



# MARA-CABI Joint Laboratory: 12 years of achievement

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## Summary

The Ministry of Agriculture and Rural Affairs (MARA) -CABI Joint Laboratory for Bio-safety (hereinafter “Joint Lab”) was launched in 2008. Since its establishment, the Joint Lab has successfully led and/or implemented 32 international cooperation projects on research and technology transfer in the broad plant protection area. More than 80 Chinese and overseas organizations have participated in these projects, with a total funding of approximately US\$ 33 million. After 12-years of operation, the Joint Lab is now widely regarded as one of the top platforms of its type within the Chinese agricultural research and development community.

An impact study was conducted, using qualitative approaches, to review stakeholders' needs and priorities on functions and key collaboration areas, to assess the output efficiency through an input-output analysis, and to evaluate social and ecological benefits of the Joint Lab. The study provides lessons and recommendations for further development of the Joint Lab, which will be beneficial for similar collaborations between CABI and other member countries as well.

## Key highlights

- With access to a global network of CABI's regional centres and member countries as well as Chinese institutions and experts, the Joint Lab is well positioned to carry out state-of-the art research projects and technology transfer projects to support north-south, south-south and triangular cooperation.
- The efficient operation of and pragmatic cooperation in the Joint Lab lie in the management and operation mechanisms, which include consultation, joint management, and full integration with CABI regional centre (i.e. East Asia) and the host institute in China (i.e. Institute of Plant Protection of the Chinese Academy of Agricultural Sciences, IPPCAAS).
- The four functions of the Joint Lab have covered all stakeholders' needs on international cooperation, and their importance ranking conforms to its original setting, namely a research and development (R&D) collaboration platform, training & exchange centre, third-party cooperation platform, and government policy consultancy.
- Among the five main collaboration fields of the Joint Lab, most project work is related to integrated pest management (IPM), invasive alien species (IAS), accounting for 60.4% of total funds of the projects, which is very much in line with CABI's expertise and strengths in biological control based IPM and IAS management.
- From a financial perspective, the Joint Lab provides good value for money (investment-benefit ratio @ 1: 4.1) for both CABI and China, demonstrating a successful and win-win partnership.
- Financial investment from China and non-cash investment (i.e. contributions-in-kind) from both CABI and Chinese counterparts are crucial for the operation of the Joint Lab both successfully and sustainably.
- The social and ecological benefits of the Joint Lab included not only the targeted outputs (e.g. chemical pesticide reduction and reduced farmers' crop losses contributing to ecological safety, food security and poverty alleviation) but also the untargeted impact of the cooperation (e.g. increase of partners' influence in related fields, expansion of partnerships, improvement of project partners' capacity, etc.).
- The overall satisfaction of the stakeholders with the Joint Lab is very high. All the respondents gave a high score of more than 8 out of 10, and 65% of the respondents gave full marks, saying that the cooperation was extremely successful and the outcomes reached or even exceeded their expectations.

## Context

Established in September 2008, the Joint Lab is operated under a Memorandum of Understanding between the Chinese MARA (former Ministry of Agriculture) and CABI, signed in 2007. On behalf of MARA, IPPCAAS takes responsibility for hosting and day-to-day administration of the Joint Lab.

Since it was established, the Joint Lab has taken advantage of the strength and expertise of both parties to develop and implement international cooperation projects, to establish talent training and technology transfer channels, and to strengthen triangular collaboration and South-South cooperation. The Joint Lab has successfully led and implemented 32 international cooperation programmes/projects on research and technology transfer in the broad plant protection area. More than 80 Chinese and overseas organizations have participated in these programmes/projects, with a total funding of approximately US\$33 million.

Under the framework of the Joint Lab cooperation, the MARA-CABI European Laboratory, hosted in the CABI Switzerland Centre, formally started operation in 2019; two in-country branches of the Joint Lab were established in Shandong and Anhui provinces; and through CABI's global network of research and member countries, China-Kenya & China-Pakistan joint labs for plant protection are under preparation. The Joint Lab has become an open international platform for agricultural scientific cooperation with its headquarters in Beijing and branches located in the key countries along the Belt and Road\*.

