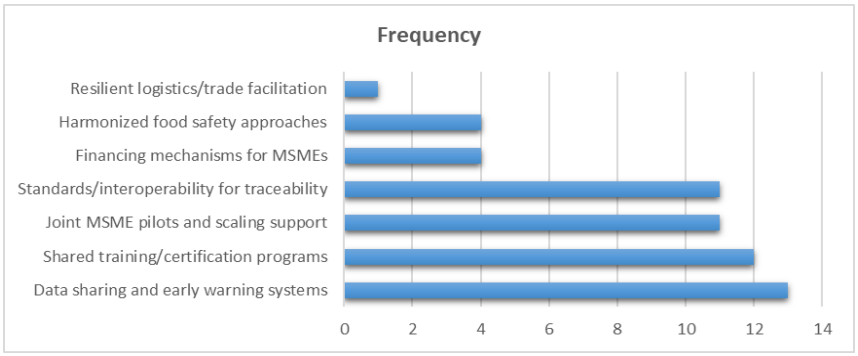
38. My current understanding of cross-border collaboration to strengthen food security across APEC economies



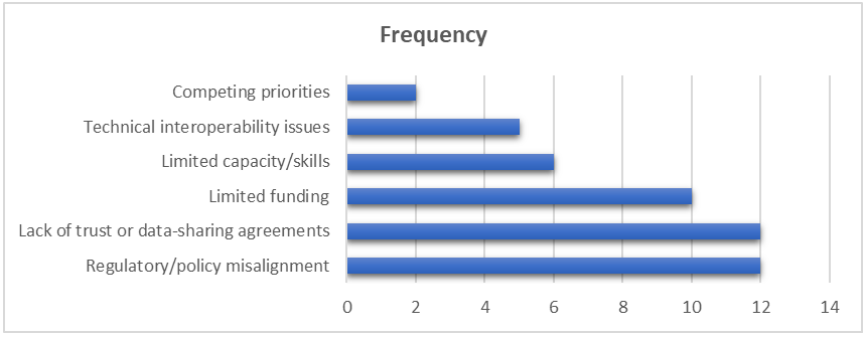
39. Your collaboration experience (multiple choice)



40. Priority collaboration areas (choose up to 3)



41. Biggest obstacle to collaboration (multiple choice)

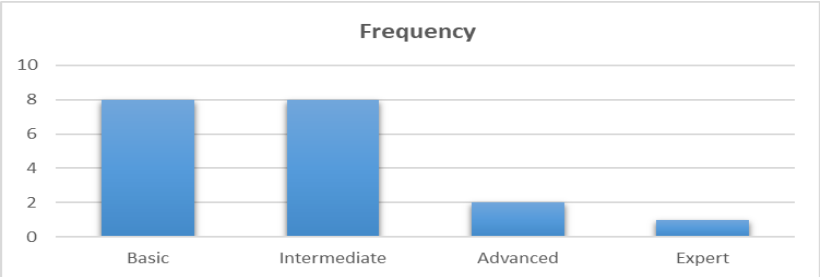


42. Propose one realistic APEC initiative (12–24 months): what it is, who should be involved, and what outcome it should deliver.

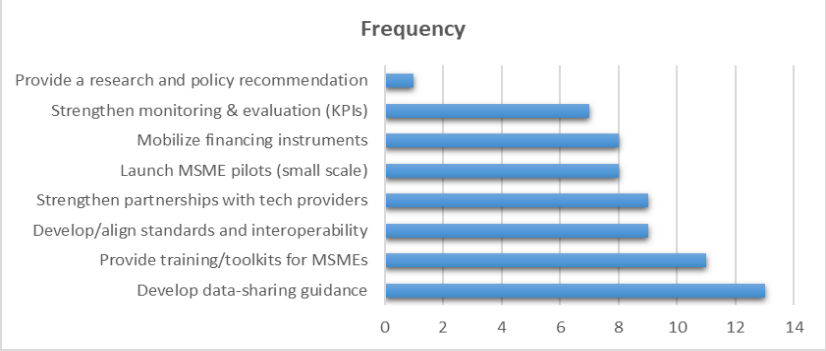
Economy	Main APEC initiative idea	Who's involved	Core outcome
Indonesia (INA)	Digital Energy Resilience Accelerator for public buildings; emerging-tech cooperation for MSMEs.	Energy ministries, cities, MDBs, tech firms, MSME agencies.	IoT-based energy savings and replicable models for MSME technology adoption.
Republic of Korea (ROK)	Implementation follow-up to APEC 2025 Food Security Ministerial Statement.	Food security ministers, senior officials, APEC fora.	Concrete regional programs and pilots that operationalize ministerial commitments.
Malaysia (MAS)	Smart agriculture and regenerative agriculture training.	Extension officers, farmers, training partners.	Higher yields and lower production costs for small farmers.
Peru (PE)	Climate-smart fisheries accelerator; regional food security & agro-climate early warning; big-data alliances and new crops/JVs.	Fisheries/ag ministries, climate services, producers, academia, private sector.	Harmonized indicators, faster response to marine/climate shocks, new resilient value chains.
The Russian Federation (RUS)	Toolkit of instruments and case studies for MSMEs.	MSME agencies, business groups, innovation hubs.	Practical guidance for MSMEs to innovate and strengthen resilience.
Thailand (THA)	Shared digital library on farming under droughts/floods.	Governments, tech firms, farmer organizations.	Easier access to practical solutions, lower costs and more stable food prices.
Viet Nam (VN)	Regional climate & food security data pilot; joint pest/disease early warning.	Ag ministries, S&T agencies, research, MSMEs.	Shared data standards and early-warning tools that improve climate-risk response.

Session 6: Recommendations and Way Forward

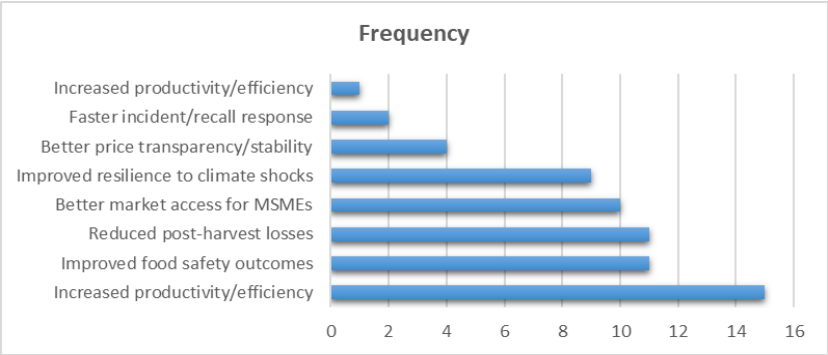
43. My current ability to contribute to actionable recommendations (policy + technology + capacity building) for food security.



44. Most feasible actions in 6–12 months (choose up to 4)



45. Success indicators (choose up to 3)



46. Please provide up to three recommendations to advance food security in the APEC region through emerging technologies, with a focus on MSMEs.

Economy	Key recommendations to advance food security with emerging technologies (focused on MSMEs)
Indonesia (INA)	1) Build MSME capacity and improve access to affordable emerging technologies, digital infrastructure, precision agriculture, IoT and AI-based analytics. 2) Develop interoperable digital food systems, blockchain-enabled traceability, and AI-driven marketplace/e-commerce platforms. 3) Invest in platforms that aggregate and analyze diverse datasets and promote transparency and fair-trade practices to support long-term business sustainability.
Republic of Korea (ROK)	1) Create robust data-sharing mechanisms across economies. 2) Scale digital and AI solutions tailored to MSMEs. 3) Strengthen capacity-building programs so small actors can effectively use these tools.
Malaysia (MAS)	1) Promote smart farming, digital agriculture and remote sensing for small producers. 2) Deploy localized, mobile-first AI tools for smallholders. 3) Use shared-service models (rather than individual ownership) and tropical "test beds" to pilot and scale innovations.
Peru (PE)	1) Roll out low-cost IoT and satellite-linked advisory systems for small fishers and farmers, plus pilots using big data and climate monitoring. 2) Expand blockchain traceability, AI-driven cold-chain optimization and new-genetics projects, organizing small producers into production groups and alliances/JVs. 3) Establish region-wide data standards, accessible digital toolkits and PPP-based cooperation platforms (big data + AI, B2B data platforms) co-designed with MSMEs.
The Russian Federation (RUS)	1) Scale smart agriculture using available IoT and AI technologies from APEC economies. 2) Develop digital B2B platforms to give MSMEs better access to markets and finance.
Thailand (THA)	Set up local community centers where MSMEs can share the cost and use of expensive tools (e.g., drones, AI sensors) to improve crop monitoring and yields.
Viet Nam (VN)	1) Develop interoperable regional data standards and shared early-warning platforms so MSMEs can access real-time climate, market and food-safety information. 2) Invest in gene-silencing technologies targeting pest genes to reduce dependence on chemical pesticides.

Annex N°3. Survey Post Workshop

APEC Survey on Capacity Building for MSMEs in the Use of Emerging Technologies to Enhance Food Security

Thank you for participating in the APEC workshop, which is part of the APEC PPSTI 208 - 2024A project "Capacity Building for MSMEs in the Use of Emerging Technologies to Enhance Food Security" This post-workshop survey seeks to evaluate the overall quality and usefulness of the workshop and to measure changes in participants' knowledge and confidence compared to the pre-workshop baseline. Your input will support evidence-based reporting and continuous improvement, including the refinement of future sessions, modalities (in-person and virtual), and follow-up activities. Completion time is approximately 8–10 minutes.

