Food and Agriculture Organization of the United Nations

Guide for training of facilitators of multi-actors agricultural innovation platforms

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Cover photos:

Photo (center): *MAIP facilitators discussing processing and storage of agricultural products with producers in Azerbaijan.*
Photo (bottom left): *MAIP facilitators meeting with beekeepers in Azerbaijan.*

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Foreword

Agrifood systems face complex and interconnected global challenges of food security and climate change and biodiversity loss. Addressing this is urgent as agricultural and food systems are contributing to the anthropogenic perturbation of earth systems that exceeds four planetary boundaries, i.e. climate change, biosphere integrity, biogeochemical flows and land system change (Steffen *et al.*, 2015). These challenges highlight the need for innovation with an emphasis on taking integrated approaches to tackle interconnected systemic challenges. Innovation can contribute to driving socio-economic growth, ensuring food security and nutrition, alleviating poverty and improving resilience to climate change, thereby contributing to the achievement of the United Nations' Sustainable Development Goals (SDGs). Innovative approaches benefit from engaging multiple actors while respecting their specific roles and responsibilities. They must be adapted to the local context to ensure impact while managing risks and avoiding unintended negative consequences.

Innovation platforms, as models for inclusive innovation, are increasingly deployed in complex systems like agrifood systems. Rooted in theories of complexity, the concept of innovation systems and practices of participatory action research and extension (Davies *et al.*, 2017), innovation platforms are a powerful tool to drive transformative change. This role appears even more promising considering the need of adaptation to and recovery from the on-going COVID-19 crisis, which demands game-changing solutions to attain global food security. With multi-actor partnership being their key characteristic (Davies *et al.*, 2017; Klerkx *et al.*, 2013; Swaans *et al.*, 2014), they link researchers, extension agents, private enterprises, entrepreneurs and smallholder farmers, creating a space for them to collaborate and co-innovate. This facilitates information and knowledge exchange and technological innovation among agricultural value chain actors, which contributes to sustainable agricultural development. Moreover, a new and effective system of technological innovation and extension is promoted through the involvement of education, research and local extension sectors in multi-actor agricultural innovation platforms (MAIPs). Therefore, MAIPs are an innovative agricultural extension and advisory service (AEAS) approach. They can provide demand-driven services to farmers and key value chain actors when they encounter production, processing or market problems. In addition, they can allow technologies or other types of innovations to scale out beyond the original innovation platform scope, geographical focus or target audience (Schut *et al.*, 2018).

Evidence from Central and West Africa shows that innovation platforms have resulted in increased yields and incomes for crops (such as maize, sorghum, soybean), meat, and dairy value chains (Davies *et al.*, 2017). In Bangladesh, similar platforms have led to an increased income and a substantial reduction of labour costs (Malabayabas *et al.*, 2014). If the MAIPs processes are truly demand-driven, participatory and

based on collective investment and action, they have the ability to bring together committed stakeholders, and result in innovations that are technically sound, locally adapted and economically feasible for farmers and all the key value chain actors.

There is a growing number of successful pre-types of MAIPs emerging, including those initiatives in Central and West Africa, China, Bangladesh, Cuba, India and Indonesia (Monyo *et al.*, 2021; Oluwole *et al.*, 2016; Rosset & Val, 2018; Schut *et al.*, 2018; Zhang *et al.*, 2016). The innovation platform Science and Technology Backyard (STB) initiative was established in China's Quzhou County (Yang *et al.*, 2021; Zhang *et al.*, 2016). It is aimed at increasing the co-creation and sharing of knowledge and skills between scientists and farmers. STB brings agricultural scientists to live in villages where they use field demonstrations, farming schools and yield contests to engage farmers in externally and locally developed innovation initiatives. Reflections on success factors highlight in-person communications, sociocultural bonding and the trust developed among farmer groups. In Cuba, the Campesino a Campesino methodology is considered the most successful way to promote farmer innovation and horizontal sharing and learning (Rosset & Val, 2018). Through this methodology, farmers share knowledge and technologies with each other through peer-to-peer learning, teaching and cooperatives.

In 2006, SysCom India was launched as an innovation platform composed of scientists, development practitioners and farmers. The consortium collaborates to develop place-sensitive organic cotton production techniques. The Consortium for Sustainable Development of the Andean Ecoregion uses innovation platforms to address issues in natural resource management. The Fodder Adoption Project in Ethiopia, with an innovation platform approach, broadened its initial narrow focus on feed to the procurement of improved crossbred cows, new milk transportation arrangements, and the establishment of a dairy cooperative.

The International Center for Tropical Agriculture and its partners developed a regional "learning alliance" in Central America to improve market access for farmers through collaborative innovation. The Convergence of Science–Strengthening Innovation Systems programme used innovation platforms in West Africa to study bottlenecks in production systems and induce institutional changes in value chains and policymaking. The Bubaare Innovation Platform from Uganda started as an international agricultural research project with research institutes, farmers' groups, private food processors and distributors. The initial objective was to develop the local sorghum value chain. By fostering market linkages for farmers, it started several other value-adding projects and finally became a multi-commodity cooperative society of farmers. It can be seen from the above cases that MAIPs (1) can be implemented at different levels, ranging from local to international; (2) can deal with a certain agricultural value chain and grow along it in an incremental manner; and (3) are contextualized according to local conditions.

Facilitation has proved crucial for enabling the interaction of Agricultural Innovation System (AIS) actors to address the target and to innovate (TAP, 2016). This "Guide on training of facilitators of multi-actor agricultural innovation platform" is aimed

at serving facilitators when MAIPs are organized. Since MAIPs are still an emerging concept, there are not many cases to refer to. This guide mainly summarizes the experiences from the implementation of MAIPs in permission, hazelnuts and honey value chains that FAO organized through the EU-funded project of Development of sustainable and inclusive local food systems in north-west region of Azerbaijan (GCP/AZE/014/EC) and STB initiatives.

This guide is a guideline tool, rather than a textbook for training MAIPs facilitators. Facilitators should keep in mind that MAIPs advocate learning by doing, through practice. They should conduct MAIPs by referring to the training activities in this book instead of copying. Although the authors have tried their best to make this guide applicable to agricultural production and social development in various places, it is difficult to cover all the content. Therefore, MAIPs facilitators using this book are encouraged to give full play to creativity and develop training activities and methods sensitive to local characteristics and value chains.

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Acronyms

AEAS	Agricultural extension and advisory services
AIS	Agricultural innovation system
COVID-19	Coronavirus disease 2019
EAS	Extension and advisory services
FAO	The Food and Agriculture Organization
FFS	Farmer field schools
FPR	Farmer participatory research
ICTs	Information and communications technologies
INRAE	Institut national de recherche pour l'agriculture, l'alimentation et l'environnement
IPM	Integrated pest management
M&E	Monitoring and evaluation
MAIPs	Multi-actors agricultural innovation platforms
NGO	Non-governmental organization
SDGs	Sustainable Development Goals
STB	Science and Technology Backyard
T&V	Training and Visit
TAP	Tropical Agriculture Platform
TOF	Training of facilitators
TOT	Training of trainers
UN	United Nations

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Chapter 1

Background

Most agricultural development integrates into value chains the forward pulling by market and backward pushing by input and supplies linkages. The extension of markets at home and abroad often makes agricultural value chains grow quickly and expand; in turn, shelf-life, food safety and nutrition, processing, packaging, handling and other market requirements acquire greater importance in agricultural value chain development.

Before reaching consumers, agro-products such as rice, wheat, corn, beef, etc. will involve multiple agricultural actors (by passing through farmers, millers, wholesalers, retailers, processors, bakers, etc.) for producing safe and nutritious food. Agricultural productivity and efficiency have become more and more dependent on wider ranges of commercial inputs and facilities such as seeds, pesticides, fertilizers, machinery and processing equipment. Meanwhile, agricultural inputs suppliers play increasingly important roles in agricultural value chain development. A sustainable agricultural system links all the key actors, and each of those linkages in the "farm to fork" system provides an enormous opportunity for innovation.

Agricultural extension and advisory services (AEAS) consist of different activities that provide the knowledge, information and services needed and demanded by the actors in rural settings. This is important to assist them in developing their own technical, organizational, and management skills and practices, so as to improve their productivity and efficiency in agricultural value chain development (Danso-Abbeam *et al.*, 2018). AEAS play a critical role in facilitating agricultural innovation for and by all rural actors and improving access and bridging the gaps between information and knowledge creation, provision and use.

Unlike traditional AEAS approaches, a multi-actors agricultural innovation platform is a holistic AEAS approach that links researchers, extension agents, private enterprises and smallholder farmers. The aim is to facilitate information and knowledge exchange and technological innovations among all the key agricultural value chain actors for sustainable agricultural development. In MAIPs, agricultural technical and market professionals including researchers, AEAS agents, agro-products processors, traders and all the other actors work together with smallholder farmers in rural areas. The MAIP is established in rural communities

Farmers sell local food products in Azerbaijan.

where farmers are empowered through farmer field schools (FFS),[1] participatory on-farm research, new technology demonstrations, farmer interest group or clubs and market connections. Consequently, when farmers encounter production, processing or market problems, they access the services of MAIPs without delay, limitations, extra fees or travel time. In addition, a new and effective system of technological innovation and extension is explored through the involvement of education, research and local extension sectors in MAIPs.

1.1 Agricultural innovation system

Agricultural innovation is the process whereby individuals or organizations bring existing or new products, process and forms of organization into social and economic use to increase effectiveness, competitiveness, and resilience to shocks or environmental sustainability, thereby contributing to food and nutritional security, economic development and sustainable natural resource management (TAP, 2016). Smallholder and family farmers are key actors and drivers of agricultural innovation in developing countries. They have found innovative solutions to sustainability challenges in their local food systems (FAO & INRAE, 2020).

To fully understand "agricultural innovation", it is first and foremost necessary to make a distinction between "innovation" and "invention". While invention culminates in the supply (creation) of knowledge, innovation encompasses the factors affecting demand for and use of knowledge in novel and useful ways. It is a systemic and dynamic process of institutional learning and often emerges from pluralistic sources of complex interactions and knowledge flows (Okbi & Amzile, 2018). The notion of novelty is fundamental to invention, but that of the process of creating new combinations of existing elements and thereby local change, new to the user, is fundamental to innovation (World Bank, 2007).

Agricultural innovation shows the following characteristics:

- It is usually incremental, consisting of many small improvements and a continuous process of upgrading, though it can also generate radical improvements;
- It often brings about combined changes in the agricultural value chain, which is improved at technical, social, economic, environmental, organizational, institutional, managerial, policy levels, etc.;
- The resulting outputs of agricultural innovation can be new production concepts and techniques, agricultural products, marketing processes, social relations, institutional and organizational structures, etc.;
- It is preferably a multi-actor process that links and engages networks of multiple actors along the agricultural value chain, including farmers, farmers' organizations, businesses, marketers, policy-makers, researchers, extension agents, NGOs, etc. This is critical not only to foster innovation processes, but to strengthen the social

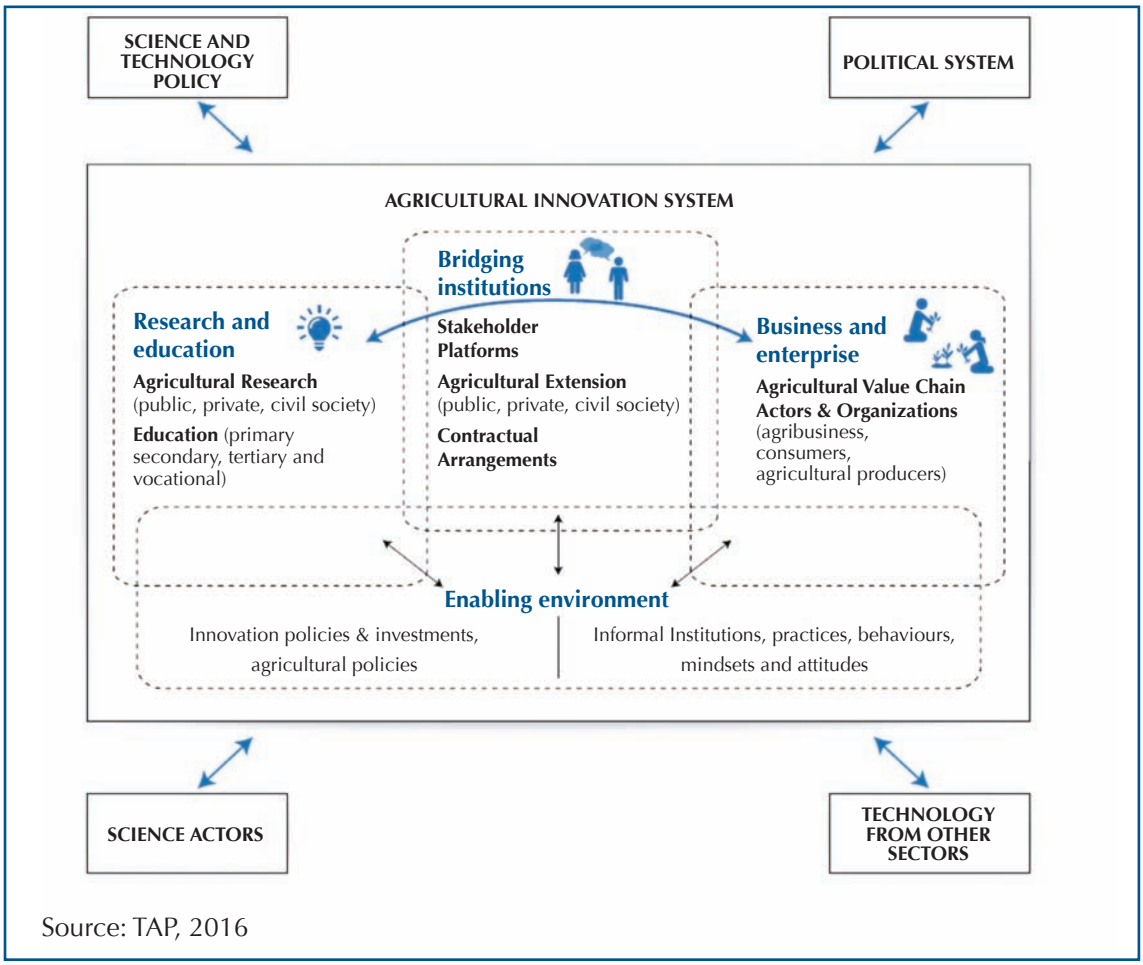
[1] Farmer field schools, or "schools without walls", were introduced by FAO and partners more than 30 years ago as an alternative to the prevailing top-down extension approach. The schools are a way to promote field-based experimentation, group organization and local decision-making through discovery-based learning.

and economic impact of innovation outputs by bridging research (technical/ technological advancement) and practice (social diffusion); and

- It is preferably demand-driven and follows a problem-solving logic. Through agricultural innovation, it is expected to come up with new solutions to address bottlenecks in the agricultural value chain, such as production problems, lack of market linkages, technological gap, competitive disadvantages, environmental problems, etc.

FAO (2018) defines agricultural innovation as "the process whereby individuals or organizations bring new or existing products, processes or ways of organization into use for the first time in a specific context, in order to increase effectiveness, competitiveness, resilience to shocks or environmental sustainability, and, thereby, contribute to food security and nutrition, economic development or sustainable natural resource management."

Considered a societally-embedded change process (Crescenzi *et al.*, 2020), innovation is increasingly approached from a systemic perspective (Granstrand & Holgersson, 2020; Tsujimoto *et al.*, 2018). An agricultural innovation system (AIS) is a network of actors along agricultural value chains including individuals and organizations, which work together to bring existing or new products, process and forms of organization into social and economic use. AIS is composed of four pillars (**Figure 1**):



Source: TAP, 2016

Figure 1. ***Conceptual diagram of an agricultural innovation system***

Research and education: Agricultural research is undertaken mainly by national and international, and public and private agricultural research institutions such as universities, technical colleges, research institutes, companies and NGOs that produce codified knowledge. Agricultural education is dominated by public universities. In many countries, more applied agricultural education takes place in public and private vocational schools.

Bridging institutions: As a network, AIS links multiple actors along the agricultural value chain, including farmers, farmers' organizations, businesses, processors, marketers, transporters, input suppliers, policy-makers, regulatory agencies, researchers, service providers, civil organizations, etc. that are involved directly or indirectly in agricultural production, processing, marketing, distribution and trade. Through inter-actor linkages, it is possible to promote pluralistic and demand-driven AEAS ranging from technical assistance, financial advice to policy implementation. AEAS generally operates at a sub-national level, and includes multiple actors such as farmers, farmers' organizations, government agencies, education institutions, upstream and downstream industries, NGOs and consultants. These actors often formalize their linkages by establishing contractual arrangements, namely, written mutual agreements, enforceable by law, between two or more parties that something shall be done by one or both.