The Joint Lab is now widely regarded as one of the top platforms of its type within the Chinese agricultural research and development community. With the Joint Lab as one of the main platforms, the "International Joint Research Centre for Agricultural Biosafety" of IPPCAAS was selected as one of National Centres for International Research by the Ministry of Science and Technology (MOST) in 2012. Dr Ulrich Kuhlmann, Co-Director of the Joint Lab, won a Friendship Award from the central government of China in 2012.

## What we did

After 12-years operation, it was necessary to conduct an impact study to review the progress, analysis output efficiency, evaluate social and ecological benefits of the Joint Lab. The operational experience and lessons learnt would be helpful to draw up the next medium-term strategy of the Joint Lab and improve performance in the future. The lessons learnt will be of benefit for similar collaborations between CABI and other member countries as well.

This study aims to answer the following questions:

- Do the functions and key collaboration areas meet stakeholders' needs?
- What is the output efficiency of the Joint Lab (outputs, investments, and input-output ratio)?
- What kind of social benefits and ecological benefits are brought by the activities of the Joint Lab, and what is the sustainability of those benefits?
- Does the Joint Lab achieve the targets set in the Joint Lab Medium Term Strategy (2016-2020)? What lessons are there for further development of the Joint Lab?

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\* The Belt and Road Initiative, proposed by Chinese government in 2013, is an economic framework designed to promote win-win cooperation and connect economies in Asia, Europe, Africa and the rest of the world.

The assessment was undertaken from June to December 2020 using qualitative approaches whereby the data was collected from various sources using document review and analysis, key informant interviews (KII), and focus group discussions (FGD). Eleven KIIs were conducted with partner representatives from six different stakeholder groups, including Joint Lab Steering Committee members, university partners, scientists from research institutes, private sector partners, extension staff, and overseas research partners. Three FGDs were conducted with scientists in research and development projects, training participants and graduate students who studied in the Joint Lab for their thesis separately. Most of KIIs and FGDs were conducted remotely via video conference platforms due to COVID-19. The information and data gathered from different sources were extracted, summarized and synthesized to produce lesson learnt and recommendations.

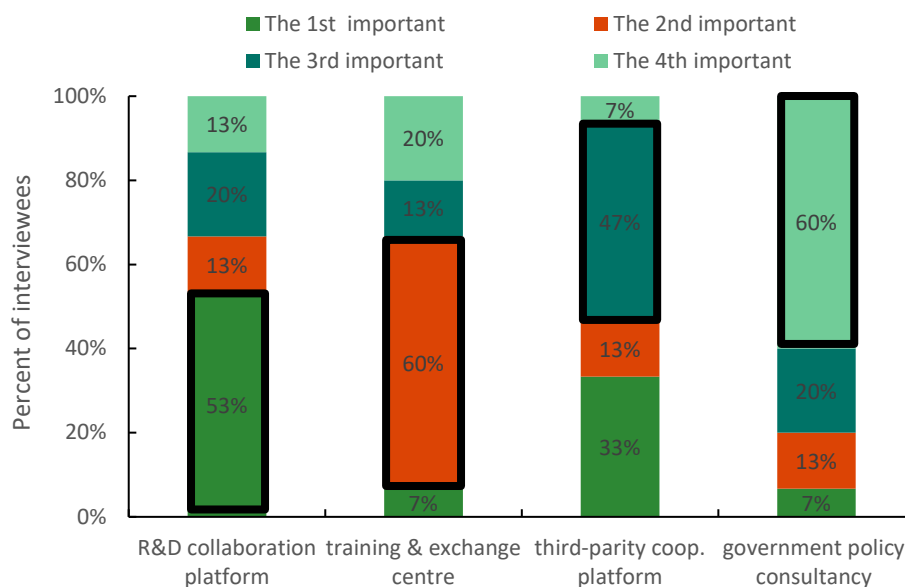
## What was achieved?