* Indicates required question

1. Name *

2. E-mail *

3. Gender *

   Mark only one oval

   - ◯ Male
   - ◯ Female

4. Economy *

Mark only one oval

- Australia (AUS)
- Brunei Darussalam (BD)
- Canada (CDA)
- Chile (CHL)
- People's Republic of China (PRC)
- Hong Kong, China (HKC)
- Indonesia (INA)
- Japan (JPN)
- Republic of Korea (ROK)
- Malaysia (MAS)
- Mexico (MEX)
- New Zealand (NZ)
- Papua New Guinea (PNG)
- Peru (PE)
- The Republic of the Philippines (PH or PHL)
- The Russian Federation (RUS)
- Singapore (SGP)
- Chinese Taipei (CT)
- Thailand (THA)
- United States (US or USA)
- Viet Nam (VN)

5. Attendance mode *

Mark only one oval

- In person
- Online/virtual

6. Sessions attended *

Multiple choice

- [ ] Session 1
- [ ] Session 2
- [ ] Session 3
- [ ] Session 4
- [ ] Session 5
- [ ] Session 6

7. Please indicate your level of agreement with the statements listed in the table below. *

	Strongly Agree	Agree	Disagree
The objectives of the training were clearly defined			
The project achieved its intended objectives			
The agenda items and topics covered were relevant			
The content was well organized and easy to follow			
Gender issues were sufficiently addressed during implementation			
The trainers/experts or facilitators were well prepared and knowledgeable about the topic			
The materials distributed were useful			
The time allotted for the training was sufficient			

8. Overall satisfaction *

Mark only one oval

	1	2	3	4	5	
Very dissatisfied						Very satisfied

9. The workshop met my expectations *

Mark only one oval

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

10. Relevance to my work/MSME context *

Mark only one oval

	1	2	3	4	5	
Not relevant	◯	◯	◯	◯	◯	Highly relevant

11. How relevant was this project to you and your economy? *

Mark only one oval

	1	2	3	4	5	
Not much	◯	◯	◯	◯	◯	Very much

12. What new skills and knowledge did you gain from this event? *

13. I gained practical knowledge I can apply within 3–6 months *

Mark only one oval

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

14. The workshop strengthened my understanding of the role of emerging technologies in food security *

Mark only one oval

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

15. Learning Gains (Pre vs Post) *

Mark only one oval

	None	Basic	Intermediate	Advanced	Expert
Post-workshop: Understanding of food security challenges in my economy					
Post-workshop: Familiarity with emerging technologies					
Post-workshop: My confidence to contribute to initiatives/pilots using emerging technologies to enhance food security					

16. Compared to before the workshop, my understanding is: *

Mark only one oval

- Significantly improved
- Improved
- No change
- Decreased

17. Rate your level of knowledge of and skills in the topic prior to participating in the event: *

Mark only one oval

	1	2	3	4	5	
Very low						Very high

18. Rate your level of knowledge of and skills in the topic prior to participating in the event: *

Mark only one oval

	1	2	3	4	5	
Very low						Very high

19. What changed the most for you? Please describe the most important new insight, tool, or approach you gained? *

20. Session 1

Mark only one oval

	Poor	Fair	Good	Very good	Excellent
Session content relevance					
Speaker/panel quality					
Practical usefulness (applicability)					
Pacing/time allocation					
Participation Quality (In-person & Virtual)					

21. Session 2

Mark only one oval

	Poor	Fair	Good	Very good	Excellent
Session content relevance					
Speaker/panel quality					
Practical usefulness (applicability)					
Pacing/time allocation					
Participation Quality (In-person & Virtual)					

22. Session 3

Mark only one oval

	Poor	Fair	Good	Very good	Excellent
Session content relevance					
Speaker/panel quality					
Practical usefulness (applicability)					
Pacing/time allocation					
Participation Quality (In-person & Virtual)					

23. Session 4

Mark only one oval

	Poor	Fair	Good	Very good	Excellent
Session content relevance					
Speaker/panel quality					
Practical usefulness (applicability)					
Pacing/time allocation					
Participation Quality (In-person & Virtual)					

24. Session 5

Mark only one oval

	Poor	Fair	Good	Very good	Excellent
Session content relevance					
Speaker/panel quality					
Practical usefulness (applicability)					
Pacing/time allocation					
Participation Quality (In-person & Virtual)					

25. Quality of interaction and discussion *

Mark only one oval

	1	2	3	4	5	
Poor						Excellent

26. Inclusiveness of participation across economies and stakeholder groups *

Mark only one oval

	1	2	3	4	5	
Poor						Excellent

27. If you joined virtually: How was your online experience?

Mark only one oval

	1	2	3	4	5	
Poor						Excellent

28. If you joined in person: How was the in-person experience?

Mark only one oval

	1	2	3	4	5	
Poor						Excellent

29. What would improve participation quality next time? (choose up to 3) *

- [ ] More time for Q&A
- [ ] More breakout groups / interactive activities
- [ ] More MSME-focused case studies
- [ ] More hands-on demonstrations
- [ ] Better moderation and timekeeping
- [ ] Better virtual engagement tools (polls, chat facilitation)
- [ ] Better interpretation/clarity of materials (if relevant)
- [ ] Other _____

30. Likelihood of taking action within 6 months *

Mark only one oval

- ◯ Very likely
- ◯ Likely
- ◯ Not sure
- ◯ Unlikely
- ◯ Very unlikely

31. What action are you most likely to take? (choose up to 2) *

- [ ] Explore an IoT pilot
- [ ] Explore a data/AI analytics pilot
- [ ] Improve traceability / food safety systems
- [ ] Engage in a cross-border collaboration initiative
- [ ] Seek financing/partners for adoption
- [ ] Share learnings internally / train colleagues
- [ ] Other _____

32. What support would help you most? (choose up to 3) *

- [ ] Practical pilot templates (scope, KPIs, cost model)
- [ ] Access to technical experts / mentorship
- [ ] Partnerships with technology providers
- [ ] Guidance on data governance/standards
- [ ] Access to finance/investment mechanisms
- [ ] Policy/regulatory guidance
- [ ] Community of practice / ongoing network
- [ ] Other _____

33. Most valuable element of the workshop *

_____

_____

_____

_____

_____

34. Top 3 areas for improvement (choose up to 3) *

- [ ] More region-specific data and benchmarks
- [ ] More MSME-oriented content
- [ ] Deeper technical content
- [ ] More policy and enabling environment discussion
- [ ] More time for networking/collaboration
- [ ] Better balance between presentations and interaction
- [ ] Better virtual delivery quality
- [ ] Other _____

35. Provide up to three actionable recommendations for APEC economies and stakeholders to advance food security through emerging technologies with a focus on MSMEs *

_____

_____

_____

_____

_____

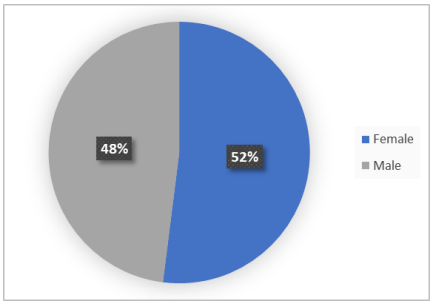
36. How will you apply the project's content and knowledge gained at your workplace? Please provide examples (e.g. develop new policy initiatives, organize trainings, develop work plans/ strategies, draft regulations, develop new procedures/tools etc.) *

37. What needs to be done next by APEC? Are there plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies? *

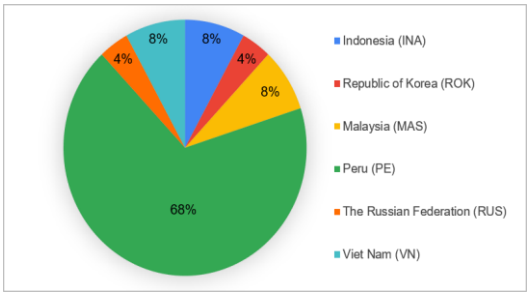
38. How could this project have been improved? Please provide comments on how to improve the project, if relevant. *

Annex N°4. Survey Post Workshop Results

1. Gender

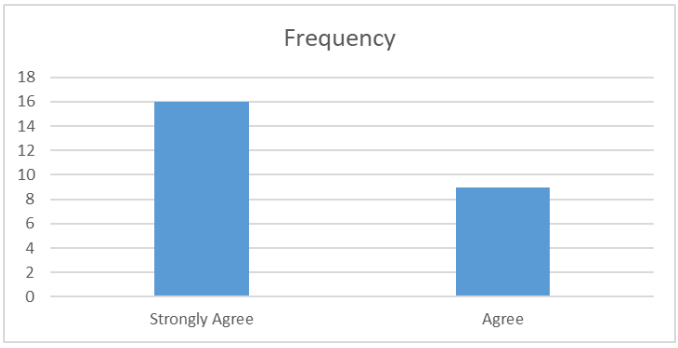


2. Economy

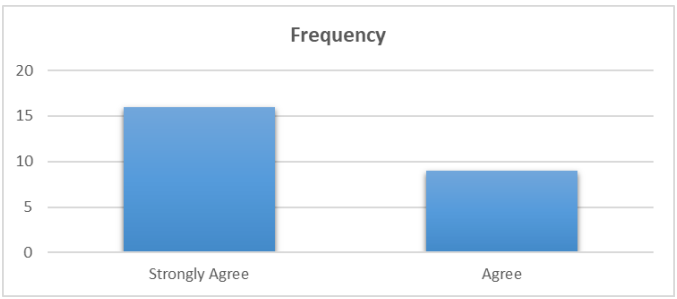


3. Please indicate your level of agreement with the statements listed in the table below.

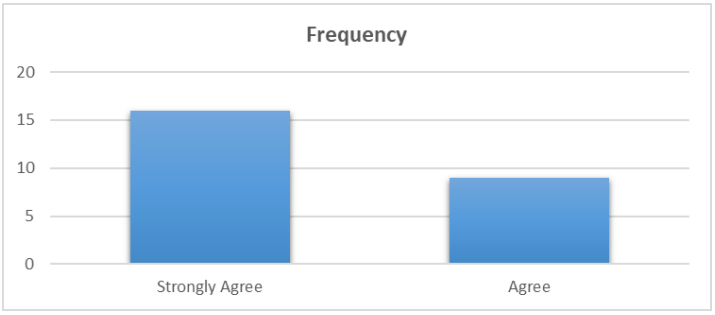
3.1. The objectives of the training were clearly defined