Businesses and enterprises: Businesses and enterprises are the main market actors in AIS, including such actors from the agricultural value chain as agribusinesses, consumers, agricultural producers, etc.

Enabling environment: Enabling environment refers to the context in which individuals and organizations put their competencies and capabilities into actions. It is bidimensional. Institutionally, it connotes both a favourable policy environment (innovation policies, investment schemes, agricultural policies, etc.) and an efficient institutional structure (public offices, banking system, etc.) supportive of agricultural innovations. Socially, it depicts the set of social norms, informal institutions, behaviours, mindsets, attitudes and rules defining the environment wherein social networks, interactions, learning, knowledge dissemination, and innovation take place.

1.2 Objectives of multi-actors agricultural innovation platforms

We propose a multi-actor agricultural innovation platform approach as a practice model for an effective AIS to enhance community-driven, local innovation and value chain development for and by smallholder farmers, supported by local, pluralistic AEAS. MAIP processes have to be truly demand-driven, participatory and based on collective investment and action, while bringing together committed stakeholders and resulting in innovations that are technically sound, locally adapted, economically feasible for farmers, and socially, culturally and politically acceptable.

MAIP is a platform supporting AIS along agricultural value chains and AEAS to respond to the needs of all the value chain actors. It is to be established in farmer communities to overcome the lack of coordination and establish linkages among

multiple actors along agricultural value chains. In general, it is meant to develop a network of AIS actors so as to facilitate their interactions and enhance its effectiveness under pluralistic AEAS. In AIS, all the value chain actors need to communicate and exchange information among them and with the external ones. In this way, the research-extension-production linkages for knowledge development and transfer can be strengthened. Furthermore, the capacities to interact, innovate and learn from each other can be built. Therefore, a platform is needed for innovation to take place and grow.

Specific objectives of MAIPs:

- Supporting AIS along agricultural value chains;
- Strengthening institutional linkages among research, education, extension and production sectors for knowledge development and transfer;
- Facilitating interaction and learning among all value chain actors to share knowledge and information through adaption and responsiveness to opportunities and challenges;
- Providing AEAS on facilitating innovations; and
- Promoting pluralistic AEAS that are demand-driven.

1.3 Principles of multi-actors agricultural innovation platforms

As a platform that facilitates innovation in agricultural systems, a MAIP needs to accommodate the needs of all actors along the value chain and effectively utilise their capacities as well as those of the relevant service providers. As such, a MAIP should operate within defined geographical boundaries, within which meaningful and regular interaction of the various actors is possible. It also requires a focus on one value chain system, or at most a few that are interrelated, to ensure that processes are driven by a common goal. Specific underlying principles ensuring inclusive innovation processes that benefit smallholder farmers and small-scale processors require that MAIPs (1) be community-driven; (2) facilitate collective learning, discovery and action; (3) build partnerships; and (4) be inclusive and demand-driven. Each of these principles is discussed in detail below.

Principle 1: A MAIP is community-driven

Farming communities have always been innovative in the face of challenges, such as weather variability, irrigation and soil issues, and pest and disease occurrence, but are not always recognized for their contribution to innovation, or their reasons for making decisions. Through a MAIP, local farmers, processors and traders can take control of collective learning, discovery and action processes around the questions that matter most to them, which will enhance their critical skills, self-confidence, and community cohesion. As a community-based and community-driven platform, a MAIP facilitates a process that seeks to empower smallholder farmers and small-scale processors and traders to solve their own issues, seek opportunities of collective interest, and take control of the direction of improvement of the various steps in their value chain. By being organized through a MAIP, access to advisory, financial and

other agricultural services will be demand-driven and therefore, better targeted at the community's specific needs and abilities. Community members are no longer the passive recipients of knowledge and technology transfer, but rather the founders and members of the co-innovation platform, the providers of essential resources for innovation, and the designers and participants of on-farm innovation activities. Moreover, they are the owners of the innovation outputs.

Principle 2: A MAIP facilitates collective learning, discovery and action

MAIPs facilitate processes of collective learning, discovery and action that lead to innovation. As a platform that links and engages multiple actors along the agricultural value chain and across service providers, a MAIP needs to allow for different types of interactions and collaborative processes, including farmers to farmers, trader to farmer, input supplier to farmer, processor to farmers, agricultural extension officers to farmer and input supplier, etc. Multi-actor interactions and collaborations are critical not only to foster co-innovation processes, but also to build up trust among the various actors and a sense of ownership among the farming community. Equally important if the strengthening of social processes in support of innovation, such as dissemination within and among communities. As these interactions generally do not occur naturally, a MAIP puts in place the necessary organizational structure and processes of facilitation. Consequently, the capacity for such organization and facilitation must be built and maintained.

Principle 3: A MAIP builds partnerships

A MAIP is a platform for multi-actor partnerships that are aimed at addressing context-specific problems along the agricultural value chain. They bring key actors from research organizations, AEAS providers, market and farming sectors together and offer them a collaborative space for innovation and knowledge exchanges. In this space, the research and AEAS sectors offer their services to the farming community to collaboratively foster knowledge generation and exchange. With a sound enabling environment, MAIP partnerships tend to be strengthened, allowing for the support from all related AIS actors, including policy makers, private sectors and civil society. This extended partnership, usually established through participatory situation analysis and problem solving, is much needed to enhance the resilience and functionality of a MAIP.

Principle 4: A MAIP is inclusive and demand-driven

A MAIP needs to be inclusive and demand-driven. The farming community is highly diverse in terms of family income, educational background, gender, age, market access, crops and livestock systems, and therefore different initiatives in the community will require different types of information and services. To support inclusiveness and effectively serve different groups in the community with different needs, a MAIP should adopt approaches that are:

- **participatory** – to involve all relevant MAIP actors in decision-making and implementation processes that matter to them. This is critical to ensure the effectiveness and relevance of MAIP activities;

Master trainer facilitating farmers participatory research in Swaziland.

- **gender- and youth-sensitive** – to ensure groups that are often ignored, such as women and youth, receive tailored support and have access to mechanisms for their empowerment; and
- able to forge **linkages** among MAIP members and partners – to build and foster a network of multiple actors by taking advantage of available institutional and financial support. Pay attention to the importance of facilitation in this process with the aim to strengthen the linkages among the actors.

Only when MAIPs are inclusive can they achieve the objective of facilitating pluralistic and demand-driven services to farming communities. To this end, a MAIP can guarantee the fine-tuning and adaptation of information and services, their delivery, the outreach mechanisms, and the communication channels used. Furthermore, it can channel policy incentives and public investments, which are needed to ensure equitable access to available agricultural services.

1.4 Basics of multi-actors agricultural innovation platforms

Although MAIPs have different formats in different agricultural value chains and different countries and regions, their basic elements are as follows:

- A typical MAIP consists of a training (or study) space, professionals (researcher or extension agents), a group of lead farmers, training and technological service facilities (e.g. computers, projectors, motor tricycles,

Master trainer conducting a farmer training on using agricultural machines in Kyrgyzstan.

brochures), experimental plots, demonstration plots, digital communication devices, etc.

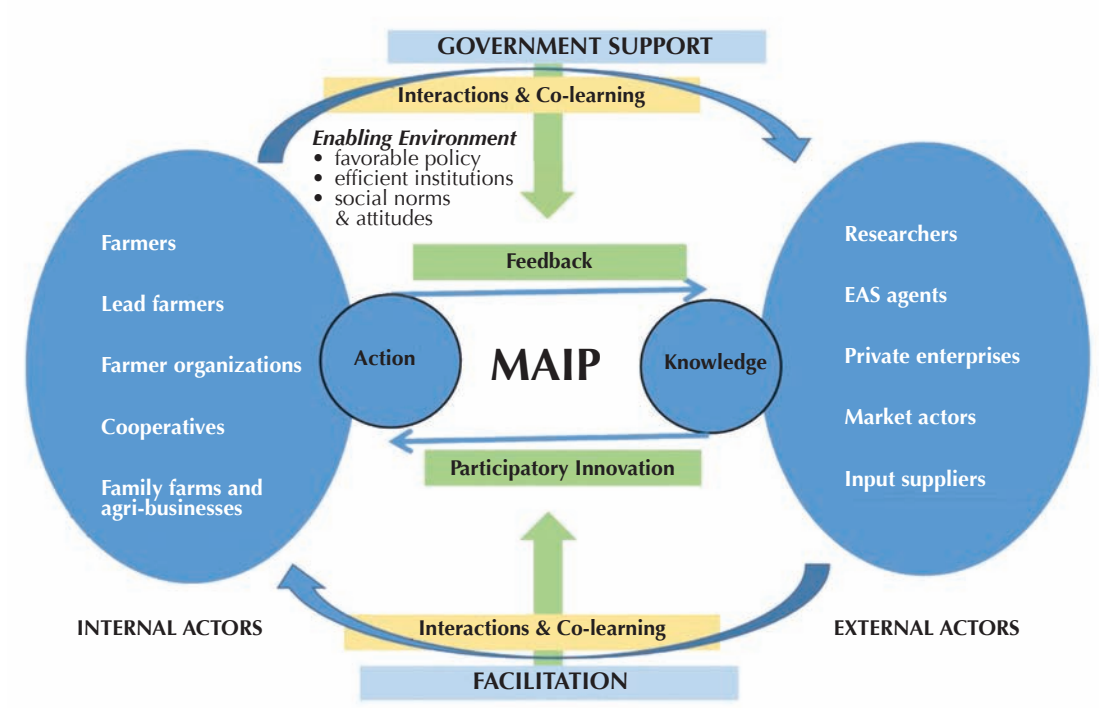
- A typical MAIP is located in farmers' communities and links researchers, extension agents, local government, private enterprises and smallholder farmers. By building partnerships and creating a collaborative environment, it facilitates technological innovation, information exchanges, and innovation diffusion so as to address farmer-specific practical problems along value chain development.
- Designed according to selected value chains under innovation agendas, MAIPs focus on providing demand-driven and pluralistic AEAS on agricultural innovation rather than agricultural production.
- MAIPs facilitate interactions and strengthen linkages among multiple AIS actors for knowledge co-creation, sharing and co-learning. Common linkages are farmers to farmers, market actors to farmers, input suppliers to farmers, processors to farmers, public AEAS to input suppliers, etc. The facilitation of different forms of interactions and co-learning processes is critical to provide demand-driven AEAS to support AIS. Interactions and co-learning processes among multiple AIS actors should be facilitated according to a need analysis. Besides, MAIPs support capacity building of multiple AIS actors.
- MAIPs conduct baseline surveys and analysis to identify 1) existing public and private AEAS for the selected value chain including agro-production gaps between the actual and what are attainable based on scientific research results and advancements, agro-product market potentials; 2) training needs of AEAS providers to promote market-oriented services and facilitate innovation; and 3)

recommendations, including policy-making and coordination mechanisms for the implementation of MAIPs.

- Facilitation and coordination of MAIPs are crucial for the success of establishing and operating them. Public AEAS agents should play the role of facilitator or coordinator in most times. But researchers, market actors or other AIS actors, when fully empowered, may also play this role in case there is no public AEAS agency or if the existing agency is weak.
- MAIPs' training of facilitators (TOF) course is aimed at developing qualified facilitators or coordinators to establish and implement MAIPs in farmer communities.

Chapter 2
Concept model of Multi-Actors Agricultural Innovation Platforms

The MAIP is a platform established in farmer communities in rural areas, which links researchers, extension agents, private enterprises and smallholder farmers to spur innovations in agriculture value chain development (**Figure 2**). Researchers and extension agents are stationed in MAIPs and work closely with farmers. Bottlenecks and constraints of a specific agricultural value chain are investigated and identified through participatory approaches, and then addressed through innovation driven by the key actors along the value chain. Farmers are empowered and knowledge generated and transferred through the MAIP, which often takes the form of farmer education, participatory on-farm research, new technology demonstrations, farmer interest group or clubs, etc. When farmers encounter any production or market



Source: The Authors

Figure 2. ***Concept model of multi-actors agricultural innovation platforms***

MAIP facilitators working with farmer on field experiment design.

MAIP facilitator discussing with farmer on soil quality.

problems, they can access the services of MAIPs. In addition, agricultural innovation is spurred through an active involvement and interactions among key actors of the value chain under question. In general, a typical functional MAIP has four components, namely, infrastructural settings, key actors, mechanisms of interactions, and enabling environment.

2.1 Infrastructural settings

A typical functional MAIP consists of all or parts of the following infrastructural settings, i.e. meeting and residential places (physical space), training and AEAS facilities (e.g. computers, projectors, vehicles), experimental and demonstration plots, and technical promotion, communication and advocacy facilities (posters, standing placards, brochures, etc.).

Meeting and residential places: Located in rural areas, empty spaces of residential house(s) are rented from local household(s) to accommodate professionals (researchers, extension agents, graduate students). The rationale is that local farmers can easily access such places. Plus, often they are familiar with the owners, who are likely to serve as a trust-building medium between the farmers and professionals. This is critical to trigger and maintain engagement and interactions between the two. In many MAIPs, a best option is to accommodate professionals in village offices or centers (such as in the case of the STB project). They are usually located at the center of the local community, where farmers gather socially in their daily life. MAIPs can use village offices as the meeting rooms for organizing training activities. It is convenient for the professionals to communicate and build mutual trust with local farmers and authorities.

Experimental fields or farms: In MAIPs, experimental fields (crops) or farms (animal husbandry, fishery) can be established to explore or develop new technological innovations. Rent is paid to the farmers who own such fields or farms. The professionals closely collaborate with them to conduct field research or farming experiments if needed. This offers a major way to address the key problems or bottlenecks of local agricultural production and jointly experiment the most feasible and location-specific solutions. It requires farmers to actively participate in research or experiments and be responsible for field or farm management, including providing necessary inputs. Throughout the experimentation, farmers are fully engaged in the research programme and exposed to new technologies. This guarantees an active interaction and a feedback loop between professionals and farmers. Indeed, on-farm participatory research is the first step for MAIPs to trigger innovation.

Demonstration plots or farms: Under the supervision of MAIPs, demonstration plots or farms can be established and normally managed by lead farmers (who usually have better skills and capacities and are open to change and trusted in the village community). Owned and managed by the lead farmers, demonstration plots or farms are used to integrate key technological innovations and practices developed from the on-farm research or introduced by the MAIP actors. However, the most important function of demonstration plots or farms is to showcase and disseminate experience, good practices and locally adapted technologies. The joint efforts of MAIP professionals and lead farmers greatly enhance the diffusion, adaptability and efficacy of new technological innovations. The demonstration plots or farms are also a platform to involve local extension networks to demonstrate new agricultural inputs, new crop or animal varieties and new agro-products.

Vehicles and training facilities: In MAIPs, vehicles like motorbikes or tricycles are used for the transportation of research equipment, including soil and plant nutrient quick-testing toolkits, digital cameras and other experimental and research tools for field experiments and trials. Training facilities include one classroom for courses, computers, projectors, public broadcasting systems and other necessary facilities are also equipped. If necessary, communication and advocacy facilities may be set up apart from the experimental and demonstration plots or farms. Such facilities mainly consist of a series of poster stands or display placards for communicating and demonstrating technological innovations and practices to visiting farmers.

2.2 Key actors of multi-actors agricultural innovation platforms

Multiple actors along a certain agricultural value chain, who provide information, knowledge and AEAS and conduct research and technical innovations, formally or informally play unique roles at different levels of interactions, exchange and synergies in MAIPs (**Figure 3**). In general, key actors of MAIPs are as follows:

Lead farmers: Lead farmers receive training from a MAIP. They are interested in agricultural innovation and enthusiastic to work with the professionals in the MAIP to achieve agricultural innovation, and are considered the backbone of the MAIP. After being properly trained, lead farmers are empowered to work with professionals to conduct on-farm participatory research and technical demonstrations and facilitate

participatory activities. They also assume the role of disseminating the generated knowledge and innovation among their fellow farmers.