The Joint Lab serves as a platform for research collaboration; a centre for training and scientific exchange; an open platform for joint collaboration with third parties; and a consultancy service unit for MARA to provide required policy advice and appropriate recommendations to China on cooperation with other countries in plant protection. The main collaboration fields include IPM technologies, prevention and biocontrol of IAS, biological pesticide research and development, reducing pesticide residues, and environmental safety research of transgenic organisms. The five key areas are hereinafter referred to as IPM, IAS, biopesticides, pesticide reduction, and safety of genetically modified organisms (GMOs).

### Functions of the Joint Lab

Most of the interviewees confirmed that the four major functions of the Joint Lab address their international cooperation needs. However, different stakeholders have different mandates, so they prioritize the functions of the Joint Lab in various order. Figure 1 shows the varying function priority given by interviewees according to the value/importance of each function for them. In general, the interviewees' ranking of the four functions conforms to the original order described in the Establishment Agreement of the Joint Lab, i.e. in order of importance: R&D collaboration platform, training & exchange centre, third-party cooperation platform, and government policy consultancy. Most interviewees agreed with the original order (47-60%, as shown in the black box of each function in Fig 1).





**Figure 1. Feedback on priority ranking of the four functions of the Joint Lab**

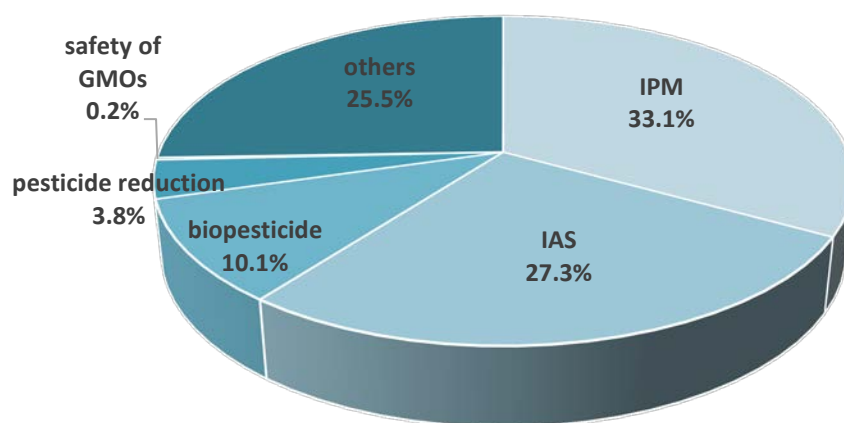
Further information on ranking of each function is as follows:

- **Function 1: R&D Collaboration Platform.** Most interviewees gave the highest priority to this function. However, private sectors and extension interviewees ranked this function in third or last place, as for private sector partners in small/medium-sized enterprises, technology R&D is not their main concern.
- **Function 2: Training and Exchange Centre.** University partners attached great importance to this function and rank this as the most important function. Moreover, all stakeholders placed a high expectation on the Joint Lab in sending Chinese young talents to study/work in CABI's other centres.
- **Function 3: Cooperation platform with third-parties.** Nearly half of the interviewees ranked this function as the third most important while one-third of the respondents stated that this is the most important and valuable function of the Joint Lab. These respondents were mainly from the private sector and extension agencies. Also, 80% of the interviewed scientists ranked this function in the top two places. The scientists hope to build collaboration with enterprises via the Joint Lab, so as to accelerate the transformation of research achievements.
- **Function 4: Providing consultancy for government policy-making.** Most of the interviewees ranked this function in third or last place. However, interviewees from the national/provincial extension agencies are still very interested in this function, and hope that the Joint Lab can strengthen the introduction of advanced agriculture development concepts and technologies, and provide references for China's policy-making.