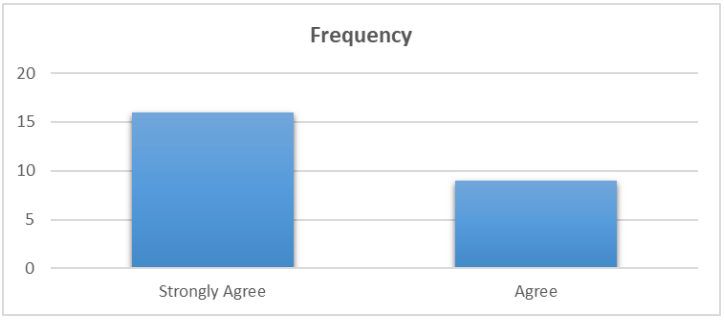
3.2. The project achieved its intended objectives



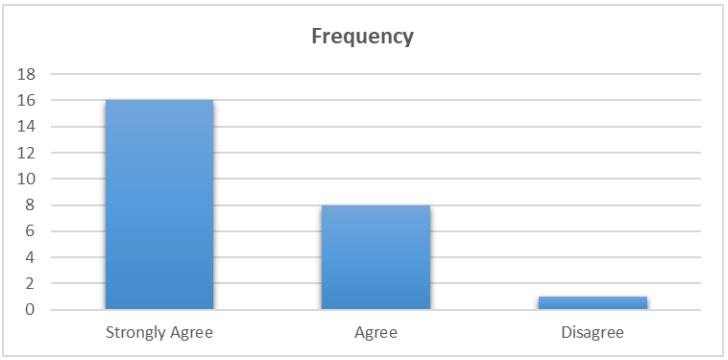
3.3. The agenda items and topics covered were relevant



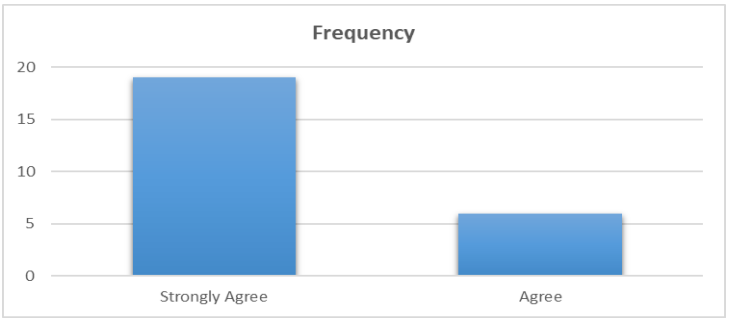
3.4. The content was well organized and easy to follow



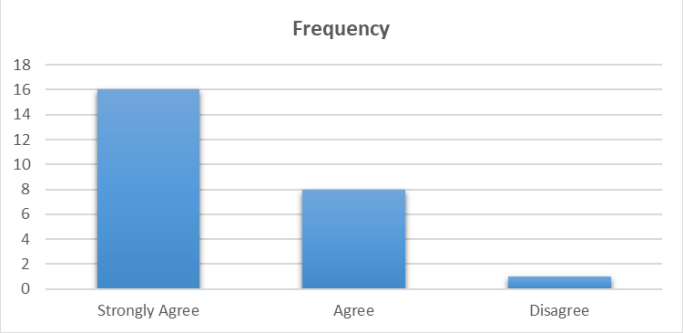
3.5. Gender issues were sufficiently addressed during implementation



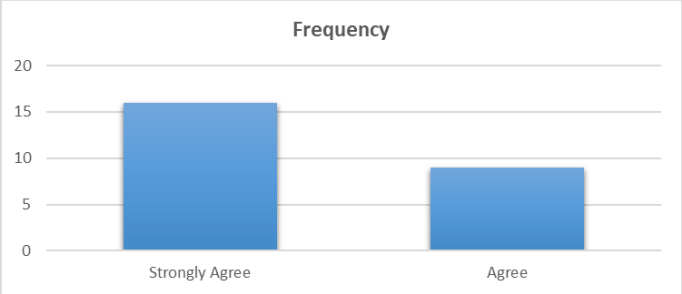
3.6. The trainers/experts or facilitators were well prepared and knowledgeable about the topic



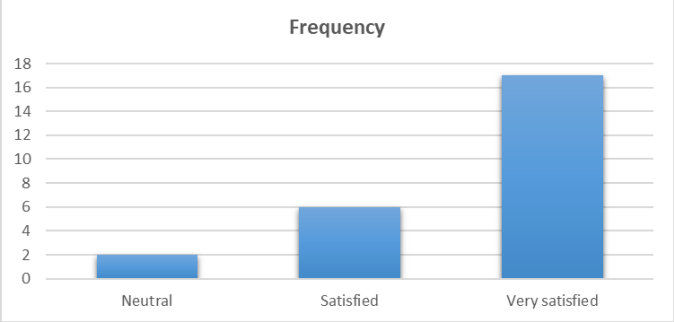
3.7. The materials distributed were useful



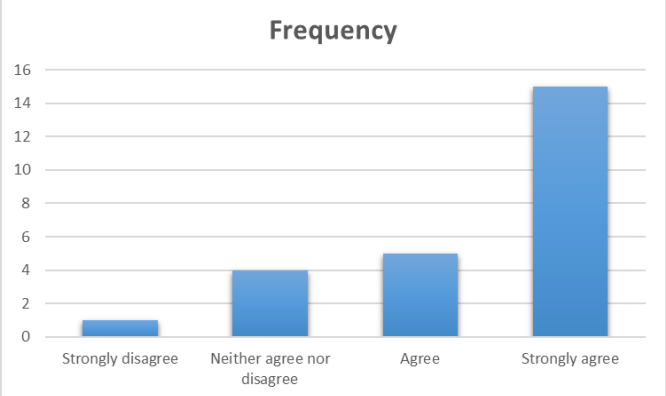
3.8. The time allotted for the training was sufficient



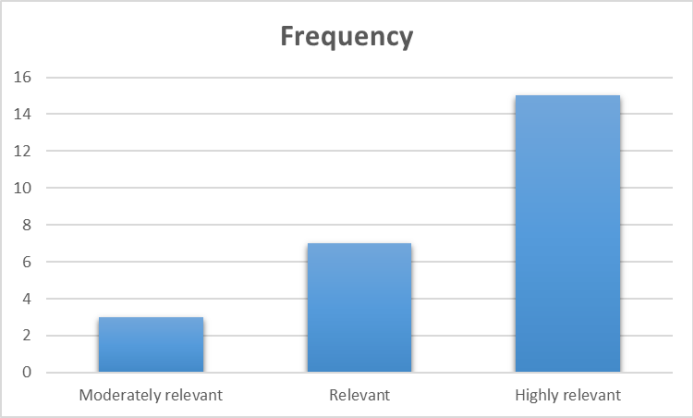
4. Overall satisfaction



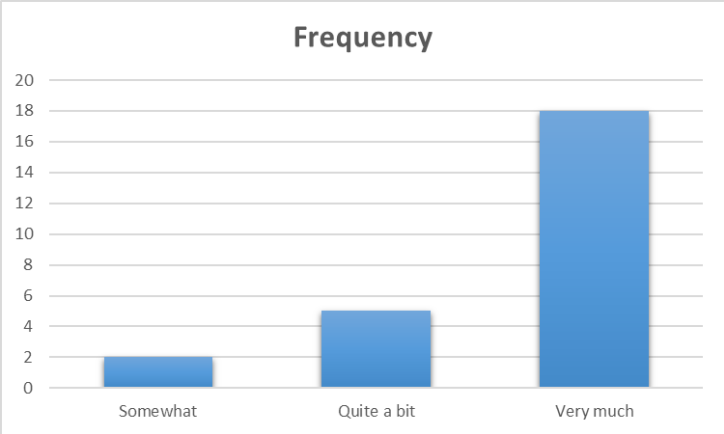
5. The workshop met my expectations



6. Relevance to my work/MSME context



7. How relevant was this project to you and your economy?



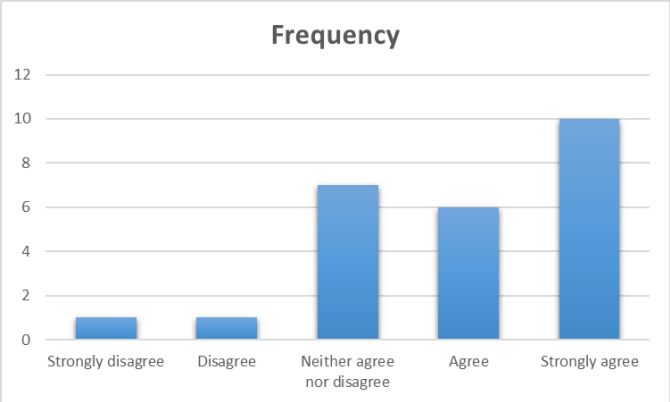
8. What new skills and knowledge did you gain from this event?

Participants stated that the event contributed to strengthening their knowledge of the use of emerging technologies applied to food security and the agri-food sector, particularly in areas such as artificial intelligence, Big Data, blockchain, IoT, remote sensing, smart farming, and digital tools for agriculture. They also indicated that they gained a better understanding of how these technologies can contribute to decision-making, agricultural monitoring, traceability, efficient resource management, and adaptation to climate change.

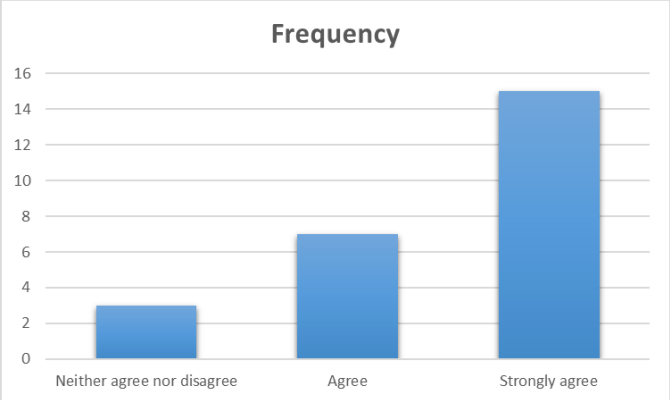
Likewise, participants highlighted that the event allowed them to learn about digital experiences and projects developed across APEC economies, as well as good practices related to MSME support, science, technology and innovation governance, and the strengthening of public policies aimed at improving food security.

Finally, participants emphasized the importance of information sharing, regional collaboration, and networking among APEC economies, identifying opportunities to promote partnerships, joint projects, and cooperation mechanisms that support the adoption and scaling of emerging technologies in agri-food systems.