Facilitator: Coordination is crucial for successfully establishing and operating MAIPs. Facilitators play an important coordination role, which is often assumed by public AEAS agents. Researchers, market actors or other actors may also play this role in case that public AEAS is unavailable or weak in the MAIPs. The main duties of the facilitators are: (1) a commitment to leadership, clearly shaping the vision, mission and implementation process along the selected value chain; (2) a commitment to continuously monitoring and evaluating (M&E) service performances provided by the multiple MAIP actors; (3) a commitment to integrating AEAS provided by the multiple MAIP actors; and (4) a commitment to enhancing technical, marketing, financial and institutional innovations to support MAIPs to foster AIS.

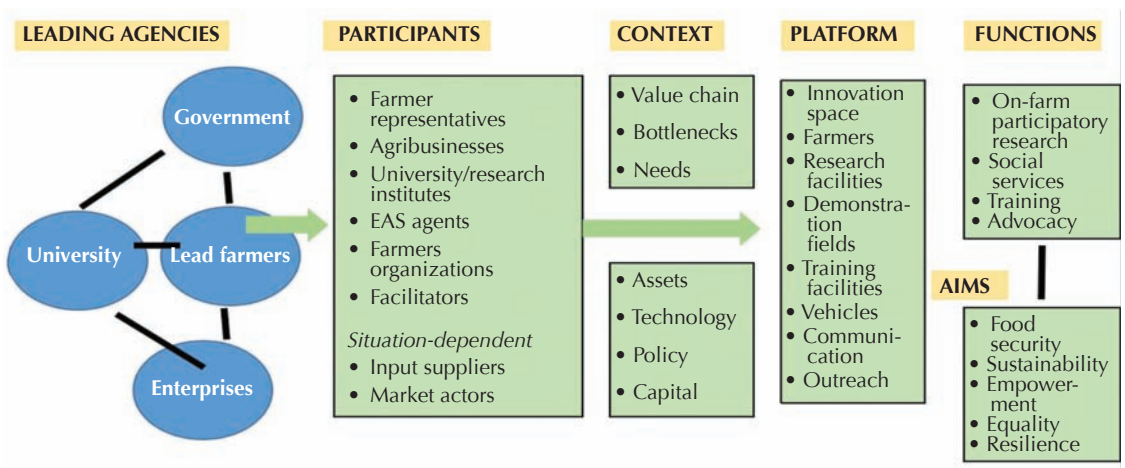
Researchers and extension agents: The researchers and extension agents from both public and private sectors are prime actors in the MAIP to facilitate on-farm participatory research and technological innovations. In most developing countries, public research and extension organizations are still important promoters of agricultural technological innovations and technological transfer. However, the importance of the role of actors is changing during agricultural innovation processes and the private sector has increasingly begun to engage. In MAIPs, the researchers and extension agents may play multiple roles, for example, they may be providers or seekers of knowledge and facilitators in various circumstances.

Local leaders and entrepreneurs: In the MAIP, the necessary support from local leaders and entrepreneurs are crucial to conduct activities in rural communities. Local leaders can provide additional resources for MAIP organization and coordination. Entrepreneurs can assist with enhancing financing and the provision of practical assistance.

Market actors: From the perspective of value chain development, market actors play unique and important roles in AIS. They establish linkages between supply and demand and organizations that help bring together farmers, processors, transporters, and distributors to consumer markets. This is vital if the value chain is to function effectively. In MAIPs, market actors extend the knowledge generation beyond the production sector to the market sector, based on price competitions and more on their abilities to provide new products or improve the quality management of agro-products. Market actors provide the opportunities of interaction between agricultural production and market demand in the MAIP in terms of consumer demands (product, food safety and certification standards, etc.), changing conditions and dynamics of markets, which are driving forces for navigating innovation in the MAIP.

Input suppliers: MAIPs are one of the best platforms for agricultural input suppliers (enterprises) to undertake experimental evaluation of their business innovations. For example, input supply enterprises could send their specialists to work and conduct field trials and demonstrations together with researchers, extension agents and lead farmers. They can redesign fertilizer or pesticide formulas based on the results of participatory field trials and develop new products by optimizing the formula of combined fertilizer or pesticide products. They can even establish and fund their own MAIPs of various agricultural value chains.

Farmers' organizations: In MAIPs, the function of farmers' organizations is mainly to guide and facilitate the reorganization of farmers by promoting such values of self-respect, self-confidence, self-reliance and self-strengthening. This paves the way for enhancing the overall agency and capacity of local farmers and thereby achieve sustainable development of MAIPs. However, it is often a significant challenge for farmers to be fully self-organized due to a lack of professional social workers in rural organizations. Through farmers' organizations, farmers can be mobilized and reorganized so that they actively participate in both learning and cultural activities. These activities are conducive to strengthening the social cohesion of local community while fostering the sustainability of the MAIPs.



Source: The Authors

Figure 3. ***Main actors in multi-actors agricultural innovation platforms***

2.3 Mechanisms of interactions

In MAIPs, multi-actor interactions are triggered through a combination of top-down and bottom-up approaches. Farmers and other key actors, as core elements of this combined approach, are fully engaged in the generation and sharing of knowledge and technologies. The main interaction mechanism of innovation practices shows four key dynamics, namely:

- agricultural value chain innovation process triggered by challenges or opportunities (research, market demand, policies, etc.);
- integrating interactions of technologies and solutions driven by market or policy demands;
- co-learning interactions between farmers and other key actors; and
- co-learning interactions among multiple key actors.

Agricultural value chain innovation process triggered by challenges or opportunities

The starting point of MAIPs is to overcome the last mile barrier of knowledge, information and technology transfer between market, research, extension and applications. This is the major limitation of sustainable agricultural value chain

development for smallholder farmers. In MAIPs, research or market actors play a leading role in generating knowledge, information and technology innovation and coordinating the entire innovation and transfer process.

For the research-led innovation process in MAIPs, a combined approach of bottom-up farmer participation and top-down researcher guidance is often used to generate knowledge and technologies in fields and/or on farms. This strengthens farmers' ownership of practical and innovative knowledge and technologies. Studies on MAIPs generally compare the agricultural production of experimental plots with that of conventional fields. The results from the former clearly demonstrate that yields achieved though scientific research consistently exceed those of conventional fields. Farmer participatory research (FPR) on the identification and analysis of this production gap and other advancements drives the subsequent knowledge co-learning process among multiple actors. The innovation of knowledge and technology is driven by research, and the subsequent application and transfer process is continuously supported and facilitated by on-farm participatory research and follow-up training activities. These research and training activities provide "zero time difference, zero cost, zero distance and zero threshold" knowledge and technology services to smallholder farmers. Through follow-up training activities, they are empowered to tap into their potential based on scientific advancement. This potential, desired by national policies and the UN's SDGs, is often difficult to harness using conventional knowledge and technology transfer approaches.

A number of identified key triggers of challenges or opportunities are market, policy, knowledge or resources. These triggers may not act alone but tend to interact with each other or in multiple modes in the value chain development. MAIPs facilitate the interactions among actors from various sectors, such as market, policy, knowledge, resource management and farming. The process of agricultural value chain innovation is triggered through creating, sharing and exchanging knowledge, information and technologies among these multiple actors.

Integrating interactions of technologies and solutions driven by market or policy demands

It is crucial for research on sustainable agricultural value chains to take into full consideration the challenges it faces. In MAIPs, FPR is usually aimed at addressing identified challenges or bottlenecks in the agricultural value chain development, including the following:

- **During production**:
  - Health of soil or breeding environment (animal husbandry and fishery) management, such as soil-borne diseases or soil degradation caused by continuous cultivation, environmental pollution due to animal waste;
  - Crop or animal pest and disease management;
  - Improve productivity while lowering costs, crop or animal varieties trials and applications, crop cultivation or animal husbandry technologies, including the breeding of new varieties for product diversification in response to new market demands; and

Master trainer facilitating a field experiment design in a MAIP TOF course.

- Crop nutrient and water management (crop production) or animal or fishery nutrition management.

■ **After harvest**:

- Storage and processing management;
- Residue testing for pesticides, harmful chemicals or organisms;
- Agro-product quality and food safety management and certifications, including packaging and compliance with domestic and international standards and norms; and
- Marketing.

■ **Social and environmental agendas**:

- Poverty alleviation by pro-poor value chain development;
- Ethical and green marketing strategies; and
- Socially and environmentally sustainable value chain development.

Co-learning interactions between farmers and other key actors

MAIPs are not only platforms for agricultural technology innovation, but also for farmer education. Along with on-farm participatory research, a series of training activities are designed and delivered by MAIP professionals (researchers or extension agents), or lead farmers to educate farmers to learn new technologies and good

practices. In addition to farmer field schools (FFS), other training methods may be used according to farmer needs. For example, field visits and observations, farmer rally or field days can be integrated into the farmer education curriculum according to local conditions. During the cropping seasons, the MAIP provides AEAS to local communities.

Co-learning interaction between farmers and other key actors occur when they participate in on-farm research, FFSs, field visits and observation and field days. Co-learning interactions between farmers and other MAIP actors are crucial for knowledge and technology transfer. MAIPs empower farmers through participatory and informal education processes. Essentially, the MAIP approach is a learner-centered, participatory process that seeks to empower farmers to solve real-world problems by promoting their participation, self-confidence, dialogue, joint decision-making and self-determination, which could not otherwise have been achieved through standard training approaches (Yang *et al.*, 2021).

Co-learning interactions among multiple key actors: It has been recognized that agricultural innovation requires strong networks, interactions and partnerships among different actors (Fieldsend *et al.*, 2020; Turner *et al.*, 2017). MAIPs are not only platforms for agricultural technology innovation, but also for networking and partnership building. The professionals (researchers and extension agents) work on the frontline of agricultural production and processing with farmers, solving the practical problems along the value chain. The professionals apply their theoretical knowledge to on-farm participatory

MAIP facilitator guiding farmers to diagnose grape diseases at a Science and Technology Backyard in China.

research and transfer technological knowledge. In doing so, professionals complete the co-learning process with farmers by understanding their knowledge, perceptions and attitudes, and with market actors by learning accurate market criteria or standards of agro-products (Garforth *et al.*, 2004; Molina *et al.*, 2021). Market actors co-learn with farmers and input suppliers by understanding processing technologies and production costs through partnerships or information exchanges. Farmers co-learn with market actors and agro-product processors by understanding market requirements of quality or standards, market prices and market volatility of agro-products. In the STB project (a specially designed MAIP), an education curriculum is designed to empower farmers as fully qualified future agricultural innovators or extension agents. Postgraduate students have to participate in the co-learning process with farmers, researchers and extension agents to conduct technology innovation, knowledge transfer and organizing farmers' training activities. After completing their three-year graduate studies with the experience of working with farmers and professionals, postgraduate students acquire not only systematic agricultural technology and knowledge, but also a good understanding of agricultural development and farmers' needs, and abilities for practical problem-solving, which cannot be achieved through normal formal education (Yang *et al.*, 2021).

2.4 Enabling environment

During the establishment and implementation of MAIPs, enabling environment is a precondition for developing innovations in response to smallholder farmers' practical needs and constraints. Government and institutional commitment to financial and infrastructural investments are crucial at all stages of MAIP implementation. It is necessary for professionals to build up capacities for participatory research, extension and farmer education across multiple sectors, with adequate funding and clear regulatory framework. Enhancing linkages between research, extension and farmers with appropriate incentives is important, such as evaluating research and education achievements of professionals should not simply be academic, but also prioritize the needs of farmers. The private sector is also taken on board to engage in the development of MAIPs and where possible, the building of ownership of MAIPs.

The implementation of MAIPs demands a strong support from the local government, public extension agencies, private sectors and farmer communities. It involves the active participation of all local stakeholders, and coordination between different sectors and sustainable funding mechanisms to support joint action on agricultural innovation along value chain development.

Effective and efficient coordination is crucial for the success of establishing and operating MAIPs. In addition to the mandated roles of MAIP facilitators, additional coordination bodies consist of key agricultural value chain actors integrated through partnerships. It should be organized and established to support the coordination of MAIP activities.

2.5 Multi-actors agricultural innovation platforms establishment and facilitation

The following steps are proposed to establish and operate a MAIP.

Step 1: Train multi-actors agricultural innovation platforms facilitators

Stakeholders who have been identified as and agreed to become MAIP facilitators are trained to enhance their knowledge and skills in a range of technical, facilitation and management topics allowing them to support local innovation and promote market-oriented services needed through MAIPs. Training modules and methods need to be adjusted based on the specific needs of the MAIP facilitators in a particular value chain and geographic region, as identified in the situation analysis. The facilitators will further facilitate the following steps in the target area (see Chapter 3 for a detailed description of the principles and suggested practices of a Training of MAIP facilitators course).

Step 2: Conduct a participatory situation analysis as a basis for setting the innovation agenda

An analysis of existing roles of and relations among stakeholders along the value chain, and assessment of the needs, opportunities, and constraints for value chain improvement, are conducted in collaboration with stakeholder representatives. This step should deliver five specific outputs:

- Output 1: Stakeholder identification and analysis.
- Output 2: Identification of the gaps between actual outputs of the value chain and attainable outputs, as indicated by scientific research, results achieved in similar areas, and/or market potential.
- Output 3: Identification of information and training needs of stakeholders along the value chain, including:
  - Farmers and farmer-processors.
  - Processors, traders, input suppliers, and other industry stakeholders.
  - AEAS providers, relating to skills and knowledge to promote market-oriented services and processes and facilitate innovation.
- Output 4: Recommendations for value chain- and location-specific establishment of MAIPs, including nomination of potential members and partners, processes to engage stakeholders along the value chain, options for policy development, and coordination mechanisms in support of establishment and operation of MAIPs.
- Output 5: An initial innovation agenda and workplan to initiate the establishment of MAIPs in the selected value chain in a particular geographic location within which the identified stakeholders operate.

Step 3: Establish the multi-actors agricultural innovation platforms

A MAIP is established once its membership, partnerships, boundaries, management, operations and an action plan have been defined by the key stakeholders. This is

best done at one or more multi-actor planning workshops that are organized and facilitated by the MAIP facilitators. The key stakeholders to be invited to the planning workshop(s) are selected based on the results of the situation analysis (Step 2), which does not necessarily include all the actors along the value chain. The focus should be on stakeholders who produce and process the agricultural products of the value chain and key AEAS providers who can address the gaps identified in Step 2. In other words, those stakeholders who are likely to become members or partners of the MAIP. Membership or partnership is decided during the meeting on a voluntary basis.

The multi-actor planning workshop(s) should contain the following set of activities:

- Introduction of the MAIP concept and processes:
  - The MAIP design, functions and expected outcomes are presented.
  - The needs for adjustment to the local conditions and stakeholder capacities are discussed.
- Membership is confirmed: key stakeholders from the farmer/processor/trader categories express that they want to become a member of the MAIP and sign up on a membership list, indicating their name, contact details and role in the value chain.
- Partnerships are confirmed: key stakeholders from the AEAS and other service providers/research institutions express that they want to become a partner of the MAIP and sign up on a partnership list, indicating their name or that of their institution, contact details and intended support role for the MAIP.

MAIP facilitator showing farmers how to use irrigation facilities in Azerbaijan.

Master trainer training farmers on new methods of agriculture in a Farmer Field School in Kyrgyzstan.

- Definition of the boundaries of the MAIP: confirmed members and partners discuss and agree on the value chain system that the MAIP will focus on and the geographical boundaries within which the MAIP will operate.
- Selection of the MAIP management team: confirmed members discuss and agree on the management roles that they require for their MAIP and formulate the management positions (e.g. general manager, secretary, treasurer, committee chairs or division managers). Nominations are called for the various management positions, after which MAIP members elect their office holders.
- Formulation of MAIP operations: Members, management team and partners discuss and agree on how they want the MAIP to operate. This could include:
  - Regular membership meetings for planning and evaluation of MAIP activities, including training, innovation, and collective action.
  - A physical location where MAIP activities will take place.
  - Financial support of the MAIP through, for instance, memberships fees, fundraising, levies on revenues from collective marketing.
  - A coordination mechanism, including an internal communication strategy.
- Development of an action plan for the first six months. This could include:
  - A prioritized innovation agenda.
  - A training agenda.
  - A priority list of collective actions.
  - A budget for innovation and training activities.

- A monitoring mechanism.
- A proposed activity calendar for membership meetings, innovation, training and other collective activities.

The MAIP facilitators need to cross-check whether all recommendations from the situation analysis are reflected in the outcomes of all of the above activities.

Step 4: Operate the multi-actors agricultural innovation platforms

MAIPs are expected to operate as a hub for key stakeholders to introduce, test and share innovative practices and ideas that will improve production and value chain of targeted agricultural commodities. Facilitators will guide local actors to (1) formulate the right questions to overcome barriers to improved agricultural systems; (2) identify potential options that can lead to innovation; and (3) link with suitable AEAS providers.