## Key collaboration areas and preferred cooperation models

By the end of 2020, the Joint Lab had successfully led and implemented 32 international cooperation projects. Most work is related to IPM and IAS, accounting for 60.4% of total value of the projects. There are significant funds allocated for other project or management work (25.5%) such as Joint Lab seed funding, Newton network+ and EU-funded Proteinsect project, which cannot be easily included into

those clearly defined collaboration areas. Less funds were spent in the areas of biopesticides (10.1%) and pesticide reduction (3.8%), and safety of GMOs are the least, at 0.2% (Figure 2). The fund distribution is in line with CABI's core strengths in IPM and IAS, and feedback from the interviewees indicated that stakeholders' cooperation needs are mainly in the areas of IPM, IAS and biopesticides.



**Figure 2. Proportion of project funds in key collaboration areas of the Joint Lab (2008-2020)**

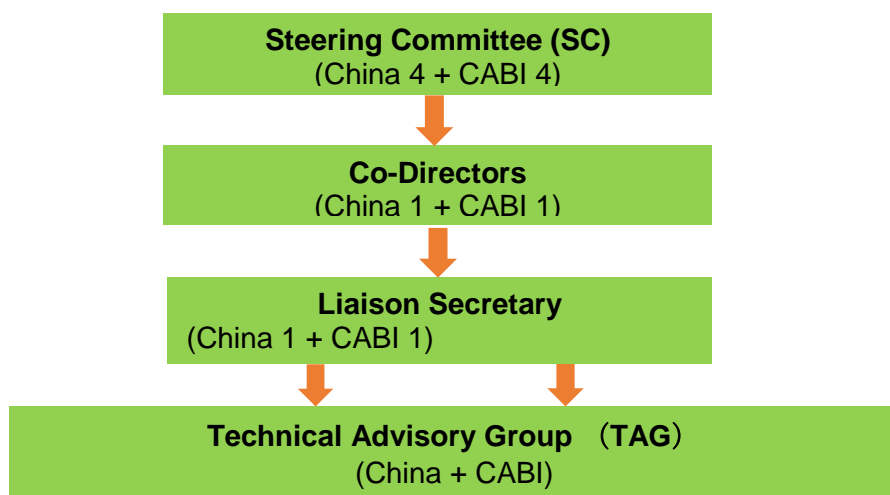
CAAS considers CABI one of China's closest partners as an international organization in the field of plant protection and agricultural development. The Biosecurity Law of the People's Republic of China, which is to be enforced in April 2021, is an opportunity for further development of the Joint Lab. It is recommended that the Joint Lab, work with the International Agricultural Science and Technology Innovation Program of CAAS, and participate in the "Transboundary Crop Pest Monitoring and Control Project", to optimize current resources and strengthen laboratory construction. The CABI members of the Joint Lab Steering Committee suggested that, based on consolidation of the current advantageous areas of cooperation, the Joint Lab should actively explore cooperation in other international hotspot topics, such as climate-smart agriculture, ecological safety, economic and environmental impacts assessment, etc.

During the interviews, the following cooperation models were regarded as the preferred models by many stakeholders for their collaboration with the Joint Lab:

- Use diversified Chinese and international funding sources to strengthen multi-cooperation through joint projects. More effort should be made to achieve the recognition and endorsement from MOST, the Ministry of Commerce, China International Development Cooperation Agency, National Natural Science Foundation of China and other major Chinese ministries and commissions.
- Cross the institutional boundaries in China to form larger research teams, which is conducive to making use of the resources and strengths of all parties.
- Short-term (3-6 month) talent exchanges with substantive work content, including providing more opportunities for Chinese young talents to work in overseas centres, and inviting foreign experts to work in China supported by Foreign Talent Programmes of the Chinese government.
- Establish long-term and effective partnerships through joint postgraduate programmes supported by collaborative projects.