9. I gained practical knowledge I can apply within 3–6 months

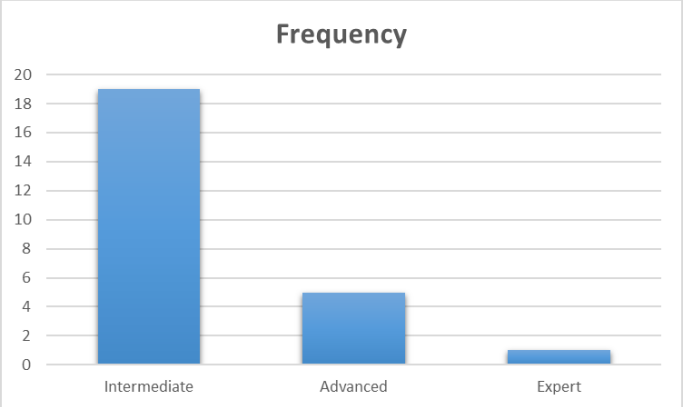


10. The workshop strengthened my understanding of the role of emerging technologies in food security

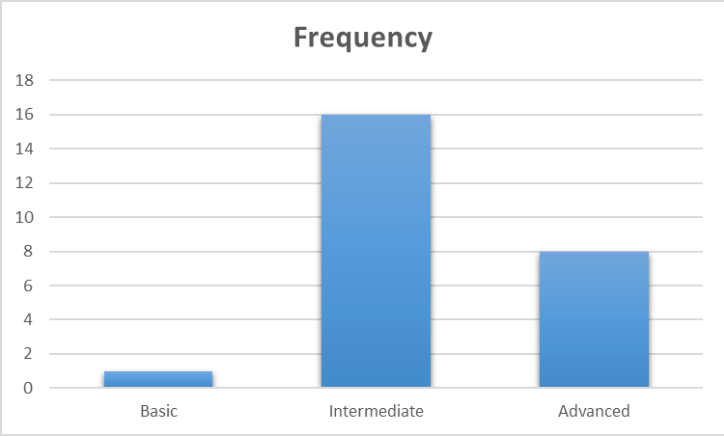


11. Learning Gains (Pre vs Post)

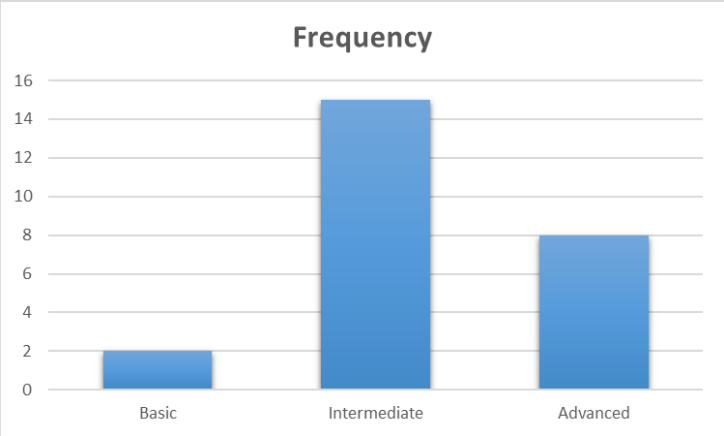
    11.1. Post-workshop: Understanding of food security challenges in my economy



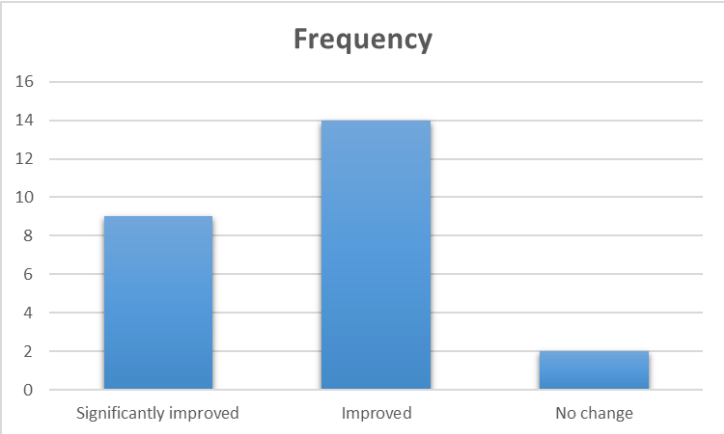
11.2. Post-workshop: Familiarity with emerging technologies in agriculture/food systems



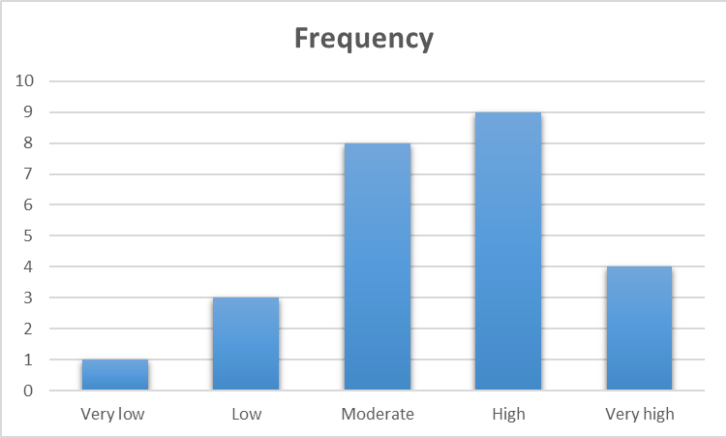
11.3. Post-workshop: My confidence to contribute to initiatives/pilots using emerging technologies to enhance food security



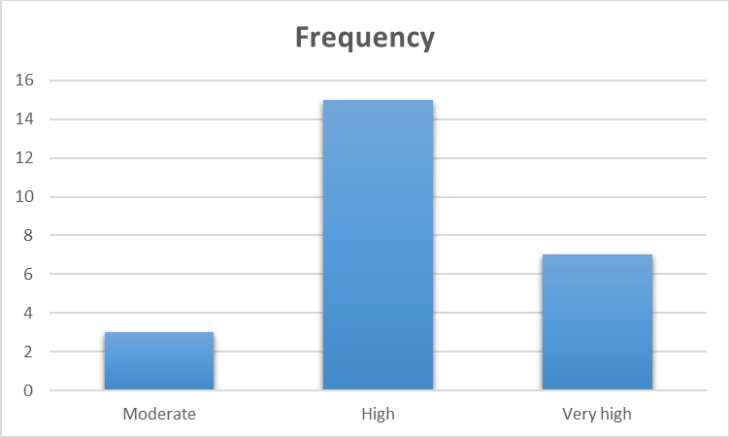
12. Compared to before the workshop, my understanding is:



13. Rate your level of knowledge of and skills in the topic prior to participating in the event:



14. Rate your level of knowledge of and skills in the topic after participating in the event:



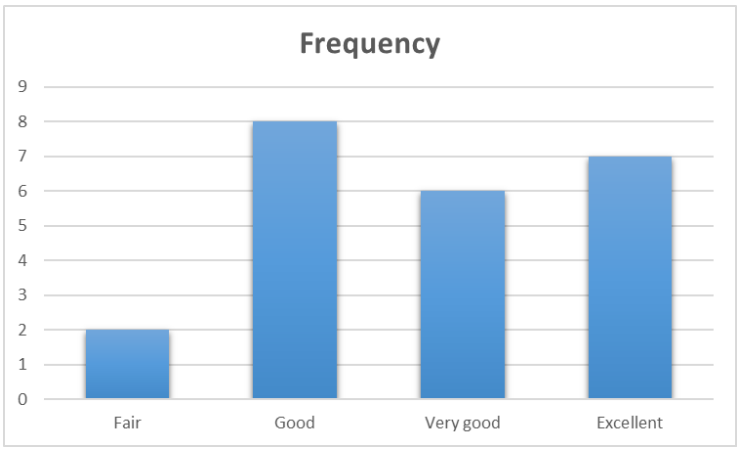
15. What changed the most for you? Please describe the most important new insight, tool, or approach you gained.

    Participants reported that the event broadened their understanding of how emerging technologies can support food security across APEC economies, particularly through the use of AI, Big Data, remote sensing, digital platforms, smartphones, and smart technologies. They highlighted new insights on applying these tools to agricultural decision-making, crop management, research, marketing, and climate-resilient food systems.

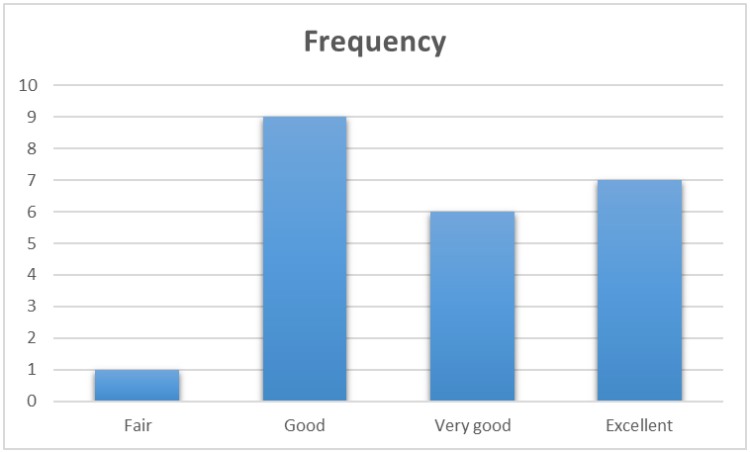
    They also emphasized the importance of learning from the experiences and best practices of other APEC economies, especially regarding MSMEs, smallholder farmers, and producers. A key takeaway was that technology adoption requires not only digital tools, but also capacity building, public-private partnerships, regional cooperation, knowledge exchange, and practical approaches adapted to local needs.