Interaction and learning processes among AIS actors should be facilitated according to the situation analysis in Step 1 and the action plan developed in Step 3. In general, different dimensions of interaction and learning processes, such as farmers to farmers, market actors to farmers, input suppliers to farmers, processors to farmers, and public AEAS providers to input suppliers, should be facilitated through the different activities of the MAIP.

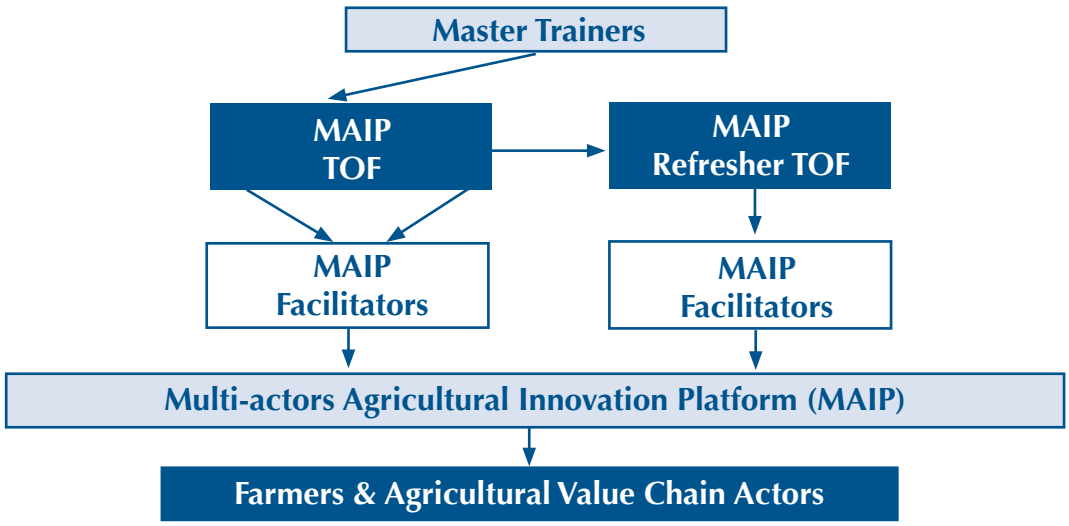
Chapter 3
Design of the multi-actors agricultural innovation platforms' training of facilitators course

In general, MAIP programs should start from the design and implementation of training of facilitators (TOF) courses. The trained facilitators establish a MAIP and operate it in a certain farmer community to promote value chain development. After a period of practice, MAIP facilitators can further improve themselves through a MAIP refresher TOF. The central point of the entire training system is MAIP facilitators (**Figure 4**), and the foothold is the establishment and development of multi-actors centered MAIPs.

3.1 Principles of multi-actors agricultural innovation platforms' training of facilitators

The MAIP TOF course prepares the future facilitators for their various roles in establishing and facilitating MAIPs around a certain value chain. The specific objectives of the MAIP TOF are for TOF participants to:

(1) Develop an understanding of the MAIP model and related core concepts and methods.



Source: The Authors

Figure 4. ***MAIP training system***

MAIP master trainer training facilitators in Science and Technology Backyard in China.

(2) Gain knowledge and skills relating to facilitation, organization, and management of MAIPs.
(3) Strengthen knowledge and skills on technical and business aspects of the selected value chains.
(4) Experience the co-design, establishment and operational workplan development of a MAIP in a pilot area.

MAIP Facilitators are expected to apply a participatory approach to MAIP design, establishment and implementation, and facilitate activities with MAIP members and partners that involve discovery learning and adaptive research. Therefore, they should learn in a participatory way and experience how it is different from the way they were trained in the formal education system. For that reason, the MAIP TOF model outlined in these guidelines is based on the following principles of adult education:

- Learning should be aligned to the goals of and anticipated benefits for the learner.
- Learning activities are designed as a process of discovery.
- Learning is personalized through
  - Activities should be adapted to different learning preferences of the participants.
  - Activities should encourage collective learning.
- Helpful feedback should be provided.
- The learning event and materials should be easily accessible, in terms of geographical location, language used, and communication platforms employed.

These principles ask for a training structure that accommodates a combination of theory, skills development, dialogue/sharing, field experience, and reflective practice. While some generic topics will be applicable in all TOF events, most of the content and activities will need to be contextualized, the value chain(s) to be targeted, and, most importantly, the profile of the TOF participants with regards to their educational background, language, communication and learning style preferences, and work experiences. As such, a MAIP TOF requires that a team of master trainers who, among themselves, have the diverse knowledge, skills and experiences to effectively design and facilitate the participatory and experiential learning processes in the given context.

3.2 Preparation for the multi-actors agricultural innovation platforms' training of facilitators course

- **Selection of trainers of the MAIP TOF course:** Trainers for instructing the MAIP TOF course must be carefully selected. Only qualified trainers with rich precedent experience of organizing training of trainers (TOT) courses on AEAS and implementing AIS are to be appointed. Normally, a group of 3-4 master trainers with one coordinator are assigned for carrying out a MAIP TOF course.

- **Selection of trainees of the MAIP TOF course:** The selected trainees are future facilitators of MAIPs. Normally, trainees are to be selected from the key actors of MAIPs, including researchers, extension agents, lead farmers, market actors, processors or other actors who are engaged with the selected agricultural value chain development.

MAIP facilitators discussing maize yield increase with a farmer at a Science and Technology Backyard in China.

- **Identification of training site:** Taking into account the actual budget and local conditions, the training venue could be at a hotel or local school or farmers' community center. Normally, it is better to choose a site with well-equipped training facilities and close to the local community where MAIP activities can be held as part of the course.

- **Preparation for training facilities and materials:** Residential houses for accommodating trainers and trainees should be rented or provided near or in the local community. For the course, training facilities and materials, including at least one classroom for indoor activities, computers, projector(s), blackboard/whiteboard, markers, sheets of paper and other necessary facilities and materials, must be equipped. If necessary, the experimental and demonstration plots or farms need to be identified, which are mainly used for the demonstration of technological innovations and practices to the trainees.

Logistical arrangements include (1) confirmation of the timing of training events and fieldwork activities; (2) the venue, facilities and catering; and (3) the preparation of training materials. For each of these aspects, budgetary considerations need to be negotiated with the project management team. The training venue should be at a location that is easily accessible by the participants and convenient for the type of activities that will be implemented. This can be a local hotel, school, rural community center, or a government agricultural information center. The training space should be large enough for the participants to work in small groups, and be equipped with furniture, presentation equipment (computer, projector, screen/

Master trainer training local farmers on banana crops in a Farmer Field School in Tanzania.

white wall, printer) and a whiteboard or blackboard. A sufficient stock of coloured markers, large sheets of paper, coloured cards, masking tape and other material required for the training sessions needs to be provided. All details regarding dates and time, location, venue, and transport arrangements need to be clearly communicated to the TOF participants in advance.

3.3 Curriculum development of the multi-actors agricultural innovation platforms' training of facilitators course

- **Curriculum development workshop:** Conduct a curriculum development workshop prior to the opening of the course. All the master trainers and relevant project coordinator or managers participate in the workshop to develop a detailed curriculum in respect to the learning objectives of the course.

- **Curriculum developed in detail:** In general, a detailed curriculum should be developed with respect to the learning objectives of the course as follows:
  - Understanding concept models and objectives of the MAIP;
  - Building up appropriate capacities of coordinating and networking of multiple actors in the innovation niches of the AIS;
  - Developing AEAS technical skills, including needs assessment, agricultural value chain analysis, agro-ecosystem analysis, farmer science, participatory on-farm research and demonstration and training, etc.;
  - Developing specific skills on facilitating different patterns of interactions, including farmers to farmers, researchers to farmers, extensionists to farmers,

researchers to extensionists, pubic to private, business to business, business to farmers, business to processors and interactions of multiple actors among all key MAIP actors;

- Enhancing necessary communication, coordination and organization skills; and
- Developing relevant work plans and budget on establishing and facilitating MAIPs along the selected value chain development.

3.4 Implementation of the multi-actors agricultural innovation platforms' training of facilitators course

The training course follows the general adult education principles applied in agricultural training programmes and provides hands-on, discovery-based training. The implementation may include the following processes:

- **Opening ceremony:** organize an opening ceremony in the form of a spot meeting, inviting local farmers, leaders, and/or relevant actors of the selected agricultural value chain to attend.

- **Training model:** use the adult-education training model that is participatory and interactive rather than the conventional spoon-fed training models. Normally, a maximum of forty trainees can be divided into six groups and the class leader(s) and group heads are to be elected in a democratic way. The trainees can enhance their learning experience through group discussions, interactions and teamwork.

- **Practice of MAIP facilitation:** if possible, the MAIP TOF course could provide a break of a couple of days to allow the trainees to hold some facilitation activities in the existing MAIP to gain experience and draw lessons for continuous skill improvement.

- **Workplan formulation:** towards the end of the MAIP TOF, the trainees formulate their workplan for establishing and facilitating MAIPs. The workplan may include the following:
  - Identify the agricultural value chain to be intervened through the MAIP according to the results of local value chain analysis and need assessment;
  - Identify the location and infrastructural settings of the MAIP, including meeting and accommodation places, training and AEAS facilities and materials, experimental and demonstration plots (if needed), and technical promotion, communication and advocacy facilities;
  - Identify the key actors of the selected value chain and their role in the MAIP;
  - Define facilitation models of interactions among the key actors of the MAIP;
  - Develop a detailed schedule for activities of interaction facilitation of the key actors of the MAIP; and
  - Develop a detailed budget for the establishment and facilitation of the MAIP.

- **Closing ceremony:** organize a closing ceremony at the end of the MAIP TOF where the trainees can review and exchange their learning experience and lessons learned. They can also share their vision and perspective on establishing and facilitating MAIPs after course completion.

Like most training events, a TOF can start with an opening session and finish with a closing session, which should be organized in a way that responds to the expectations of the various stakeholders involved in the event.

At the start of the learning session, it is recommended to engage the participants in the formulation of a collective "learning contract", which provides a confirmation of the TOF's learning objectives and planned processes. This is an important symbolic step for participants to commit to and have ownership of the learning process. It can also be used as a baseline in evaluation at the end of the TOF.

The core of the training is defined by the learning curriculum. Ideally, the TOF consists of three blocks of training sessions, each of a minimum of two days, with several weeks of fieldwork in between to test ideas in the field and conduct the first steps of MAIP establishment. Each block will engage the participants in reflection on prior field experiences, exploring new concepts, practising skills, and developing workplans for the next period of fieldwork. Training activities should be diverse to keep the attention of the participants focused, and relevant to their realities in the field.

Regular monitoring activities can be conducted, either per session or at the end of each day, to assess the participants' satisfaction with the training content and processes. This can be done through mood meters, questions about learning outcomes and suggestions for topics to be covered in future session. Monitoring data collection can be done either on paper sheets stuck on the wall of the training venue, on individual score sheets, or electronically (online polls or brief questionnaires). To assess knowledge gains, pre- and post-tests can be commissioned.

Evaluation is done at the end of each block, with the final evaluation being more comprehensive and assessing participants' perceptions about achievement of the overall training objectives. This can be done through a questionnaire, a group discussion, or a combination of both.

3.5 Learning contract of the trainees of multi-actors agricultural innovation platforms' training of facilitators course

A learning contract of the MAIP TOF should be developed and a consensus be reached among all the trainees. This is meant to enable them to apply the capacity and skills they have gained from the training course to establish and facilitate MIAPs after course completion. The contract could be signed at the end of the training course.

3.6 Mentoring of multi-actors agricultural innovation platforms facilitators

It is recommended to establish a mentoring mechanism to support the MAIP Facilitators during the periods of fieldwork and upon completion of the TOF. This can be done in the form of a chat group on a social media platform that is regularly used by all participants (e.g. a WhatsApp Group, Microsoft Teams Chat, Facebook Messenger Group, WeChat Group, etc.). Such a mechanism also provides peer support and exchange.

If needed and feasible, a refresher training around six months after the establishment of the first round of MAIPs could be useful for further strengthening the capacity of the MAIP facilitators and preparing for further outreach. A refresher training should start with the sharing of the various experiences of the facilitators teams in reflection of the principles and functions of the MAIPs, as introduced during the original TOF. Through reflective practice and exchange, the facilitators will be able to analyse what worked for them, what they did well and what needs improvement, and also provide feedback to the master trainers what should be adjusted in the model of the MAIPs and/or the TOF. New topics, as requested by the participants, can be introduced and plans for further outreach of MAIPs can be collectively developed.

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Chapter 4
Training activities of the multi-actors agricultural innovation platforms' training of facilitators course

4.1 Understanding the concept model of multi-actors agricultural innovation platforms

Objectives: (1) to familiarize the trainees with the basic structure and specific activities and requirements of MAIPs and understand what they expect to learn from the training; (2) to enhance the communication and trust between the facilitator and trainees; and to (3) make the TOF of MAIPs more relevant and targeted. The facilitator can design and arrange the course according to the needs of the trainees, so as to address local community's actual problems of value chain development.

Materials: blank sheets of paper, pens, whiteboard, etc.

Method: brainstorming or focus group.

Steps: The facilitator introduces the main objectives, contents and basic elements of the activities of the MAIP to all the trainees and asks them to articulate their opinions, expectations and needs.

Brainstorming: The trainees discuss in small groups and write down their needs on sticky notes. Each sticky note contains only one need. After this, the facilitator collects all the notes and pastes them on the wall. The notes should be roughly classified according to the types of needs, such as knowledge, skills, solutions to a certain problem, assistance and services from government or extension agents, etc.

Focus group discussion: The trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to indicate what they want to learn most in this training. The facilitator or one trainee will record the conversation of the trainees on paper/whiteboard. The records should be roughly classified.

Summary by the trainer: Regardless of the sticky notes resulting from brainstorming or the written records of focus group discussion method, the facilitator should classify them and explain in an itemized way as much as possible, indicating which needs will be involved in the training, which can be solved by themselves, and which are not covered in the training (**Table 1**). This can not only increase the enthusiasm of the trainees for the training but make them feel that the training is centered on their needs.

Time limit: 120–180 minutes

MAIP master trainer training facilitators in Azerbaijan.

TABLE 1. Exemplary table for the facilitator's reference when wrapping up the training

Items in MAIP	What did the trainer say	Trainees' opinion and evaluation (feasible/ infeasible)	Defined actions	Conclusions	Remaining unclear issues
Item 1: Infrastructure settings (1, Residential, 2, 3, 4)					
Item 2: Key actors (1, 2, ----)					
Item 3: Mechanism of interactions					
Item 4: Enabling environment					

4.2 Participatory needs assessment on multi-actors agricultural innovation platforms community

Objectives: The key community actors participate in the formulation of the MAIP. The facilitator should have a full immersion in the rural community where the MAIP is to be constructed, so as to work on its planning closely with community members. This brings about the following positive effects:

- The community can proactively "discover" and give priority to their needs and opportunities. Based on this, the MAIP activities are to be designed, and interactive activities can be made more sensitive to the characteristics of the community;
- All MAIP training activities need to create an environment of ownership for farmers and local authorities. This can enhance the local community's sense of responsibility and obligations;
- The selection of trainees and implementation personnel should be made considering the roles they play and the tasks they assume, so as to guarantee a solid MAIP team; and
- Through all the above aspects of activities, it is expected to achieve an independent and sustainable implementation in the community.

Materials: large blank paper for whiteboards, marker pens, 0.5 kg seeds (corn, peanuts or any other seeds or objects that are suitable for counting), notebooks, pencils, etc.

Methods: Analytical (cross-sectional) survey, key informant interview (informal interview), brainstorming, focus group discussion, etc.

Steps: The facilitator introduces the location and basic requirements of agricultural value chain selection of the MAIP to all the trainees and asks them to articulate their opinions, expectations and needs.

Once the village where the MAIP is to be hosted is decided, it is necessary to prepare for the investigation of the context conditions of the village, including collecting basic statistics about the village, such as population, leading agricultural industry, crop types, farmer income, etc.

Carry out a field survey of the MAIP community (village). The survey expects the following results:

- Decide on the key crops or agricultural value chain targeted by the MAIP;
- Identify the constraints of the agricultural value chain and the methods to solve these problems in order of their importance; and
- Determine the composition of the MAIP (criteria for trainee selection, gender balance, etc.).