## Management and operation mechanism

The Steering Committee (SC) acts as the governing body of the Joint Lab, comprising of eight members with four from China and four from CABI. The SC chairperson alternates yearly between China and CABI members. Two Co-Directors are responsible for overall management and two co-liaison secretaries are responsible for liaison and implementation of working plan. The technical issues of the Joint Lab have been monitored by a Technical Advisory Group (TAG) composed of scientists from both parties (Figure 3). The SC members meet once a year, and are responsible for reaching unanimous agreement in respect of plans for reviewing research activities and approving work plans as well as financial statements.



**Figure 3. The Joint Lab management structure**

Three scientists at CABI East Asia are permanently based in the Joint Lab, which enables SC's management decisions to be followed up and implemented very efficiently. The key elements of the efficient operation of and pragmatic cooperation in the Joint Lab lie in the management and operation mechanisms, which include consultation, joint management, and full integration with the CABI regional centre and IPPCAAS.



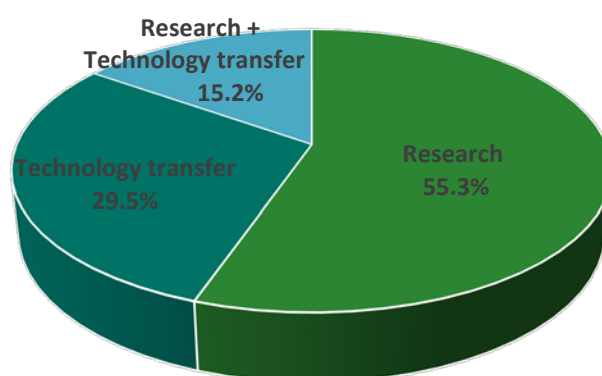
The 13th Joint Lab Steering Committee Virtual Meeting in 2021

## Economic efficiency of the Joint Lab

Evaluation of the economic efficiency of the Joint Lab provides useful information for decision makers from MARA and CABI to make the optimal utilization of the resources and facilities available, improve the Joint Lab performance and outcomes, and run the Joint Lab in a sustainable manner. However, to make the evaluation simple and meaningful in the context of financial returns to both sides, we only use the direct investment costs and project incomes to make the best-bet estimation of the economic efficiency from a financial perspective rather than a complicated study based on economic analysis model.

## Output

The 32 international projects implemented through the Joint Lab platform have a combined funding of US\$ 33.18 m (incl. China's donation to the CABI Development Fund, CDF). Within these projects, there are 21 research projects, which make up 55.3% of the income, followed by eight technology transfer projects (29.5%) and three projects with a combination of research and technology transfer (15.2%) (Figure 4).