16. **Session 1:**

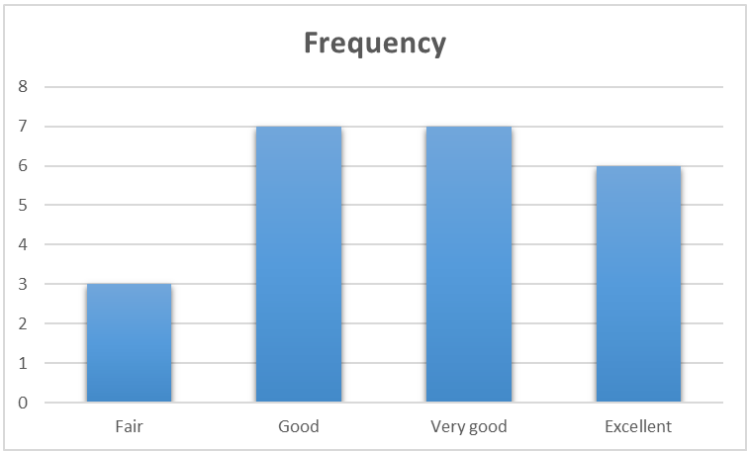
16.1. Session content relevance



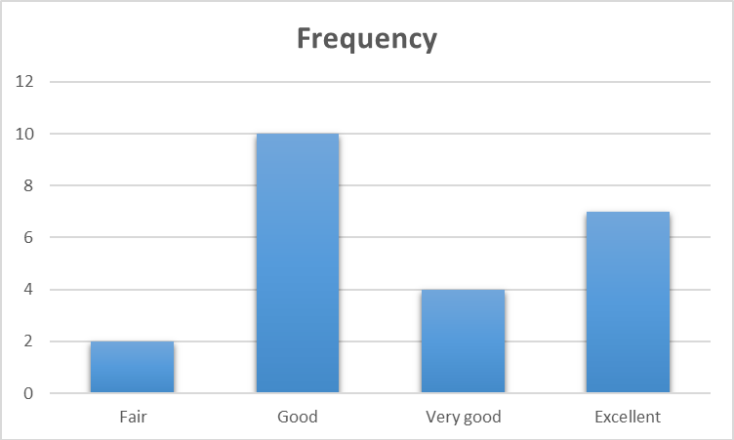
16.2. Speaker/panel quality



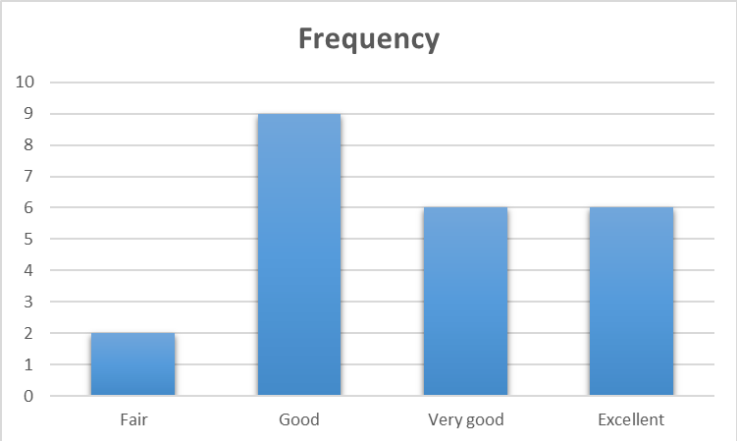
16.3. Practical usefulness (applicability)



16.4. Pacing/time allocation

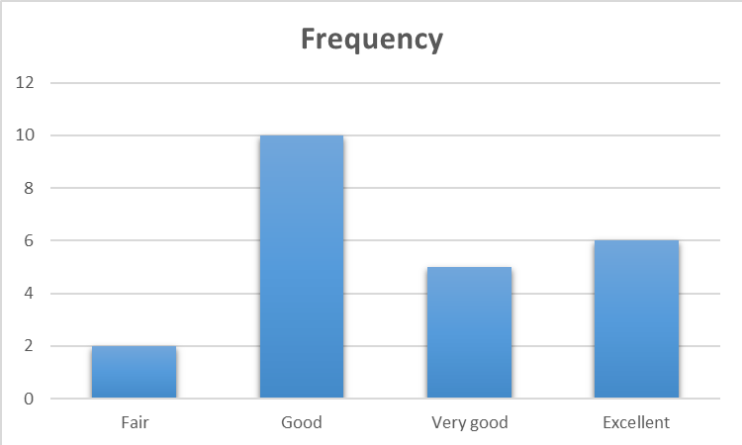


16.5. Participation Quality (In-person & Virtual)

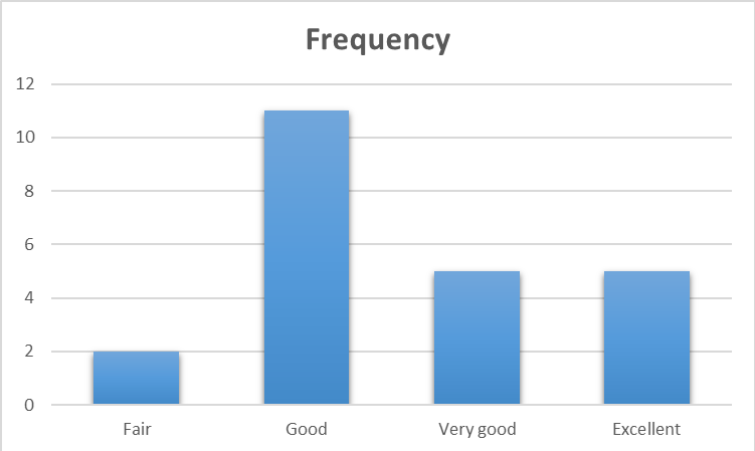


17. **Session 2:**

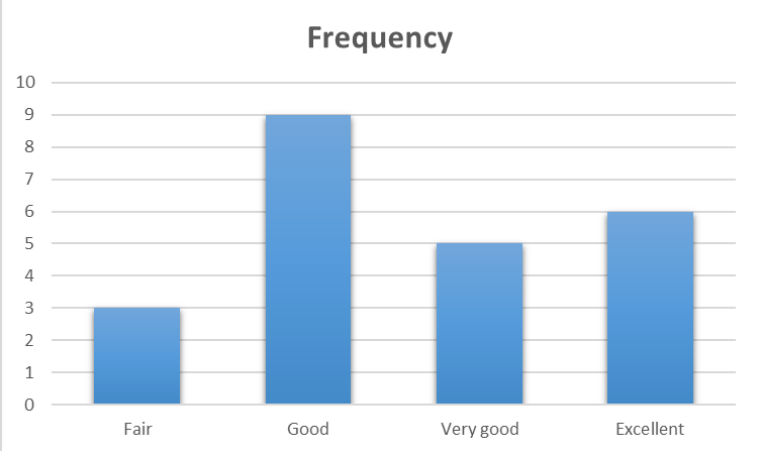
17.1. Session content relevance



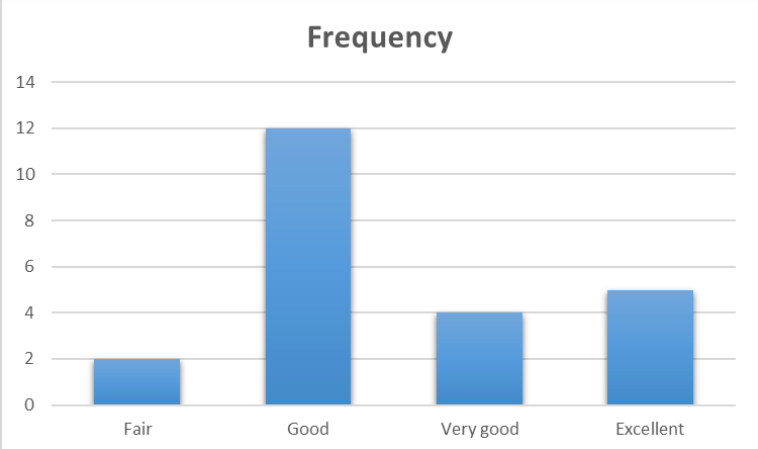
17.2. Speaker/panel quality



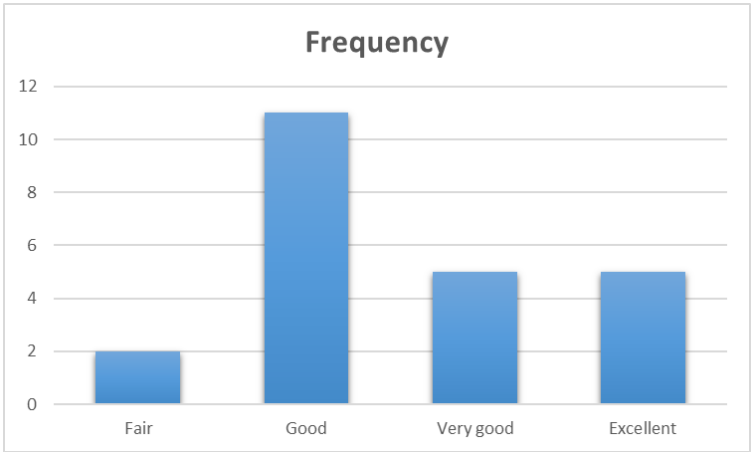
17.3. Practical usefulness (applicability)