Summary by the facilitator: Regardless of the sticky notes resulting from the brainstorming or the written records of focus group discussion, the trainer should classify and explain them in an itemized way as much as possible, including clearly introducing and explaining the survey methods in the following sections. The trainees should be allowed to think about which method should be used under which circumstances and try to get the results through simple investigations.

Time limit: 180–240 minutes

MAIP location selection: Before establishing a MAIP in a community, it is first necessary to select a suitable implementation location. The following is a set of indicators that can be proposed by a qualified MAIP trainer to determine locations at different levels. The specific content is summarized in Table 2:

MAIP facilitators discussing innovation agendas in the TOF course in Azerbaijan.

TABLE 2. MAIP location selection (survey form)

Criteria	Survey objects	Method of implementation
Ecological zone (MAIP hub) level		
• the main production area of the target agricultural value chain • there are good market opportunities (conditions) • environmental conditions • the main source of income of local farmers • whether the local government is likely to give sound support • have good natural conditions to produce crops (especially water supply and pollution there are (potentially) good MAIP trainers	*Survey or consultation objects of trainer/ coordinator:* • local government leaders and related personnel • project officers • institutions and enterprises related to agricultural production and operation	• collect basic data of the ecological region under investigation: visit the place where the MAIP will be implemented, and verify the data • consult the provincial agricultural management department • organize a seminar for local agricultural extension staff
• the community is representative of agricultural production in the region • there is a large area of crop cultivation that is concentrated and mainly commercial crops • non-order agricultural production • good infrastructure (irrigation, transportation and power supply)	• sellers of farm products market • sellers of agricultural inputs	• field surveys and observations of environmental conditions • organize seminars with the participation of trainers, local plant protection personnel and community leaders • make a decision
Community level (MAIP)		
• is it a representative village? • there is a large area of crop cultivation that is concentrated and mainly commercial crops. Or a large scale of livestock farming • what is the market outlook? • sound infrastructure (irrigation, transportation and power supply) • whether community leaders are likely to give sound support	Trainers consult: • local community leaders • local farmers • local agricultural extension staff • institutions and enterprises related to agricultural production and operation	• field surveys and observations of environmental conditions • organize seminars

After the MAIP village is selected, it is necessary to prepare for the investigation of its context conditions. Therefore, a participatory method is to be adopted to disclose local realities. Active community participation in this process is crucial, in terms of guiding the direction and content of the MAIP implementation based on community needs and interests; and arousing the interest of the community and their commitment to the upcoming MAIP activities.

Multi-actors agricultural innovation platforms community (village) survey

Objectives:

(1) Get familiarized with the context conditions of the community where the MAIP is to be implemented;

(2) Explain to the community the objectives and significance of the MAIP implementation, so as to guide them to actively participate in the MAIP implementation;

(3) Complete the survey of the village's context conditions, so as to familiarize the MAIP trainers with its agricultural ecology and social characteristics. This is important for facilitating upcoming focus group discussions;

(4) Understand the reasons why farmers choose specific agricultural industries (production, cultivation, processing) and specific agricultural management measures; and

(5) List the important problems faced by farmers during production.

Expected results:

- Define the key crops or agricultural value chain targeted by the MAIP;
- Rank the limiting factors in the selected agricultural value chain and the methods to solve these problems in order of their importance; and
- Determine the participant composition of the MAIP (standards for trainee selection, gender balance, etc.).

In each village survey, the team must consist of at least two facilitators, two farmers or local community leaders. The extent of the survey (how long, how many people participate, the main content, etc.) and the specific method of each activity should vary according to the specific conditions of the place and the expected results of different activities. The following activities are recommended: conducting cross-sectional surveys, including field observations; informal interviews with farmers (male and female), retailers of agricultural inputs, agricultural product retailers, consumers and community leaders; and using different participatory rural assessment methods to conduct focus group discussions with farmers. Before the survey, a preliminary seminar should be organized with the participation of village leaders and 1-2 farmers who have responded to the survey to discuss and modify the survey method and the related forms.

Investigation method 1: Cross-sectional survey

The purpose of this activity is to gain a good knowledge of the land use issue of the village where the project is located. Cross-sectional survey(s) should be carried out before the focus group discussion, so that the members of the survey team can better understand the content of the farmers' discussions. Observe the village and

its farmland and talk to random people encountered on a walk. The interview team is best accompanied by 1-2 key actors (farmers, grass-roots leaders). Observations and conversations should be recorded in a notebook at any time. A field observation record table can be designed and modified according to the specific situation (make copies as needed), considering:

- Land use situation: such as crops, land fertility, water supply, etc.
- Buildings.
- The use of non-agricultural and non-residential land (such as forests, reservoirs, etc.).

Materials: notebooks, pencils, cross-sectional survey record sheets

Investigation method 2: Key informant interview

This activity is aimed at obtaining relevant information about agricultural production and post-harvest from local community members through informal methods. It is recommended that local farmers or other personnel participating in the survey use the following content for reference and discussion.

Farmers (male, female):

- The roles played by men and women in crop planting, market sales and vegetable processing and utilization.
- Crop planting modes.
- Reasons for choosing crop types and varieties.
- Utilization of crop cultivation patterns.
- Problems in production and market.
- Ways to solve these problems.
- Perception of opportunities to improve agricultural production.

Retailers of agricultural inputs (male and female):

- The pesticide formulations that cultivating farmers like.
- Usually, farmers will consult what types of pesticides to buy, or they know what types of pesticides they need to buy.
- Did the farmers say that pesticide poisoning occurred during use or under other circumstances?

Agricultural product vendor (salesperson):

- Local market network.
- Procedures and formalities for entering the market.
- What are the constraints on the market for agricultural products produced in the region?
- Perceived opportunities to improve agricultural production.

Community leader:

- Roles and tasks in agriculture development.
- Constraints in agricultural production.
- Perceived opportunities to improve agricultural production.

Materials: notebooks, pencils.

Investigation method 3: Focus group discussion

This activity is aimed at understanding the importance of agricultural production, problems encountered during cultivation and post-harvest, and participation patterns of male and female farmers during and after cultivation in this community. The seminar should be open to every farmer in the community. Anyone motivated can participate, but no fewer than 20 and no more than 50 people.

It is better not to let the village leaders choose the participants, nor guide them to discuss and speak. The latter must take the initiative to participate. The strategy of inviting farmers to participate can be discussed and negotiated with the village leaders in advance to ensure gender balance and a mixture of poorer farmers and more affluent ones. The timing of the meeting should be such that all types of people can participate. Different meeting timings are to be arranged according to different types of people, such as male and female farmers, agricultural produce growers and distributors, community leaders and members, etc.

The following methods are recommended (although not all need to be used in a meeting):

- Seasonal calendar.
- Crop importance ranking (define the MAIP main crop on this basis).
- Ranking of the important problems encountered in the production of the selected crop.
- Distribution map of work tasks of different genders.
- Open discussion.

Before starting the discussion, the members of the survey team should introduce their background to the participants, mentioning that the meeting is a part of training in the village and a foundational work for identifying the training objects and contents and evaluating the effectiveness of the training in the future.

Seasonal calendar: The seasonal history of crop production includes 13 months of the anniversary as designated by the participants (see Table 3). It should be drawn on a large paper sheet. The patterns or changes in different factors affecting agricultural production are marked in the corresponding months. These factors should include the contents in Table 3. However, participants are invited to add other related factors (changes in market prices of agricultural products, busy and idle months, etc.).

TABLE 3. Seasonal history of crop production

Factors \ Month		3	4	5	6	7	8	9	10	11	12	1	2	3
Rainfall														
Temperature														
Crop														
Other factors														

Crop importance rankings: The villagers participating in the assessment are asked to list all the types of crops cultivated in the village in the past two to three years and record the information in a table from which five important crops that the majority agree with are to be selected (Table 4).

Villagers are also asked to explain the factors for choosing these crops, such as high yield, good market prices, low input, etc. Fill in these factors (minimum three and maximum six) together with five important crops in the table (see the template table below). Each factor of the five crops can be counted with corn kernels, peanuts, or something that can be counted so as to sort out its degree of importance. Give each villager five corns for each factor (a row). The more a factor influences a crop, the more corn kernels are to be given to it (for example, give all the five kernels to a factor that influences a crop the most). If the impact on all crops is the same, put one grain for each crop. If the villagers think that the result is not in line with the actual situation of the village, they can make appropriate adjustments if they agree. After all the factors are sorted out, the score can be calculated and compared.

TABLE 4. Sorting of crop types

Factor \ Crop	Chinese cabbage	Eggplant	Water spinach	Cucumber	Cowpea
Others					
Total					

Based on the above analysis, the villagers determine the most suitable crop for training for the MAIP. As shown in the above table, one should consider choosing between Chinese cabbage, eggplant, water spinach, cowpeas or cucumber, or

a vegetable variety that has the potential to greatly reduce the existing problems through training. The following exercise activities focus on the crops selected by the trainee groups.

Crop problem rankings: The participants are then asked to fill in the problems encountered in the production and sales of the selected crop in the table on a large blank paper (Table 5). Let them discuss 5-6 of the most important and urgent problems. The main outcomes of these problems are discussed in the next step, for example (1) production reduction; (2) reduced quality; (3) difficulty in implementing; (4) high cost of implementation; or (5) other reasons considered by farmers. Record the important opinions, explanations and conclusions of the discussion on the blank paper, and then discuss how to solve each problem with integrated pest management (IPM) measures. The above conclusions can be used as an entry point for discussion in the MAIP planning meeting. Therefore, all the forms should be kept for future meetings.

TABLE 5. Obstacles in the production and sales of crops

Crop / Factors					
1.					
2.					
3.					
4.					
5.					
Total					

Problem / Reason						
Total						

Distribution map of male and female work: This discussion should be carried out separately for men and women. It is possible to focus on women and men separately in a focus group discussion, or separately on different occasions (for example, when you see a group of women in the field, you can ask their opinions).

Ask them to discuss and list all the work related to the production and sales of agricultural products (put similar work into categories as much as possible). Let each participant (male or female) work on a table for each selected crop to determine the proportion of time spent by males and females working in their family and reflect the realities of the village based on the average (see the template table below). The total

number of four seeds for each person represents 100 percent of the workload. Each seed represents one task. Let them independently put them into the corresponding column according to their actual situation. No seeds means no workload (but implies that the other column is 100 percent workload), one means less than 25 percent, two means 25-50 percent, three means 50-75 percent, and four means 75-100 percent. Calculate the number in each grid. When all rows (tasks) are done, calculate the number of seeds in each column.

TABLE 6. Division of labor

Task	Labor distribution	
	Male workload	Female workload
1. *Task* A	⊗⊗⊗⊗ ⊗⊗⊗⊗⊗⊗ ⊗⊗⊗⊗	⊗⊗⊗⊗⊗⊗ ⊗⊗⊗⊗⊗⊗⊗⊗ ⊗⊗⊗⊗⊗⊗
2. *Task* B		
…		
Total		

It can also be expressed in other ways, depending on the trainees' understanding of the percentage of workload. For example, colour can also be used to indicate the proportion of male labour and female labour respectively in completing the workload (see the template table below). Discuss the final results of the analysis. Considering the scope of MAIP, the type of people most suitable for training should be defined, men or women or both.

TABLE 7. Division of labor

Task	Labor distribution	
	Male workload	Female workload
1. *Task* A	30%	70%
2. *Task* B	50%	50%
…		
Average		

At the meeting, allow participants to discuss any related issues at an appropriate time. After the above-mentioned activities are over, opportunities should be provided to them to discuss other issues of interest to them. After the meeting, draw conclusions about what kind of training activities can be carried out, and what general materials about the implementation has been obtained. Explain the content of the preparation for the next steps of the training (student selection, curriculum setting). Thank all farmers, leaders and related personnel for their cooperation, participation and support.

4.3 Agricultural value chain analysis

Objectives: (1) to familiarize the trainees with the methods of the investigation and analysis of agricultural value chain; and (2) to enable trainees to design and arrange innovative activities in MAIP by understanding and mastering these methods, so as to solve the difficulties faced by value chain development in the community.

Materials: paper, pen, whiteboard, etc.

Methods: brainstorming and focus group discussion.

Steps:

(1) The facilitator introduces the main objectives, contents and basic methods and steps of agricultural value chain analysis, and asks the trainees to share their opinions, expectations and needs.

(2) Brainstorming: The trainees discuss in small groups and write down their needs on sticky notes. Each sticky note contains only one need. After this, collect all the notes and paste them on the wall. The notes should be roughly classified according to the types of needs, such as knowledge, skills, solutions to a certain difficulty, assistance and services from government or extension agents, etc.

(3) Focus group discussion: The trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to articulate what they want to learn most in this training. One facilitator or one trainee will record the conversation of the trainees on paper/whiteboard. The records should be roughly classified.

(4) Summary by the facilitator: Regardless of the sticky notes resulting from the brainstorming or the written records of focus group discussion method, the facilitator should classify them and explain in an itemized way as much as possible, including which needs will be involved in TOF training, which can be solved by themselves, and which are not covered in the training. This can increase the enthusiasm of the trainees for the training.

Time limit: 120–180 minutes

Introduction to agricultural value chain analysis

What is agricultural value chain? A "value chain" in agriculture identifies the set of actors and activities that bring a basic agricultural product from production in the field to final consumption, where at each stage value is added to the product. A value chain can be a vertical linking or a network between various independent business organizations and can involve processing, packaging, storage, transport and distribution. The terms "value chain" and "supply chain" are often used interchangeably. [2]

[2] See: FAO, ILO, IFAD (2010). Gender and Rural Employment Policy Brief #4: Agricultural value chain development: Threat or opportunity for women's employment? Retrieved from http://www.fao.org/3/i2008e/i2008e04.pdf.

What is agricultural value chain analysis? It is an approach that analyzes a production unit or process in a market chain – from input suppliers to final buyers – and the relationships among them. It analyzes the factors influencing performance, including access to and the requirements of end markets; the legal, regulatory and policy environment; coordination between firms in the industry; and the level and quality of support services (Table 8). Value chain analysis is a useful analytical tool that helps the understanding of overall trends of industrial reorganization and identify change agents and leverage points for policy and technical interventions. Therefore,

- it breaks the value chain into its constituent parts in order to better understand its structure and functioning;
- it identifies chain actors at each stage and discerns their functions and relationships and thereby determines the chain governance or leadership to facilitate chain formation and strengthening;
- it identifies value-adding activities in the chain and assigns costs and added-value to each of those activities;
- it identifies the flow of goods, information and finance through the various stages of the chain; and
- it evaluates each stage in order to detect problems or identify opportunities to improve the contribution of specific actors and the overall performance of the chain.

Tools used in value chain analysis. There are no fixed rules as to how value chain analysis should be carried out. A range of qualitative and/or quantitative research tools can be used:

- Participant observation
- Semi-structured interviews
- Focus group meetings
- Structured questionnaire
- Market mapping

Steps used in value chain analysis

- Step 1: Activity analysis – Brainstorm the activities that you, your team or your company undertake that in some way contribute to your customer's experience. Identify step-by-step the flow of work that you or your team carry out.
- Step 2: Value analysis.
  - For each activity you've identified, list the "value factors" – the things that your customers value in the way that each activity is conducted

- Write down these value factors
- Write down what needs to be done or changed to provide great value for each value factor

- Step 3: Evaluate changes and plan for action
  - Pick out the quick, easy and cheap wins
  - Screen the more difficult changes
  - Prioritize the remaining tasks and plan to tackle them in an achievable way

TABLE 8. Template table for agricultural value chain analysis

Value chain sectors	A. Current status	B. Attainable based on scientific results or market potentials	Analysis on gaps between B and A and how to narrow the gaps	Current status of EAS			Needs for improved EAS in MAIPs		
				Who	How	What	Who	How	What
1. Crop soil health management									
2. Crop nutrient and water management									
3. Crop yield and quality management									
4. Crop health management									
5. Harvest and storage management									
6. Safety and quality testing and monitoring									
7. Processing and package management									
8. Certification and marketing									

4.4 Understanding the roles of multi-actors agricultural innovation platforms facilitator

Objectives: (1) to familiarize the trainees with the basic responsibilities and requirements of MAIP facilitator; and (2) to improve trainees' self-confidence in implementing MAIPs.

Materials: pens, paper, whiteboard, etc.

Method: Brainstorming.

Implementation steps: The facilitator introduces to all the trainees the main objectives, content and basic elements of the MAIP, and asks them to share their opinions, expectations and needs regarding the responsibilities of the MAIP Facilitator.