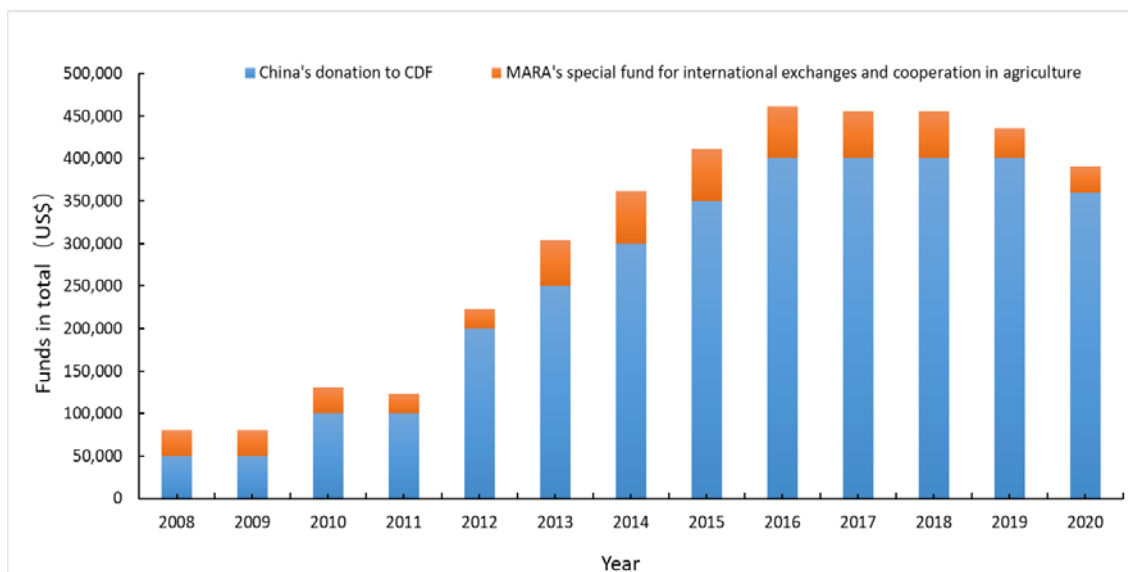


**Figure 4. Proportion of different project types implemented through the Joint Lab (2008-2020)**

## Investment

Between 2008 and 2020, China's donation to CDF to support the Joint Lab was US\$ 3.36 m, and IPPCAAS also received CNY 3.6135 m (US\$ 552.1k) to support the operation of the Joint Lab under the MARA's special fund for international exchanges and cooperation in agriculture (Figure 5). The in-kind contribution (staff time, travel and training) from both sides for the Joint Lab is around US\$ 3.43 m. Thus, the total direct financial investment and in-kind contribution is US\$ 7.23 m.





**Figure 5. Financial contributions of China’s donation to CDF and MARA’s special fund for international exchanges and cooperation in agriculture for IPPCAAS to support the Joint Lab between 2008 and 2020.**

### Input-output analysis

Based on the investment and project revenue data as described above, we can conclude that investment of US\$ 1 to the Joint Lab results US\$ 4.1 in return.

### Social and ecological benefits of the Joint Lab

The social and ecological benefits of the Joint Lab are achieved through project implementation. Generally speaking, the benefits can be divided into two categories: 1) benefits brought by the achievement of project targeted outputs; 2) benefits brought by non-targeted change.

### Social & ecological benefits brought by the targeted outputs of projects

All activities in the Joint Lab have contributed social and ecological benefits directly or indirectly via the achievement of project target outputs. Research activities have improved understanding and knowledge of biology and ecology of target pests, which laid a solid theoretical foundation for the development of relevant biocontrol products and bio-pesticides. Training sessions for agricultural technicians and farmers have improved the quality of agricultural advisory services, and enhanced farmers’ awareness of IPM-compatible technology and products. Technical demonstrations and extension have reduced the use of chemical pesticides, making a contribution to ecological safety. Moreover, the technology transfer projects transferred IPM-compatible technologies from China to other developing countries in Africa and Southeast Asia, which has brought good social and ecological benefits to the recipient countries, and contributes to implementation of China’s strategy of “Agriculture Going Global”.

In view of the complexity of assessing social and ecological benefits, most projects have not conducted a systematic assessment, but the quantitative outputs of many projects can indirectly reflect their social and ecological benefits (see Box 1 for examples).