17.4. Pacing/time allocation

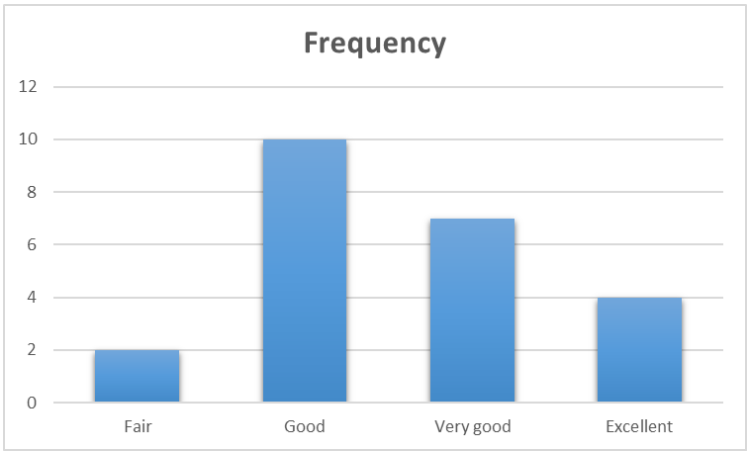


17.5. Participation Quality (In-person & Virtual)

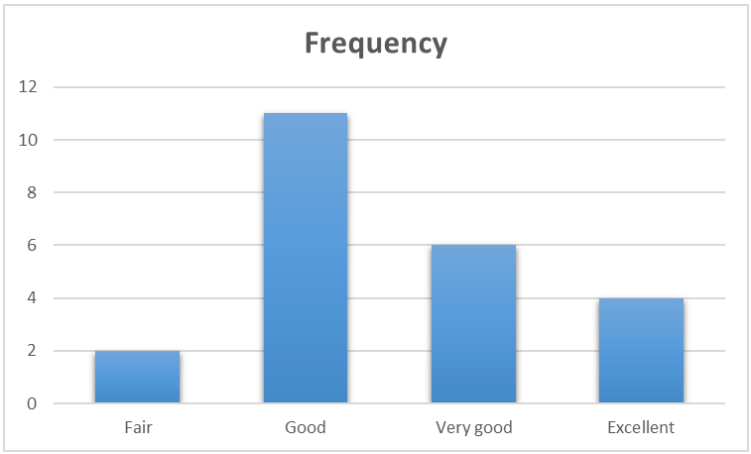


18. **Session 3:**

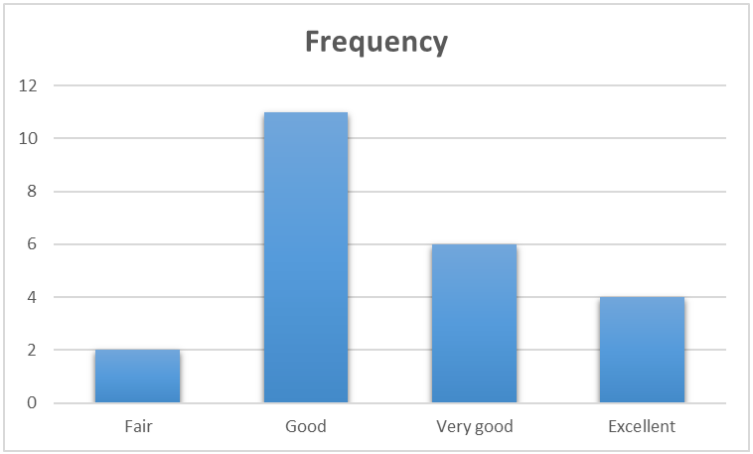
18.1. Session content relevance



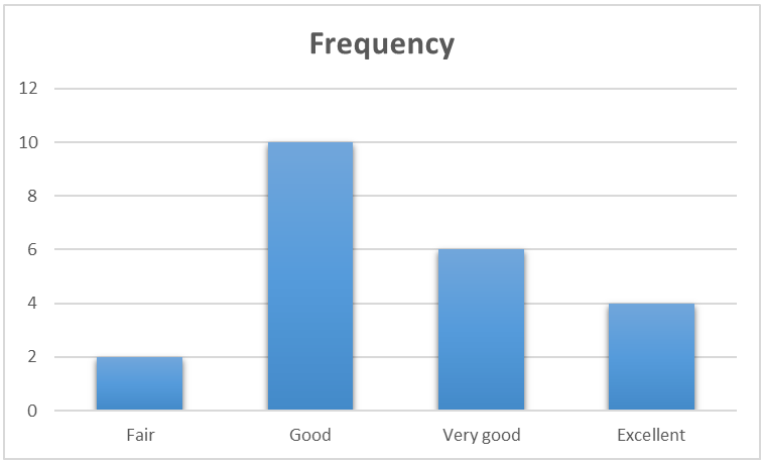
18.2. Speaker/panel quality



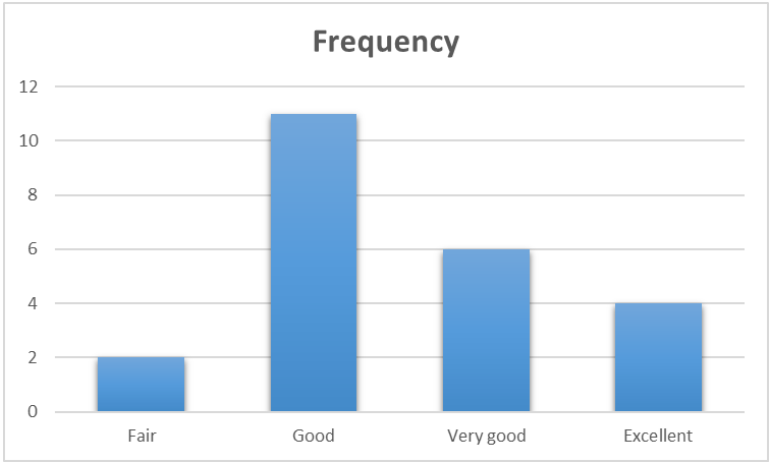
18.3. Practical usefulness (applicability)



18.4. Pacing/time allocation

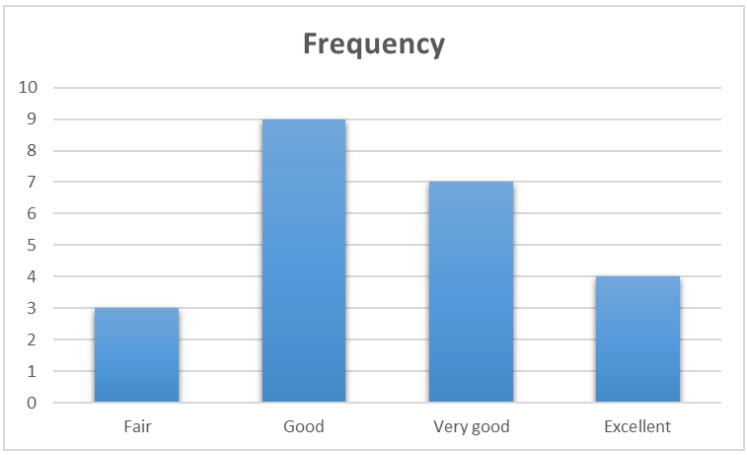


18.5. Participation Quality (In-person & Virtual)

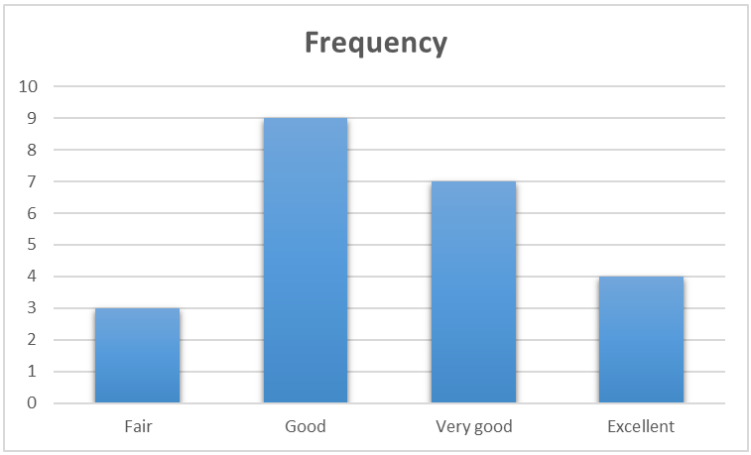


19. **Session 4:**

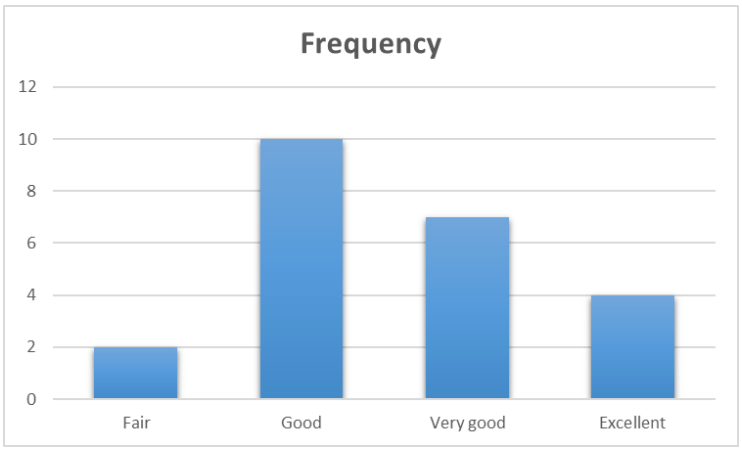
19.1. Session content relevance



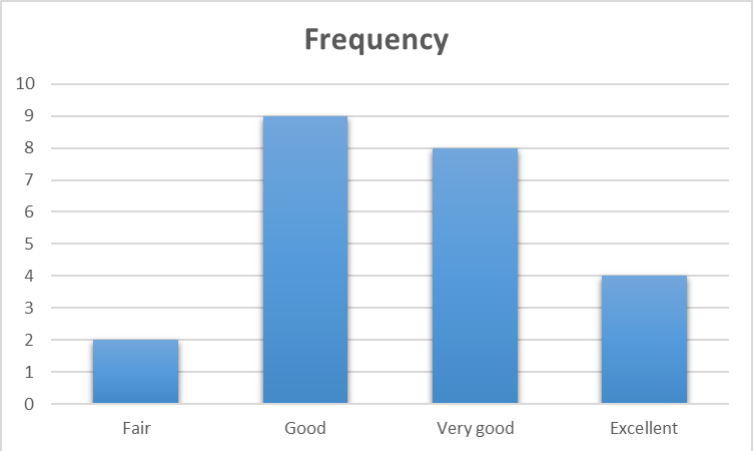
19.2. Speaker/panel quality



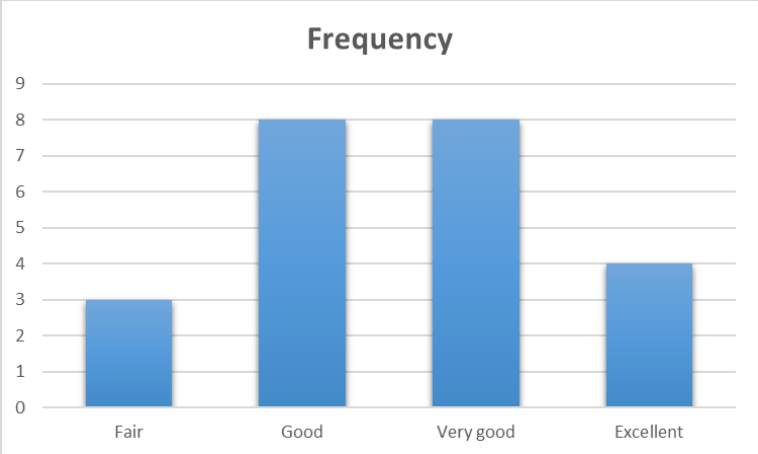
19.3. Practical usefulness (applicability)