The trainees discuss in small groups and write down their opinions on sticky notes. Each sticky note contains only one opinion. After this, the facilitator collects all the notes and pastes them on the wall. The notes should be roughly classified according to issues related to the responsibilities of the MAIP facilitator, such as knowledge, skills, working modalities, methods, etc.

Summary by the facilitator: The facilitator should classify them and explain in an itemized way as much as possible which opinions will be involved in TOF training, which can stimulate the trainees to solve by themselves, and which are not covered in the TOF training. This can not only increase the enthusiasm of the trainees for the training but can make them feel that the training is centered on their needs.

Time limit: 120–180 minutes

Main responsibilities of the multi-actors agricultural innovation platforms facilitator (for reference only)

A MAIP facilitator is far more than just an organizer. They play complex and multiple roles, including as a coordinator with extensive experience, a proponent of innovative research topics, facilitator, technical promoter, and information disseminator. A good MAIP facilitator should be able to handle some difficult MAIP problems and scenarios. The most important tasks of MAIP facilitators are as follows:

- Before carrying out MAIP activities, facilitators should guide rural communities to conduct demand and agricultural value chain assessments, determine the location of MAIP and select relevant agricultural value chain innovation activities based on specific local issues;
- Propose and formulate MAIP budget management plan and be responsible for the expenditure, documentation and reimbursement of MAIP funds;
- Arrange accommodation for researchers and extension personnel;
- Arrange field observations and field trials on test plots and demonstration plots;
- Arrange technical training and exchange activities;
- Before each MAIP activity, prepare all the materials needed for the special content and team activities;
- Before each activity, introduce and explain in detail its objectives and specific steps;

- Train the trainees to observe and analyze the content of the learning field together, and answer some related questions raised by the trainees;
- Train and motivate the trainees to conduct in-depth and detailed investigations and observations for the selected value chain and carry out innovative activities;
- Mobilize every key MAIP actor to actively participate; and
- As a manager, ensure that MAIP's schedule and activities are carried out as planned. If there are changes to the schedule and content, get first the consent of key MAIP actors.

4.5 Identifying innovation agendas in the multi-actors agricultural innovation platforms

Objectives: (1) to familiarize the trainees with the content and requirements of MAIP innovation activities; (2) to enhance their self-confidence in facilitating MAIP innovation activities; and (3) to train the trainees to solve the problems in value chain development through innovation.

Materials: paper, pens, whiteboard, etc.

Methods: Gap analysis, network mapping.

Implementation steps

(1) The facilitator introduces to all the trainees the main objectives, content and basic elements of the innovation in MAIP, and asks them to share their opinions, expectations and needs. Furthermore, the facilitator asks the trainees to think about how to define the innovative themes and approaches around the agricultural value chain in the MAIP;

(2) GAP Analysis: The trainees discuss in small groups and write down their opinions on sticky notes. Each sticky note contains only one opinion. After this, the facilitator collects all the notes and pastes them on the wall. The notes should be roughly classified. The facilitator takes a selected agricultural value chain as an example, analyzes the gaps between the pre-, mid- and post-production links and the ideal state, and trains the trainees to analyze and discuss the themes, participants, and methods of innovative activities;

(3) Network Mapping: During a Network Mapping event, the trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to talk about their personal opinions. One facilitator or one trainee will record the conversation of the trainees on paper/whiteboard. The records should be roughly classified. The facilitator takes a selected agricultural value chain as an example and analyzes the key actors in the pre-, mid- and post-production links. Finally, the facilitator trains the trainees to analyze the key actors in each link and discuss their mutual influence and effect; and

(4) Summary by the facilitator: Regardless of the sticky notes resulting from the brainstorming or the written records of focus group discussion method, the

facilitator should classify and explain them in an itemized way as much as possible, including which needs will be involved in TOF training, which can be solved by themselves, and which are not covered in the training. This can not only increase the enthusiasm of the trainees for the training but can make them feel that the training is centered on their needs.

The above gap analysis and network mapping in MAIPs can be used together or separately according to the actual situation.

Time limit: 200–240 minutes

4.6 Facilitating interactions among key multi-actors agricultural innovation platforms actors

Objectives: MAIPs are mainly aimed at facilitating interactions among the key actors along the selected value chain. Interactions between key actors are prone to generating new ideas and fostering innovations. This section enables trainees to: (1) understand the main types of interactions; (2) develop necessary skills to facilitate main types of interactions; and (3) build confidence on facilitating innovation process.

Materials: pens and pencils, markers, papers, whiteboard, computers, projectors, experimental plots, demonstration plots and digital communication devices.

Methods: Brainstorming and focus group discussion.

Implementation steps:

(1) The facilitator introduces to all the trainees the main objectives, content and basic elements of the interaction and learning processes of MAIPs and asks them to share their opinions, expectations and needs;

(2) The trainees discuss in small groups the main types of interactions in the innovation systems along the agricultural value chain. The facilitator writes down their opinions on sticky notes. Each sticky note contains only one opinion. After this, the facilitator collects all the notes and pastes them on the wall. The notes should be roughly classified;

(3) The trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to talk about the facilitation method that they want to learn most in the training regarding main types of interactions. One facilitator or one trainee will record the conversation of the trainees on paper/whiteboard. The records should be roughly classified; and

(4) Summary by the facilitator: Regardless of the sticky notes resulting from the brainstorming or the written records of focus group discussion method, the facilitator should classify them and explain in an itemized way as much as possible, including which needs will be involved in TOF training, which can be solved by themselves, and which are not covered in the training. This can not only increase the enthusiasm of the trainees for the training but can make them feel that the training is centered on their needs.

Time limit: 120–180 minutes

Main types of interactions among the key multi-actors agricultural innovation platforms actors

In the process of agricultural value chain development, lack of interaction among the actors tends to undermine innovation processes. MAIPs are an effective tool to facilitate interactions between the key actors. Types of the interactions are as follows:

Farmer to farmer: Farmer to farmer interactions promote the spread and transfer of agricultural production and post-harvest innovations among them. Normally, this type of interaction rarely occurs without facilitating or organizing lead farmers or other key actors of agricultural value chains. MAIPs serve as a space conducive to farmer to farmer interactions through various actions, such as farmer field days, farmer rally, farmer interest club and associations and farmer field schools (FFSs), etc. Farmer co-learning interactions occur through their participation in on-farm research, FFSs, field visits and observations. Co-learning interactions of farmers with other stakeholders are crucial for knowledge and technology transfer. MAIPs empower farmers through participatory and non-formal education processes.

Researchers to farmers: In MAIPs, researchers should play a leading role in knowledge and technology innovation and coordinate the innovation process of technology development and transfer. For the research-triggered innovation process, a combined bottom-up farmer participation and top-down researcher guidance approach should be used to generate knowledge and technologies in the fields, on the farms and in the farming systems. This helps overcome the last mile barrier of knowledge transfer by developing practical and farmer-owned knowledge and technologies. Research in the MAIPs generally compares agricultural production on research plots with conventional farmer fields. The results from the research plots demonstrate clearly that agricultural production achieved through scientific research consistently exceeds those in the conventional practices. Farmer participatory research on the identification and analysis of this production gap and other advancements drive the subsequent knowledge co-learning process of multiple actors. The innovation of knowledge and technology is triggered by research, and the subsequent process of knowledge and technology applications is continuously supported and facilitated by on-farm participatory research and follow-up demonstration and training activities. These research activities trigger innovation that provides "zero time difference, zero cost, zero distance and zero threshold" knowledge and technology services to smallholder farmers. It also empowers the smallholder farmers through follow-up training activities to fulfil their potential based on scientific advancement. These attainable potentials are usually desirable in national policies and SDGs but prove difficult to achieve using common traditional knowledge and technology transfer approaches.

Extension agents to farmers: MAIPs provide pluralistic AEAS to smallholder farmers by engaging public education, research and extension sectors and private enterprises. MAIPs are not only an agricultural technology innovation platform, but also a farmer education one. Along with on-farm participatory research, a series of training activities are designed and delivered by MAIP professionals including extension agents and lead farmers to train farmers to understand

agricultural production ecosystems and learn new technologies and good practices. In addition to farmer field schools, other training methods are used in response to farmer needs. For example, field visits and observation, farmer rallies, fairs and shows are integrated into the farmer training curriculum according to local conditions. During the cropping season, MAIP professionals including public and private extension agents and market actors also provide AEAS.

Business to farmers: It is well recognized that MAIPs are one of the best platforms for private enterprises to undertake experimental evaluation of their business innovations. For example, input suppliers can cooperate with MAIPs to test and improve their products in local communities. They can send their specialists to work with lead farmers, conducting farmer participatory field trials and demonstrations to expand the applications of their products and markets. The business to farmer interaction is conducive to win-win and pro-poor business innovations in terms of the economic profits of the enterprises and the income increase of the smallholder farmers. It is also commendable that through these interactions, both farmers and enterprises can better comply with standards and criteria set by domestic and international markets.

Business to business: Business-to-business interactions rarely occur when coordinating mechanisms and facilitation by public associations are absent in agricultural value chain development. MAIPs provide optimal platforms to coordinate business to business interactions among key market actors. The market competitive pressure stimulates key market actors to interact and innovate so as to provide high quality and new value-added products at lower prices. This kind of business to business interaction can coordinate agricultural value chain development in terms of upgrading marketing standards, promoting production technical advancements and other forms of innovations.

Interaction among multiple actors: It is argued that innovation requires dense networks and partnerships among multiple actors. Through MAIPs, multiple actors interact in various ways once good coordination mechanisms are established. For example, knowledge and technology innovation is triggered by research, while the subsequent process of knowledge and technology applications are continuously supported and facilitated by researchers, extension agents, lead farmers and farmers through the follow-up training activities and AEAS. To cope with fluctuating markets, partnerships and networks need to be built up among market actors, researchers, extension agents and farmers. This is supportive of sharing accurate information about market price and production costs and expertise to jointly improve productivity, quality and branding of the agricultural products.

Interactions and co-learning processes among multiple actors: MAIPs are established to provide necessary AEAS to support AIS by facilitating interactions and co-learning processes among the multiple AIS actors. This should be facilitated according to the needs analysis. In general, different dimensions of interactions and co-learning processes, such as farmers to farmers, market actors to farmers, input suppliers to farmers, processors to farmers, and public AEAS to input suppliers, should be facilitated through different AEAS activities. The AEAS approaches of interactions and co-learning processes are proposed in Table 9.

TABLE 9. AEAS activities that facilitate interactions and co-learning processes of MAIPs

Interactions and co-learning processes	AEAS activities of MAIPs	Proposed key topics
Farmers to farmers	FFS, farmer club, farmer associations, ICTs	Technology transfer, value creating chains, information sharing
Market actors to farmers	Farmer business school, ICTs	Consumers' preferences and standards, information sharing.
Traders to farmers	Farmer business school, ICTs	Consumers' preferences and standards, information sharing
Processors to farmers	FFS, training and visiting (T&V)	Consumers' preferences and standards, information sharing
Public EAS to input suppliers	Workshop	Food safety regulations and testing, certification and marketing.
Public EAS to traders (market actors)	Workshop	Standards and food safety regulations and testing, certification and marketing
Public EAS to farmers	STB, FFS, T&V and ICTs	Value creating chains, technology transfer, information sharing. certification and standards

4.7 Facilitating farmer participatory research

Most facilitators have high design skills and abilities in agricultural research. But this is not the case when they facilitate farmers to do experimental research. They always do too much for the farmers, resulting in research that they themselves want to do rather than a genuine farmers' research. Although farmers are involved in all the processes of research planning, experimental design, field surveys, and result analysis, they tend to believe that they are not responsible for the research process and show little sense of accomplishment for the research results. When asked "why do you use this method or another to do this experiment", farmers always answer "it was the facilitator who told us to do this or that". Strictly speaking, this kind of research is not a farmers' research. Another common problem is that facilitators themselves lack scientific knowledge and skills in agricultural research and have no idea about research design. As a result, farmers are allowed to do everything, leading to a research process or method irrespective of the requirements of scientific research. This section introduces the method of facilitating farmer participatory research (FPR) in MAIPs.

Types of farmer participatory research

Experimental research carried out by individual or groups of farmers is an important tool for acquiring new knowledge, testing and comparing new methods, improving transferred technologies to adapt to local conditions, and solving the

problems they face. Experimental research can be classified into the following types according to its different objectives:

- *Learning-oriented experimental research:* The facilitator knows the results whereas the farmers do not. One of the purposes is to learn experimental research methods, and the other is to allow farmers to participate in demonstrative experimental research and demonstrate the results.
- *Adaptive experimental research:* The facilitator probably knows the results whereas the farmers do not or are uncertain. Its purpose is to carry out localised adaptive research and demonstration of new knowledge or introduced new technologies.
- *Innovative experimental research:* Neither the facilitator nor the farmers know the results. Its purpose is to design a new experimental study in response to the existing problems.

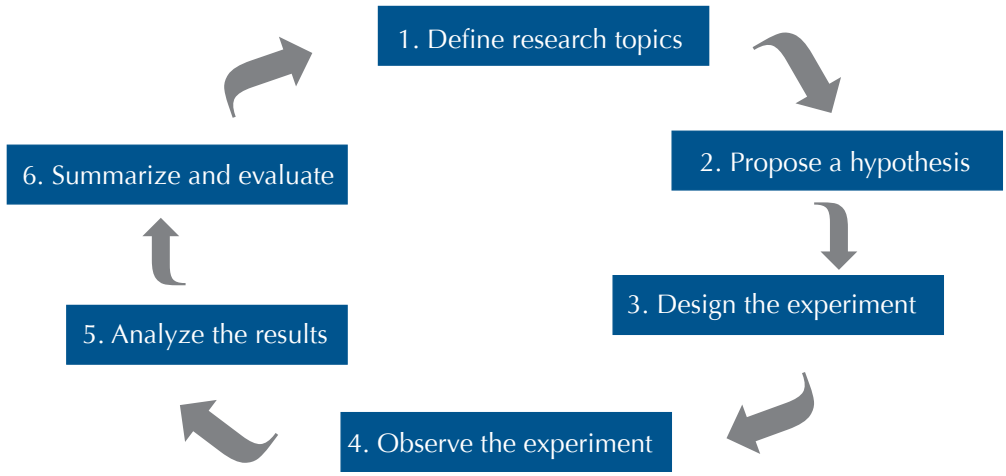
To effectively understand and solve the problems faced by farmers, it is necessary to organize, facilitate and design according to different experimental research purposes. Few experimental studies can include the above-mentioned objectives at the same time, unless the second and third objectives can be easily combined with the first one. MAIPs generally focus on learning-oriented experimental research. Some selected farmer trainee groups can also conduct adaptive or innovative experimental research in the follow-up activities of MAIPs. In the learning cycle, all farmer trainees must start with problem-solving activities to learn knowledge. Therefore, experimental research methods must be introduced at the beginning of the training. As a way of developing modes of thinking, it should provide them with skills so that they can learn and master the knowledge from the first phase of the training on, while making better decisions based on sufficient information sources. At the beginning of the second phase of the training, farmers should be asked to conduct experimental research in their own learning fields.

Apply the following guidelines to help farmer trainees design simple, easy-to-do, but credible experiments. The results can provide a basis for their decision-making. Training farmers to conduct experimental research will help them independently and correctly conduct experimental research after completing the training.

Facilitation steps

Facilitators assume a very important role in FPR. They should guide farmers to adopt correct experimental methods and provide basic experimental principles, so that the trainees can obtain the skills to continue experimental research through direct participation in the entire experimental research process.

Take a specific situation as an example and ask the trainees what steps are taken for research, what is the first step, the second step and so on. **Figure 5** depicts the six steps necessary for farmers to engage in FPR. It is similar to a learning cycle diagram.



Source: The Authors

Figure 5. ***Learning cycle of farmer experimental research***

Step 1. Define the research topic: It is farmers who must propose and conduct the research. The topic should be aimed at problem-solving. In order to help farmers ask proper questions about their crops, a "topic selection table" is useful (Table 10). This method can be used when preparing for field trials. The first column of the table is the agricultural activities from planting to harvesting, the second is the current measures taken by farmers, the third is the improvement potential of current measures, the fourth is the limiting factors of improvement, and the last is the selection of research topics. Generally, one experimental research has only one topic. The topic selected in the example below is the use of urea.