#### Box1. Example of project outputs reflecting social & ecological benefits of the Joint Lab

- ✓ The research results of the BioSpace project have been promoted and applied in Henan, Anhui and Hainan provinces. By using space-enabled remote sensing to guide the precise prevention and control of crop pests and diseases, the amount of local chemical pesticides was reduced by 20-30%.
- ✓ Plantwise has trained 810 plant doctors in Beijing, Sichuan, Guangxi and Henan provinces, established 231 plant clinics, and provided personalized plant protection advisory services to more than 240,000 farmers for free. The *People's Daily*, *Farmers' Daily*, *CCTV-7* and other media have shared over 30 comprehensive articles on plant clinics, and highly praised the positive role of plant clinics in pesticide reduction and ensuring the quality and safety of agricultural products.
- ✓ Joint research has been done on the standardization and field application technology of *Trichogramma*, a natural enemy of rice and corn pests. More than 41,200 technicians and farmers in Guangxi and Yunnan Provinces were trained, and the projects covered a total of 102,047 hectare (ha.) of maize and rice field.
- ✓ Projects introduced mature production technologies of 3 natural enemies of insect pests in maize, cruciferous vegetables and potatoes to North Korea and Rwanda. The projects established 43 local factories of natural enemies or bio-pesticides, trained 1,218 plant protection technicians and more than 31,400 farmers, and created demonstration fields covering 1,167 ha, and total application areas of 44,000 ha. The projects achieved an increase in grain production by 5-10% in North Korea, reducing the yield loss of vegetables and tuber crops by 20-30% in Rwanda.
- ✓ Efforts were made to transfer biological control technologies on rice and maize pest management to Laos and Myanmar. 14 natural enemy rearing factories were established, 90,000 copies of 50 technical training materials in local languages were produced and distributed, and more than 29,390 technicians and farmers were trained. The cumulative application area was 27,000 ha, and the projects increased the local production of rice by 2-10% and reduced the frequency of chemical pesticide spraying by 30-50%. The official media of Laos and Myanmar, *Vientiane Times* and *The Global New Light of Myanmar*, covered the local application and demonstrations of the project technology 6 times.



Plantwise plant doctor gives IPM-compatible recommendations in one plant clinic in Beijing in 2019

### Social & ecological benefits brought by non-targeted changes

In addition to the target outputs, such as papers, patents, technical trainings, and services to farmers, the cooperation with the Joint Lab has also produced many unexpected/non-targeted positive effects for partners, which are also social benefits achieved by the Joint Lab. These benefits include:

- **Enhanced the influence of partners in related domestic and international fields.** For example, “Plant Clinic” has become a symbol of Beijing Plant Protection Station in the agricultural extension system of China; several Chinese experts were appointed by international academic associations through the Joint Lab platform; CABI was recognized by New Zealand Institute for Plant and Food Research Limited as the preferred partner in biological control of invasive pest.
- **Expanded international and domestic partnerships.** For example, as partners of the EuropeAid funded Greater Mekong Subregion (GMS) Maize and Rice IPM projects, Shandong Academy of Agricultural Sciences and IPPCAAS continued to work together with partners in Laos and Myanmar beyond the projects. A series of bilateral scientific exchanges and capacity building projects have been implemented as a result.
- **Improved the comprehensive capabilities of partners in international project management.** Feedback from many project teams indicated that the Joint Lab has brought invaluable enhancement to their international project development and management capabilities, which is one of the most valuable contributions of the Joint Lab platform to the capacity building for Chinese partners.
- **Promoted the implementation of local Green Pest Control policy.** For example, a natural enemy production company in Hebei Province participated in the EuropeAid GMS Maize and Rice IPM projects, which has increased the local government’s awareness and emphasis on biological control, leading to more government support for promotion and application of natural enemy products and promotion of the implementation of Green Pest Control policies.



Soil insect pest control training, conducted by Joint Lab scientists in Rwanda in 2015

## Targets achieved and cooperation satisfaction

### Achievement of targets set in the Joint Lab medium-term strategy (2016-2020)

Aligned with China's 13th Five Year Plan, the Joint Lab developed a medium-term strategy 2016-2020, approved at the 9th Joint Lab SC meeting in early 2017. To date, the Joint Lab has achieved the targets set in the medium-term strategy, with nearly 100% completion of the critical milestones.