19.4. Pacing/time allocation

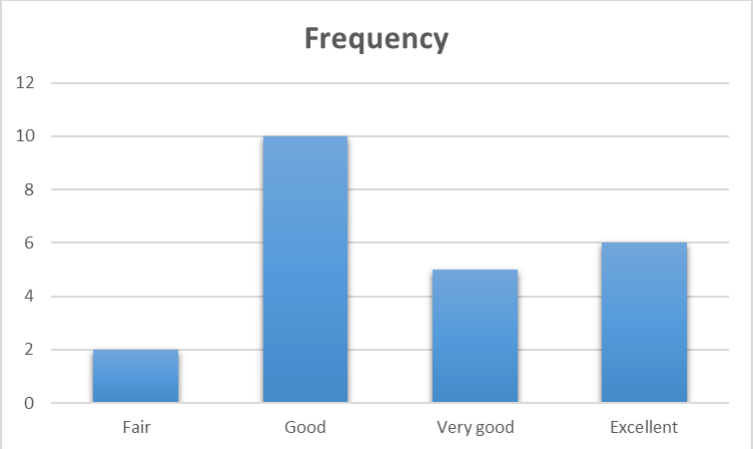


19.5. Participation Quality (In-person & Virtual)

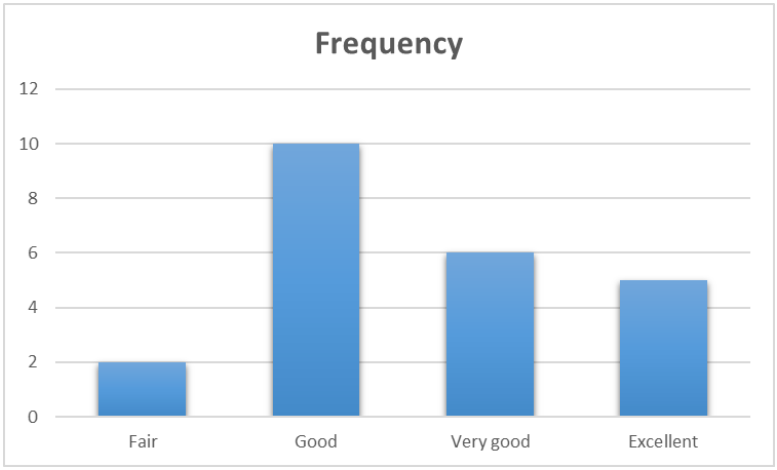


20. **Session 5:**

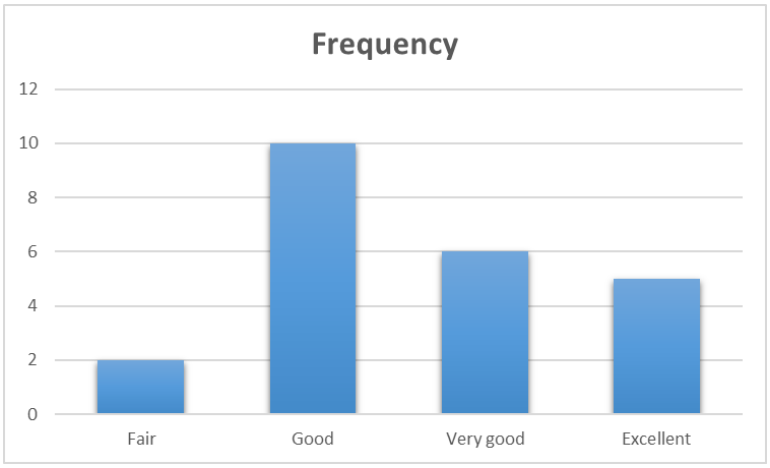
20.1. Session content relevance



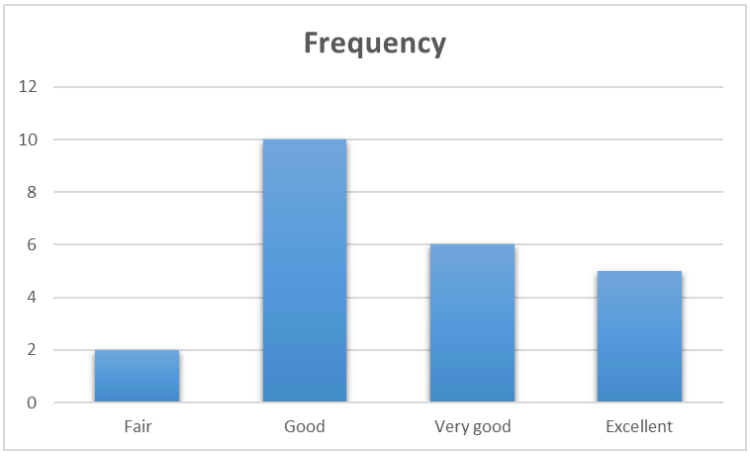
20.2. Speaker/panel quality



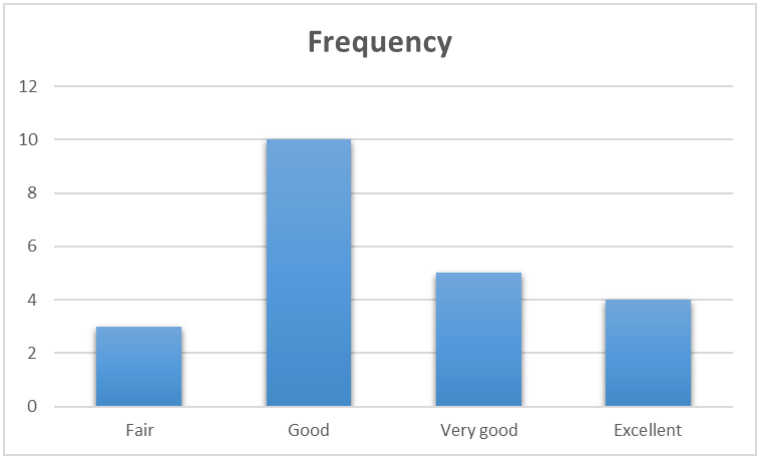
20.3. Practical usefulness (applicability)



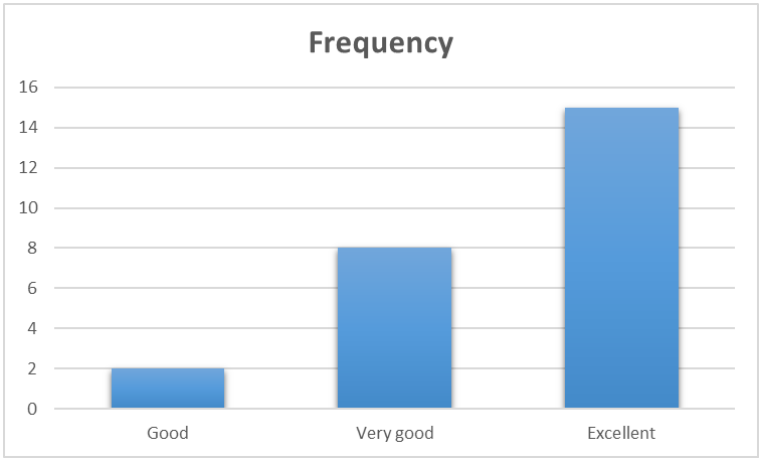
20.4. Pacing/time allocation



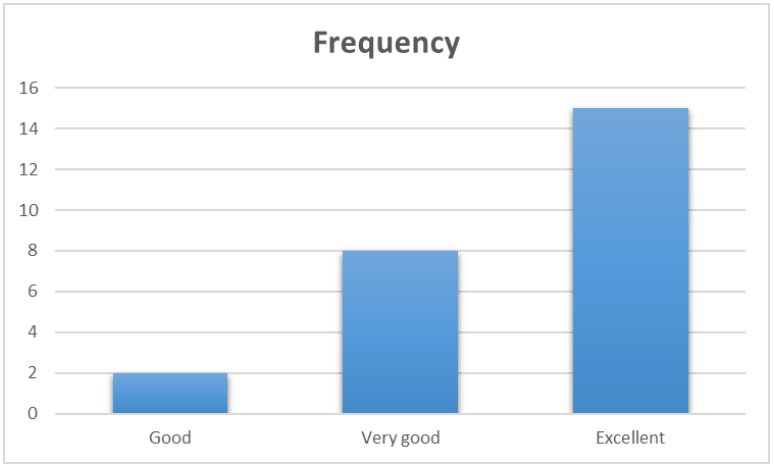
20.5. Participation Quality (In-person & Virtual)



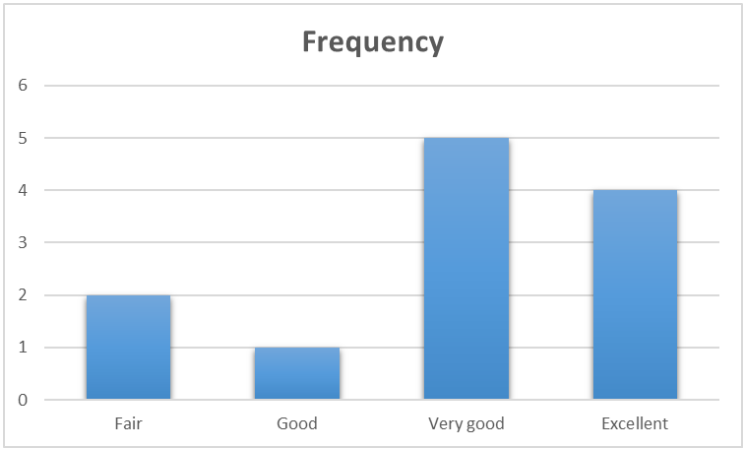
21. Quality of interaction and discussion