TABLE 10. Topic selection table

Agricultural activities	Current measures	Improvement potential	Limiting factors	Topic selection
Tillage	Shallow tillage	Deep tillage can promote crop growth	Rotary tiller is unavailable or too expensive	-
Planting	Direct seeding	Transplanting can increase yield	Lack of labour	-
Fertilisation	Inadequate urea application	More application can increase yield	May increase investment	Urea usage amount
Weeding	Artificial weeding	Using herbicides	May increase investment	-
...	...	...	...	-

Step 2. Propose a hypothesis: Inspire every farmer to come up with as many hypotheses as possible through brainstorming. Avoid the situation where there is only one hypothesis and the facilitator dominates the farmers' thinking. For example, as for the research topic "urea use", some farmers believe that "increasing urea will increase yield". A certain farmer proposes that "more urea will increase weeds" and so on. In agro-ecosystems, increasing or decreasing the use of urea will have a positive or negative impact on crops. A concept table can be used to summarize these hypotheses (Table 11). The first column is all possible impacts of the selected topic on crops, ecosystems, and social and economic aspects. Farmers indicate the sources of these concepts in the second column. Some concepts may have been tested, while others are just ideas. The third column is the farmers' view on the concepts. The following is a conceptual table of the topic "increasing urea use".

TABLE 11. Concept table of the topic "increasing urea use"

Concept	Concept source	Views on concept
Increasing urea will increase crop yield	Agricultural technology station	I don't believe it. You have to test locally
Applying more urea will increase weeds	A farmer said so	Possible, to be observed
Increased application of urea will speed up crop growth	A farmer's experience	Yes, where does the growth speed up
Applying more urea will harden the soil	Introduced in the newspaper	Possible, to be observed
Use more urea, some diseases and insects will aggravate	A farmer said so	Possible, to be observed
Applying more urea will increase investment, and it will not pay off	A farmer's experience	Yes, to be proved by experiment

The concept table is like the blueprint of a house. With it, farmers can plan how much the experiment will deal with, determine what to observe and so on.

Step 3. Design the experiment There are two important principles of field trial design, namely, natural variation and deviation. If farmers understand and consider them, they can design good experimental studies. Natural differences occur between plants within a plot, in different plots, or in different parts of a plot. This is especially important in the case of small test plots. Take the research topic "the amount of urea usage in Chinese cabbage" as an example (Table 12):

(1) State the existing problems in detail and define the research topic. It is best to test only one factor at a time in an experiment to make it as simple as possible, for example, the variety, the use time of potash fertilizer, or the amount of organic fertilizer. Simplicity means clear results. If we compare the combination of a series of factors, such as fertilizer A with high planting density, and fertilizer B with low planting density, we will not be able to understand the role of each factor. For multi-factor experimental research, it can be split into multiple single-factor experiments. Otherwise, the interaction of multiple factors will confuse

farmers, which is not conducive to their analysis and intuitive evaluation of experimental results.

(2) Determine the purpose of the experiment in detail as much as possible. What do we need to know after the end of the experiment?

(3) Determine the experiment treatment. Too much or too little treatment counts can hardly produce useful information. The most suitable number of treatments for each experiment is 2-3. First determine the control treatment, generally using conventional operations with known results as a control, such as farmers' conventional methods or standards recommended by the agricultural technology extension office. Other treatments should consider the actual situation in the field and the capacity of the farmers (economy, labor). The range of differences between treatments should be appropriately increased to facilitate farmers to analyze and compare experimental results with simple statistical methods.

(4) Ensure the reliability of the experiment. In farmer-led experimental research, 2-3 repetitions of each treatment are sufficient. The same field comparison should be adopted as much as possible. The area of the plot should not be too large. The soil quality and fertility of the test site should be basically uniform.

TABLE 12. Experiment design of the research topic "the amount of urea usage in Chinese cabbage"

Research topic	The amount of urea usage in cabbages
Objective	Test how much urea can be reduced without reducing the yield of cabbages
Hypothesis	The current utilisation rate of urea is low
Treatments	Treatment A: 50 kg/ha Treatment B: 100 kg/ha Treatment C: 150 kg/ha Treatment D: 200 kg/ha (farmers' regular dosage = control)
Repetitions	3 (1, 2 and 3)

Use 200 kg/ha of urea used by farmers as a control to determine the experimental treatment level. Considering that the purpose of the experiment is to reduce the amount of urea used as farmers cannot afford to use more urea, all treatments must be lower than the control. Subsequent experimental research should focus on comparing the difference between different dosages and find out the dosage range with the highest yield.

Examples of experimental design layout:

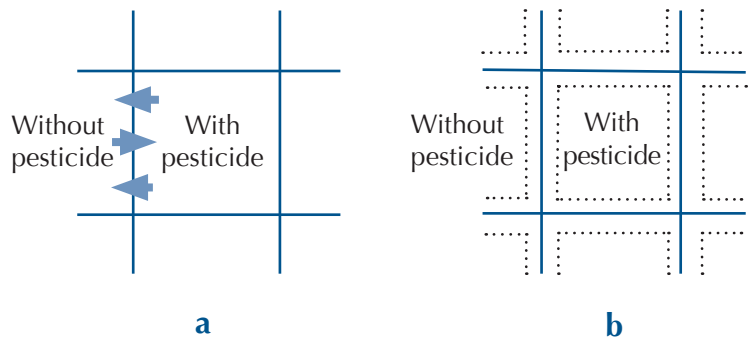
A-1	**B-1**	**C-1**	**D-1**
B-1	**C-1**	**D-1**	**A-1**
C-1	**D-1**	**A-1**	**B-1**

Prepare test plots. The area of each repeated plot shall not be less than 10 m2. The shape of each plot should be the same, as square as possible. If it is difficult to make the area of all square plots the same, carefully measure the area of each plot and arrange various treatments according to the plots. The arrangement of treatments should be such that the repetitions of each treatment are not adjacent (system block design). Random design is rarely used in simple field trials, because in this case the random arrangement of repeated plots may produce some interference.

A simple but not very accurate method is to plant the same number of crops in a plot, such as planting 60 crops as one furrow. However, the row spacing can vary, which may be beneficial for some plants and not so for others. When analyzing the test results, we need to test the yield of each plant. It is best to keep the plot area and the number of plants planted in each plot constant.

If a plot with repeated treatment is adjacent to another one with repeated treatment, it may be greatly affected by other plots, resulting in errors (*See* **Figure 6a**). Bias or interference affects the quality of test results. It may be caused by factors such as the drift of pesticides and fertilizers, the activities of insects and so on. As a test for crop density or variety comparison, the impact of such errors is relatively small.

First, errors can be reduced by increasing the plot area. An experiment to study pest management tends to have a lot of errors and requires a larger plot area than an experiment to study crop planting density. Second, for the non-surveyed areas of each plot with surrounded protection lines (at least one meter on each side) around each plot, the sampling for experimental investigations should be limited to the middle part of the plots (**Figure 6b**). Setting up ridges between plots can prevent moisture from driving the movement of fertilizers.

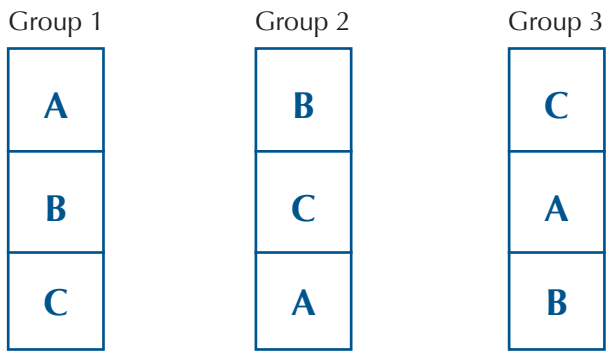


Source: The Authors

Figure 6. ***Source of errors and reduction using pesticide application as an example***

When a field is too small, if all the plots are arranged, a big error will occur because the plot area is too small. Therefore, group design tends to be used. One group is a complete set of treatments (**Figure 7**), and there is a spacing between each group and the other groups. Due to the spacing between them, each group has its own natural characteristics, which means that there are differences between groups in terms of altitude, soil fertility, water conditions, etc. Therefore, the application of group design will result in the addition of variation to the test results, which makes it

more difficult to obtain clear test results. It is recommended to avoid the application of group design as much as possible and arrange the test in a large enough field with good consistency across the field.



Source: The Authors

Figure 7. ***Group design and variation***

Each plot should have a mark (such as bamboo slices). Use a waterproof marker pen to clearly write the name of the test treatment and the sequence of repetitions on the mark.

Define the variables to be measured. The variables must be directly related to the purpose of the research. When the purpose is to provide information on the influence of the research factors on the yield, both the growth indicators and the final yield of the experiment need to be measured. Determine the investigation of frequency and method of the selected variables.

Step 4. Observe the experiment What to observe? Who will observe? When to observe? How to observe? All need serious consideration. The impact on all aspects of the ecosystem listed in the previous concept table should be included in the observation content. How to observe determines the accuracy of the test results. For example, to measure the height of crops, each plant must be measured, and to measure yield, it is necessary to harvest a certain area of crops. The observation of individual plants requires consideration of the representativeness of individual plants. Take at least ten plants from each plot. If it is a larger area (such as a 5 x 5 meters range), harvest one piece in the middle of each plot. The observation time varies according to its content. Yield measurement is carried out during the crop maturity period and weed observation may be more important in the early crop growth period. The optimal design of field trials of crops, insects, and diseases is based on the subject of the experiment, the conditions and area of the experimental field, and the depth of research. Therefore, it is impossible to give a unified test design standard. On the contrary, the trainees should master the basic principles of experimental methods so that they can carry out some experimental designs themselves. The three most important experimental design principles were discussed above. The farmer trainees should have a good understanding of the following points:

- Natural variation: understand why repetitions are needed and how to determine the appropriate sampling size.

- Determine the appropriate size of plots and the edge protection lines.
- Simplicity: Single factor test, limited number of treatments and sensitive treatment spacing.

Step 5. Analyze the results: Train farmers to use simplified mathematical statistical methods, namely, analyzing single-factor, three-treatment, and three-repetition farmer research data with range mapping and consistency comparison methods.

Before analyzing a set of collected research data, the farmer trainees must undergo MAIPs or other training. They should have some understanding of basic simple statistical analysis of average, deviation, range, sampling and distribution, precision, variation, etc. in advance. The training results show that farmers can fully understand and master simple statistical analysis methods. In order for farmers to make a reasonable analysis of a set of data generated in the research, they absolutely need to participate in these basic statistical games and graphic training in FFS.

Step 6. Evaluate the results: Farmers' evaluation of the research results is a very important step. The facilitator must guide the farmers to fully discuss the analysis results of all observation indicators and ask them to make a summary table of the results, comprehensively analyze the impact of the studied factors on ecosystem and find correct conclusions. At the same time, it should be compared to the concept table formed in the second step to guide farmers to discuss: For example, what new discoveries and new knowledge have been obtained from the research? Which aspects need further research?.

The results of the discussion should give farmers a sense of accomplishment after completing the research, stimulating their creative thinking and enthusiasm for agricultural production.

Training farmers to learn experimental research methods

Before the farmer team conducts field experiment, it is very important to explain the "rules of the game", so as to ensure the credibility and usefulness of the experimental results. Often times, many farmers compare their own operations with those of other farmers, or use another field or the next season to test and compare some new methods, ideas, materials, etc. Helping them understand the importance of systematic experimental research and design will greatly enhance farmers' ability to solve problems. When they have grasped the basic experimental methods and agreed to conduct experimental research in accordance with the requirements (for example, how many repetitions they are willing to set), it is very important to provide them with the opportunity to practice. MAIPs should carry out some simple experiments that can obtain clear results, such as a variety comparison test or a test with different fertilizer dosages. The facilitator is mainly responsible for introducing the experiment design and steps of implementation. The farmer trainees should however be allowed to determine each step.

Facilitating learning-oriented experiments

There are many experiments in MAIPs for learning rather than research. The facilitator knows the experiment results. The main purpose of these experiments is to demonstrate the method and steps, or some actual situations. The test result is a

new content only for the trainees, which can increase their knowledge base. Learning-oriented experiments need to be well designed and prepared in advance. The purpose and procedures of the experiment must be made very clear to all the trainees, although they are expected to give various suggestions on the variables to be measured. The facilitator should always pay attention to whether the expected results are obtained. If not, he or she should find out the reason(s). The experiment results serve not as an innovation, but as an experience to help the trainees gain knowledge.

Facilitating innovative and adaptive research

The purpose of innovative experiments is to obtain new ideas, methods, or technologies to help solve existing problems. Adaptive experiment research is meant to test the results of innovative experiments under local conditions and adjust and adapt them accordingly. The above two types of experiments must be designed according to specific problems and local conditions. As innovative experiments and adaptive experiments can provide farmers with powerful tools to solve new problems they encounter and obtain decision-making information, they should be encouraged to design, implement, and analyze results of such experiments in MAIPs.

4.8 Facilitating farmers to understand market

Agriculture is the main source of livelihood for most farmers. If farmers can grow the products demanded by the market and supply the quality demanded by the latter at a specific time, then there tends to be a higher chance for the former to make profits. If farmers decide and grow their products without looking at market needs, then they can seldom expect to be able to sell their products on the market at a desired price. A common problem among the smallholder farmers in developing countries is that they tend to conduct farming without adequately understanding market information (Abraham & Pingali, 2020; Meemken & Bellemare, 2020).

Most farmers believe they are passive receivers of agricultural product prices and can do nothing about it. Especially under the production model dominated by numerous smallholder farmers, farmers often do not take the initiative to develop the market. They neither understand market needs and changes, nor do they know how to produce agricultural products that meet market needs while increasing profits. Therefore, there is an urgent need for smallholder farmers to receive training in agricultural product marketing.

MAIP training on agricultural product marketing can help farmers make scientific and reasonable decisions. A participatory training method is to be adopted to foster farmers' self-decision-making ability, instead of telling farmers how to do it. This is because of two reasons: first, only by improving their autonomous decision-making ability and quality standards can farmers produce competitive products in the fierce market competition. Second, extension personnel should not direct or directly tell farmers to plant certain crops. Because if such crops are produced, once the market changes and becomes unmarketable, the latter may demand the former to bear the economic loss.

As a participatory training platform, MAIPs have unique advantages in training farmers to gain knowledge of agricultural product marketing. In the MAIP training, farmers can discover market sales problems and find ways to solve them through participatory discussions. The core of MAIP training is to cultivate farmers' scientific marketing decision-making ability, rather than making marketing decisions on their behalf.

Training farmers to increase the profitability of their production

In agricultural production, the conventional extension of agricultural technologies mainly emphasizes the improvement of production capacity and crop yield, rather than increasing the profit of farmers. Farmers need to be trained to increase their production profits, especially for those engaged in cash crop production. To this end, the facilitator must first help farmers understand the factors that affect the profit from production to market sales. Table 13 lists the main factors that affect the profit of agricultural products.