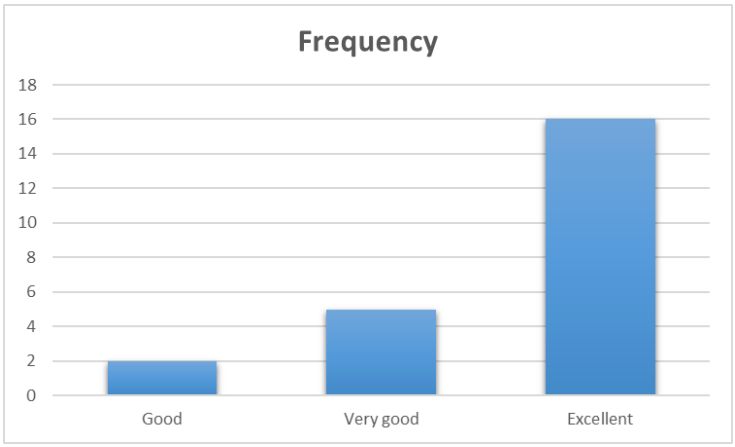
22. Inclusiveness of participation across economies and stakeholder groups



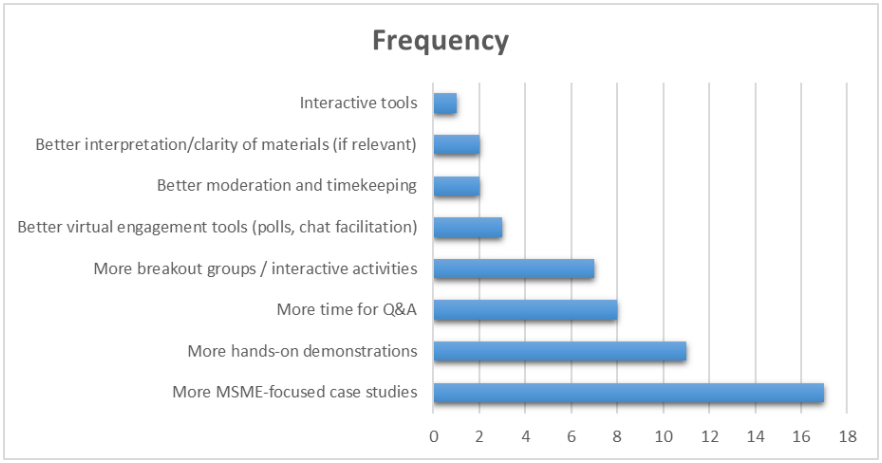
23. If you joined virtually: How was your online experience?



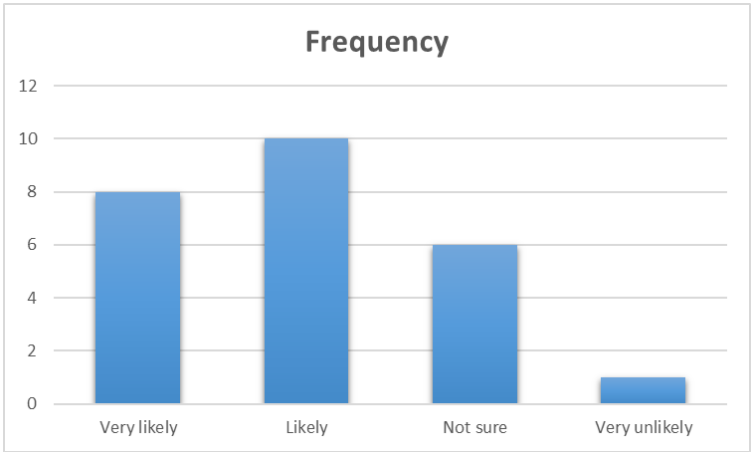
24. If you joined in person: How was the in-person experience?



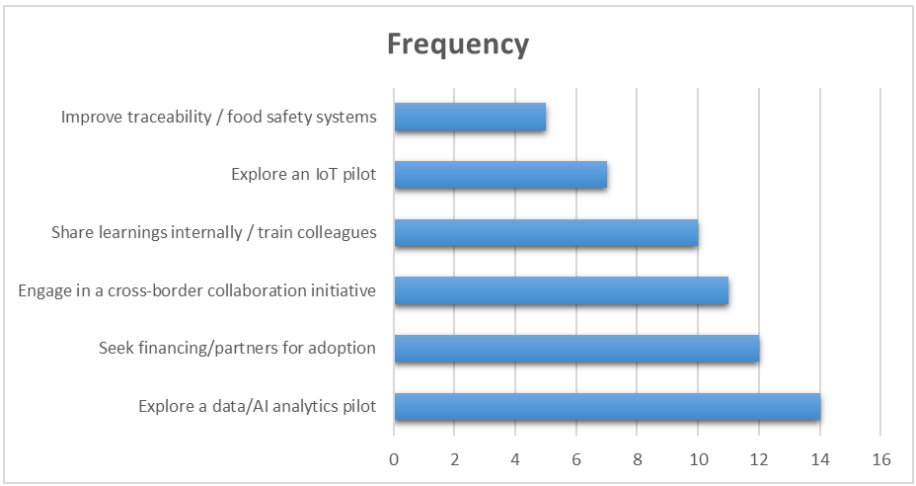
25. What would improve participation quality next time?



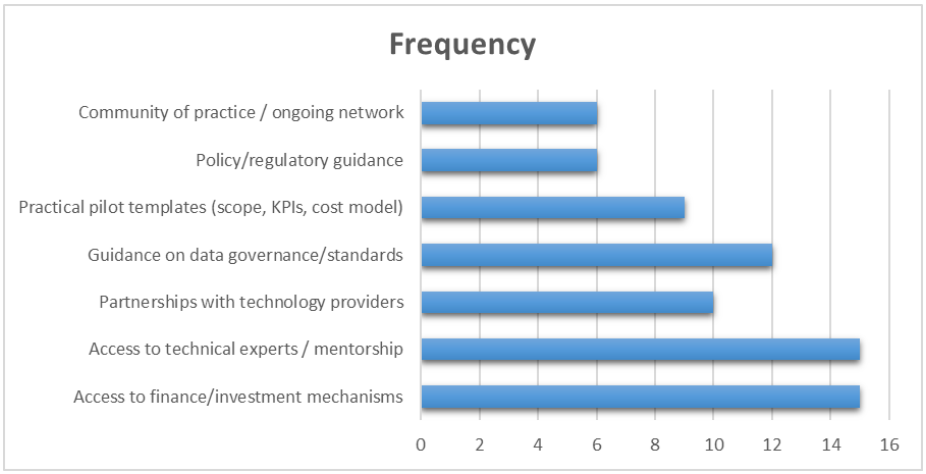
26. Likelihood of taking action within 6 months



27. What action are you most likely to take?



28. What support would help you most?



29. Most valuable element of the workshop

    Participants identified the exchange of experiences among APEC economies as the most valuable element of the workshop. They highlighted the opportunity to share best practices, lessons learned, and practical examples on the use of AI, digital technologies, and data tools to strengthen food security, agriculture, and climate resilience.

    They also valued the expert presentations, discussions, networking opportunities, and connections established with participants from other economies, which helped identify possible pathways for future collaboration. Overall, the workshop was appreciated for promoting dialogue, collaboration, and knowledge exchange among diverse stakeholders.

30. Top 3 areas for improvement

Top	Areas
1	More region-specific data and benchmarks
2	Deeper technical content
3	More time for networking/collaboration

31. Provide up to three actionable recommendations for APEC economies and stakeholders to advance food security through emerging technologies with a focus on MSMEs.

    Based on participants' responses, three key recommendations are proposed:

    a. Strengthen digital infrastructure, connectivity, and data-sharing platforms to support MSMEs and smallholder farmers in accessing information, market intelligence, digital tools, and regional knowledge exchange.
    b. Promote capacity building and practical training in emerging technologies, including AI, Big Data, smart farming, digital platforms, and smartphone-based solutions, to improve agricultural decision-making, productivity, traceability, and market access.
    c. Foster regional cooperation, public-private partnerships, and pilot projects among APEC economies, with funding mechanisms that support research, dissemination, implementation, and the scaling of affordable technologies adapted to MSMEs' needs.

32. How will you apply the project's content and knowledge gained at your workplace? Please provide examples (e.g. develop new policy initiatives, organize trainings, develop work plans/strategies, draft regulations, develop new procedures/tools etc.).

    Participants indicated that they will apply the knowledge gained by developing or strengthening policy initiatives, work plans, strategies, procedures, and tools related to food security, digital transformation, and the use of emerging technologies in agriculture.

    Several responses highlighted the intention to organize training activities and knowledge-sharing sessions for colleagues, MSMEs, farmers, and other stakeholders, with a focus on AI, data-driven tools, smart farming, and digital solutions. Participants also mentioned the development of pilot initiatives, monitoring and evaluation systems, and innovation indicators to support evidence-based decision-making.

In addition, some participants emphasized the importance of building alliances and joint work with public institutions, private actors, academia, and regional stakeholders, applying new technologies to local challenges, strategic crops, aquaculture, production chains, and agricultural modernization processes.

33. What needs to be done next by APEC? Are there plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies?

    Participants suggested that APEC should translate the project's outcomes into a structured follow-up roadmap aimed at advancing food security through the adoption of emerging technologies. Proposed actions include the development of joint pilot projects, technology transfer initiatives, capacity-building activities, and knowledge-sharing platforms among APEC economies.

    The responses also emphasized the importance of strengthening regional cooperation through joint research, communities of practice, and mechanisms to monitor progress and disseminate lessons learned. In addition, participants highlighted the need to involve governments, academia, the private sector, MSMEs, and larger companies in order to support the scaling of AI, digital tools, data systems, and other emerging technologies, in accordance with each economy's food security priorities.

34. How could this project have been improved? Please provide comments on how to improve the project, if relevant.

    Participants positively assessed the project and highlighted three main opportunities for improvement: incorporating more region-specific case studies and practical examples; providing deeper technical guidance for MSMEs; and establishing clearer follow-up mechanisms, such as pilot projects, mentorship, joint research, and action plans.