TABLE 13. Main factors that affect the profit of agricultural products (quantity, price, sales volume and marketing cost)

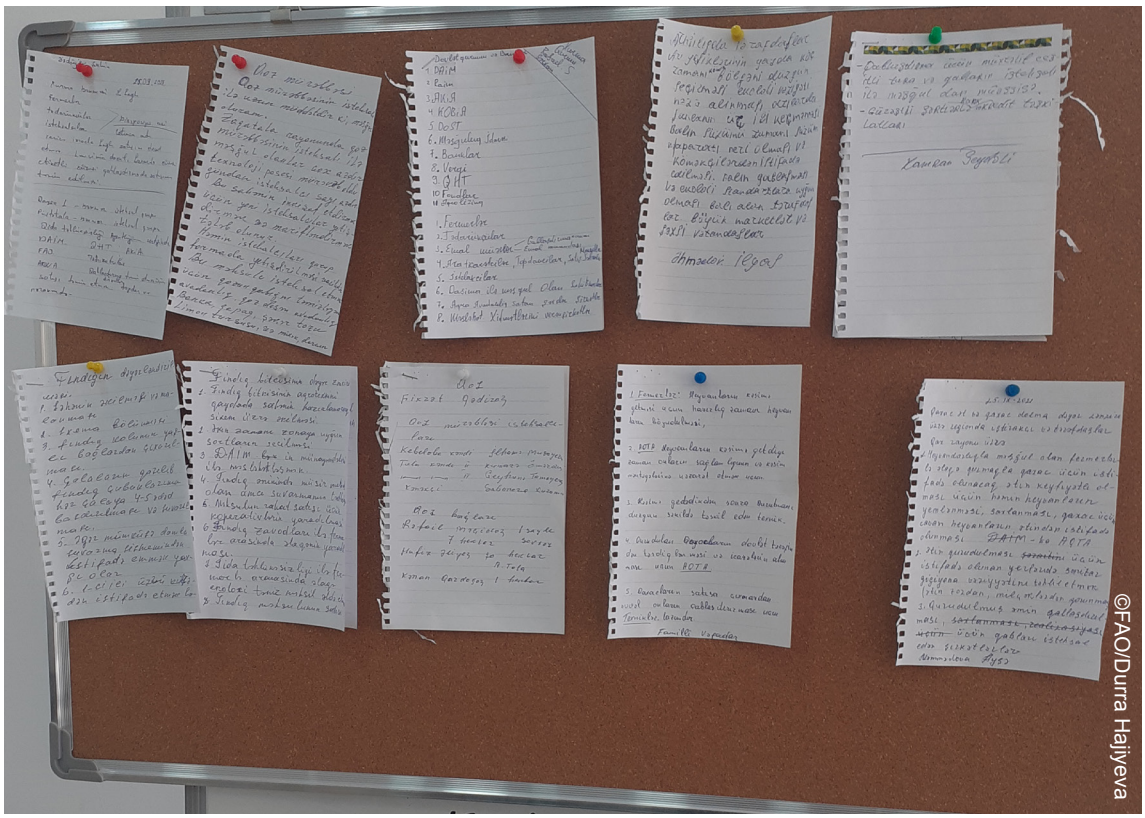
	Baseline level	Output (10% increase)	Half into the market	Price (10% reduction)	Price (10% increase)	All into the market	Marketing cost (10% reduction)
Yield	10 000	11 000	10 000	10 000	10 000	10 000	10 000
Sales volume (%)	80%	80%	50%	80%	80%	100%	80%
Sales volume (kg)	8 000	8 800	5 000	8 000	8 000	10 000	8 000
Unit price (yuan/kg)	5	5	5	4-5	5-5	5	5
Sales (yuan)	40 000	44 000	25 000	36 000	44 000	50 000	40 000
Production cost (yuan)	10 000	11 000	10 000	10 000	10 000	10 000	10 000
Marketing cost	16 000	17 600	10 000	16 000	16 000	16 000	14 400
Total cost	26 000	28 600	20 000	26 000	26 000	30 000	24 400
Profit	14 000	15 400	5 000	10 000	18 000	20 000	15 600
Compared to baseline		+10%	-64%	-29%	+29%	+43%	+11%

According to the above table, it can be seen that the facilitator must guide the farmers' market behaviour and decision-making in the following aspects:

- If the farmers' sales channels are not smooth, that is, the sales ratio is low, the profit of agricultural products will be significantly reduced. This result shows that if the market is saturated, overproduction of agricultural products is very dangerous. In MAIP training, the facilitator should help farmers understand the importance of marketable agricultural products and of making production decisions based on market demand.
- The increase in prices has a significant effect on the increase of agricultural products because their production and marketing costs are generally fixed. A small price increase can greatly increase the profit; and conversely, a small price decrease may lead to a large decrease in profit.
- Marketing costs (including advertising, transportation, packaging, etc.) may be higher than production costs in some cases, especially in the sale of gardening or vegetable crops. Reducing marketing costs can also greatly increase the profitability of agricultural products.

Training farmers to weigh profits and risks

High profits are always associated with high risks. Agricultural companies that gain high profits are often takers of high risks. For example, in the production of flowers and some special varieties of fruits, although the price and profit are high, the market demand is very limited. The price is prone to dropping significantly due to overproduction. Moreover, such high-profit crops have high requirements for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Brainstorming on marketing profits and risks of the selected local agricultural products in a training course of MAIP facilitators in Azerbaijan.

production technology, are more sensitive to pests and diseases, and have higher production risks. In contrast, some bulk agricultural products (such as grain crops like rice, corn, wheat, etc.) have relatively stable market prices due to their high demand. The advantage of producing these bulk agricultural products is that the market risk is relatively low, but the profit is also relatively low. Therefore, in MAIP training, the facilitator trains farmers to correctly weigh the profits and risks of planting various crops and make reasonable decisions based on their own economic conditions and ability to bear risks.

During the MAIP training process, the facilitator must help farmers weigh profits and risks from the following aspects:

- Who are the buyer's competition? First, look at how many buyers are competing to buy the products. If there is only one buyer, the price of agricultural products may be very low. If there are more buyers, the price and profit may be higher due to competition among several buyers.
- Foster farmers' habit of collecting market information. If they do not understand market conditions, it is difficult to bargain with buyers/sellers.
- What is the quality of agricultural products? Buyers tend to give higher market prices for high-quality agricultural products. Train farmers to pay attention not only to the quantity, but also to the quality of agricultural products.
- What is the transportation cost? Buyers often offer lower prices for agricultural products that have high transportation costs, especially those that are purchased in small quantities, far away from the market or from places with poor transportation conditions. Sellers bid lower prices when purchasing at the origin of agricultural products in order to maintain their sales profits.

Training farmers to understand price changes in the market chain

The price of agricultural products gradually rises along the industrial chain from the place of production to the market. Generally speaking, the selling price of agricultural products in the field is the lowest. For example, after a seller purchases certain fruits in the orchard, they need to be processed, packaged and transported to the market and reach consumers after wholesale and retail. It is not difficult to understand that the retail price is the highest. The price is also affected by the location of the link where farmers sold the products in the market chain. Although the highest price can be obtained by selling agricultural products in the last market link, exceptional costs must be paid, such as transportation, packaging and other marketing costs.

In MAIP training, the facilitator must train the farmers to understand the price changes in the market chain from the following three aspects:

- Identify new market demand, so as to plant new high-profit crops. In developing countries, the market demand for agricultural products always follows this law of change: Urban consumers have an increasing demand for processed food or semi-finished products. With the development of the catering industry, the demand for vegetables and fruits is increasing. The retail market for agricultural products is becoming more diversified, and at the same time, the market share of agricultural

products sold by supermarkets is increasing. Changes in market conditions have provided farmers with new opportunities.

- When sellers make profits, they also have costs and risks. In an active market, the role of sellers is very important. To a certain extent, they can reduce the market risk of agricultural products.
- Product loss: Economic loss often occurs in the chain of agricultural products from production to market, especially horticultural products such as vegetables and fruits. This can be the loss of weight. For example, when you purchase 100 kg of vegetables, when they are shipped to the market, they may only be 90 kg due to the evaporation of water. With time, the economic value also decreases. The prices of fresh vegetables or fruits tend to decrease as their freshness decreases.

Training farmers to understand short-term changes in agricultural product prices

The prices of agricultural products change with the changes in market demand, reflecting that the prices of the same products vary greatly at different times and seasons. Differences in the prices of agricultural products in different seasons, especially those of vegetables and horticultural products, have significantly affected farmers' income. Generally speaking, at the beginning of the harvest period of a certain agricultural product, its price is relatively high. As it is harvested in large quantities, its price is also greatly reduced. However, in the latter part of the harvest season, prices will rise as the market supply decreases. For vegetables and other agricultural products with strong seasonality, if produced and supplied off-season, both the market price and profit are the highest. In MAIP training, farmers should be taught to learn to analyze the seasonal changes in the price of agricultural products and determine the appropriate planting and harvesting time, so as to obtain good planting benefits.

The facilitator must help farmers understand the price changes of agricultural products in different seasons from the following three aspects:

- In a certain season, the supply of the agricultural product on the market, especially the sales volume in the first few days of the season will vary. If the sales volume is small whereas the supply volume is large, the market price will definitely go down. Consequently, selling should be avoided in this season. On the contrary, better income can be obtained.
- Focus on a specific short-term market demand change, such as the Spring Festival and National Day, etc. The price may be higher before these holidays.
- Know the selling time of similar products from other farmers and avoid selling the same products in large quantities at the same time. Use greenhouses and other technologies to advance or postpone the selling time for their products.

Training farmers to understand the long-term changes in agricultural product prices

If you pay attention to the annual price changes of agricultural products, it is not difficult to find that the average price of a certain agricultural product may be high

in a certain year, but drops a lot in the following year, and then rebounds in the next year. It is easy to understand this kind of inter-year price change trend because the rise in the price of a certain agricultural product will inevitably lead to other farmers' starting to plant this crop. The market supply will increase rapidly in the short term, and the market price will quickly drop in the following year. In MAIP training, it is very important for farmers to learn how to analyze the long-term changes in agricultural product prices, which helps them plan the structure of crop cultivation so as to obtain good and stable planting benefits. The facilitator must help farmers understand the long-term market price changes of agricultural products from the following aspects:

- Changes in the long-term market demand for agricultural products are mainly due to changes in people's tastes and attitudes and socio-economic structure. For example, some studies have shown that broccoli is rich in antioxidants, which can reduce the occurrence of cardiovascular diseases, and garlic has the same effect. Therefore, the long-term market demand for broccoli and garlic is likely to increase.
- The economic growth of a country or region can obviously bring about changes in the market demand for agricultural products. For example, as the economy grows, the market demand for grain crops will not change much, while the demand for fruits, vegetables and garden products will increase substantially.

Training farmers to understand marketing functions of value chains

Marketing agro-products is a complex system. Marketing links producers with consumers, which involves infrastructure, harvesting equipment, storage and processing facilities, transportation vehicles and wholesale and retail platforms. The provision of agro-products from farms to consumers refers to the marketing functions of value chains, which are normally composed of four categories of functions:

- The function of **harvesting**, which happens at farms and ranches. Harvesting methods vary among different products. Some products are harvested by hand, some by machines while others by specific tools.
- The function of **assembling**, which means delivering products to a center like packaging shelter, grain elevator, gin or processing site. Assembling is meant to get large quantities together to make marketing more efficient. With recent innovations of digital platforms, it is possible to assemble agro-products online.
- The function of **grading**, which means sorting products for uniformity. Grading can take place during or after assembling. Grading involves several factors, for example size, colour, variety or chemical residues and so on.
- The function of **transportation**, which means moving products from one place to another, and reaching consumers at last. Agricultural products are transported in various vehicles such as wagons, trucks, barges, railways and airplanes. Certain facilities must be available for cold-chain transportation of fresh products.

The facilitator must help farmers and other key actors in the MAIP understand

complete marketing functions of the selected value chain development, covering not only technical aspects, but also infrastructural and policy developments.

4.9 Facilitating participatory design of multi-actors agricultural innovation platforms

Objectives: (1) to familiarize the trainees with the design of MAIPs in the selected value chain development; (2) to enable trainees to appropriately design and plan innovative activities in MAIPs, so as to solve the constraints faced by value chain development in the community; and (3) to enable trainees to understand and use appropriate methods and steps to facilitate innovative activities in MAIPs.

Materials: paper, pens, whiteboard, etc.

Methods: rapid participatory appraisal, brainstorming, focus group discussions.

Steps:

(1) Facilitator introduces the main objectives, concept models, infrastructural settings and basic methods and tools for facilitating innovative activities in MAIPs, and asks the trainees to share their opinions, expectations and needs.

(2) Brainstorming: The trainees discuss in small groups and write down their needs on sticky notes. Each sticky note contains only one need. After this, collect all the notes and paste them on the wall. The notes should be roughly classified according to the types of needs on designing a MAIP in a selected value chain, such as knowledge, skills, solutions to a certain difficulty, assistance and services from government or extension agents, etc.

(3) Focus group discussion: The trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to articulate what they want to learn most in this training on the design of MAIPs. One facilitator or one trainee will record the conversation of the trainees on paper/whiteboard. The records should be roughly classified.

(4) Summary by the facilitator: Regardless of the sticky notes resulting from the brainstorming or the written records of focus group discussion method on the design of MAIPs, the facilitator should classify them and explain in an itemized way as much as possible, including which needs will be involved, which can be solved by themselves, and which are not covered in the training. This can increase the enthusiasm of the trainees for the training.

(5) Assign trainees to design the MAIPs in the selected value chains as homework or as the follow-up activities, they can work either in groups or individually to design the MAIPs.

Time limit: 180–240 minutes

Outline of a typical MAIP*:*

MAIPs may have different forms in accordance with local conditions and the selected value chain development. But the following elements must be taken into consideration when MAIPs are designed:

- Selection of MAIP site;

- Infrastructural settings of the MAIP;
- Selection of key actors of the MAIP;
- Needs assessment of the MAIP key actors;
- Identify innovation agendas, objectives and goals of the MAIP;
- Develop interaction mechanisms among key MAIP actors;
- Facilitation activities of interactions among key MAIP actors;
- Enabling environment for the MAIP; and
- Participatory budget management for supporting the MAIP.

4.10 Developing multi-actors agricultural innovation platforms monitoring and evaluation (M&E) scheme

Objectives: (1) to familiarize the trainees with the development of MAIP monitoring and evaluation (M&E) scheme; (2) to enable trainees to appropriately design and plan MAIP monitoring and evaluation (M&E) scheme, so as to ensure the quality and smooth implementation of MAIPs; and (3) to enable trainees to understand and use appropriate methods and steps to implement the M&E scheme.

Materials: paper, pens, whiteboard, etc.

Methods: focus group discussions.

MAIP facilitators observing and discussing about posters in a Science and Technology Backyard in China.

Steps:

(1) Facilitator introduces the main objectives, basic methods and tools for developing the MAIP M&E scheme, and asks them to share their opinions, expectations and needs.

(2) Focus group discussion: The trainees sit altogether in a circle instead of breaking into groups. Everyone uses a short sentence to articulate what they want to learn most in this training on the development of the MAIP M&E scheme. One facilitator or one trainee will record the conversation of the trainees on paper/whiteboard.

(3) Summary by the facilitator: The facilitator should classify the written records of focus group discussion method on the development of the MAIP M&E scheme and explain in an itemized way as much as possible, including which needs will be involved, which can be solved by themselves, and which are not covered in the training. This can increase the enthusiasm of the trainees for the training.

(4) Assign trainees to develop a MAIP M&E scheme as a homework or as a follow-up activity. They can work either in groups or individually to develop it.

Time limit: 180–240 minutes

Outline of a typical MAIP M&E scheme:

The following elements must be taken into consideration when a MAIP M&E scheme is to be developed:

- Internal M&E on the process of the MAIP by the facilitator;
- External expert evaluation of the MAIP;
- Impact assessment of the MAIP; and
- Key indicators used in the M&E scheme.

Annex: Generic structure of multi-actors agricultural innovation platforms' training of facilitators curriculum

A detailed multi-actors agricultural innovation platforms' training of facilitators (MAIP TOF) curriculum always needs to be designed based on the local context, training needs and participant profiles, a generic structure is recommended here, as given in Table 14 below. The generic structure contains (1) general sessions (opening and closing); (2) sessions dealing with topics related to MAIP objectives, processes and facilitation in three blocks; (3) sessions on topics related to the selected value chain(s); and (4) fieldwork after each training block.

TABLE 14. Generic structure of MAIP TOF curriculum

MAIP related topics	Value chain related topics	Fieldwork focus
Opening session: Opening, introductions of master trainers, participants, training objectives and outline		
BLOCK 1: MAIP CORE CONCEPTS		
• Multi-actor Innovation Platform – 1: principles, functions • Actors in the agricultural innovation system of selected value chains • Participatory situation analysis for MAIP agenda setting • Principles and practice of agricultural advisory and consulting services • Gender-sensitive programming and value chain development	• Opportunities to increase production • Small scale processing and storage techniques	*Fieldwork 1:* Participatory situation analysis • Methodology development • Situation analysis data collection • Socialisation of MAIP among potential members • Presentations of fieldwork experiences and findings
BLOCK 2: MAIP FACILITATION SKILLS AND ESTABLISHMENT		
• Multi-Actor Innovation Platform - 2: Establishment, facilitation • Adult education: principles of experiential learning • Facilitation of adult education: designing a learning experiment • Basic and advanced communication skills: • Participatory Learning & Action - 1: principles and practice	• Standards and marketing of agricultural products • Agri-business development	*Fieldwork 2:* Establish pilot MAIP_ • Workplan development to establish a pilot MAIP • MAIP establishment workshop(s) • Presentations of fieldwork experiences and findings
BLOCK 3: MAIP FACILITATION AND OUTREACH		
• Participatory learning and action - 2: facilitation, design of learning and adaptive experiments • Use of visual aids • Organization and management of consulting services • Monitoring and evaluation • Outreach and institutionalisation of MAIPs	• National and international food safety standards for production, product packaging, labelling, promotion, sales, and certification	*Fieldwork 3:* Pilot MAIP facilitation • Workplan development to strengthen and facilitate pilot MAIP • Workplan presentations and discussion • Pilot MAIP operations
Closing session: Wrap up, evaluation, closing		

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