- **Publications:** 91 in total, within which 31 papers with IF>2.
- **Training of postgraduate students:** 15 PhD and MSc graduates and 20+ postgraduate students were trained through the Joint Lab platform and relevant projects.
- **Plantwise implementation in China:** 180+ plant clinics are in operation in China, serving over 240,000 farmers cumulatively. The Beijing Pesticide Reduction Management System, based on plant clinics, has been running since 2017 with an annual budget of CNY 100 million (US\$ 14.7 million) of subsidies currently available to support the implementation of the Green Pest Control Subsidy Policy. "Plant Clinics Promoting Green Pest Control Technology" was awarded the first prize of the Beijing Municipal Agri-Tech Extension Award in March 2020.
- **Partnerships:** The Joint Lab has been steadily expanding its national/global network, e.g. establishing the European Lab in Switzerland, two associate labs in Shandong and Anhui provinces, exploring links with the Malaysian Agricultural Research and Development Institute (MARDI) -CABI Joint Lab in Malaysia and further opportunities in Kenya and Pakistan, and working with over 80 national and international partners.
- **Project implementation and development:** Over 20 international collaborative projects have been implemented and/or ongoing through the Joint Lab platform, and 35 new proposals developed for funding, within which 20 have been approved. The successful rate of submitted proposals is 66.7%.

### Partners' satisfaction of cooperation

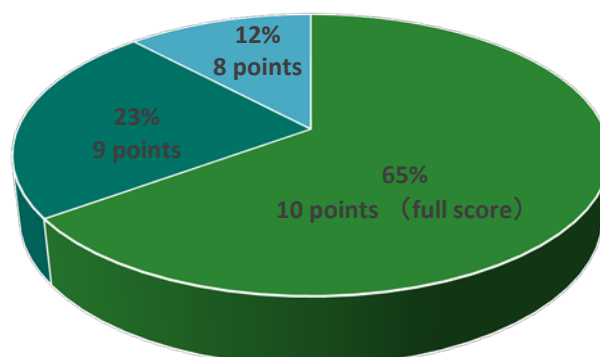
Partners scored their overall satisfaction with the Joint Lab based on whether the cooperation has achieved their expected targets, and also to take into account the communication within and efficiency of the cooperation. The score is from 1-10 points, and the higher the score, the more the satisfaction. The scores of the 17 responses received were all between 8-10 points, reflecting the high overall satisfaction of the partners with the Joint Lab (Figure 6). Among them, 11 partners gave a full score of 10. They believed that the cooperation was extremely successful, and the project had progressed step by step according to the plan, and also the project output/outcome reached or exceeded their expectations. The interviewees who did not give full marks were mainly concerned about the continuity of cooperation, local flexibility during implementation of the development projects, and more targeted and personalized guidance of trainings.

The following recommendations were proposed by stakeholders to address these concerns:

- Establish a long-term exchange/communication mechanism for partners, such as holding an online academic exchange seminar every year, so that partners can maintain exchanges after the project ends and thus find opportunities for further cooperation;
- For development projects, take full account of the status quo of agricultural development, cultural and social characteristics of recipient countries. There should be more flexible in the project plan and implementation;



- Improve the existing training courses with practical tutor sessions to enhance the practicality of the high-quality courses from the Joint Lab.



**Figure 6. Partners' satisfaction scores on collaboration with the Joint Lab**

## The way forward

The vision of the Joint Lab is to become a world recognized Centre of Excellence for collaborative research and technology transfer in green plant protection technology development, particularly prevention and control of transboundary crop pests and diseases through environmentally friendly biological control and IPM approaches. This study indicated that the key functions and key collaborations areas of the Joint Lab generally meet stakeholders' needs and priorities. The Joint Lab is delivering social and ecological benefits to stakeholders against its plans with a positive input-output ratio and significant research outputs. The Joint Lab has also successfully developed and implemented projects particularly carrying out research in IPM and IAS, supporting south-south cooperation and technology transfer.

Going forward, we intend to continue to grow and expand the Joint Lab network domestically and globally to support China's 14th Five Year Plan, the Belt and Road Initiative as well as CABI's Medium Term Strategy (2020-2022) and beyond. This will be achieved through continued investment and concerted strategic development of the Joint Lab in Beijing and the European Lab in Switzerland, strengthened partnerships with other partners in China (e.g. Chinese Academy of Sciences, Chinese Academy of Tropical Agricultural Sciences, provincial academies of agriculture in Shandong, Anhui and Guangdong province, agricultural universities and plant protection stations at different levels, etc.) and other countries, exploring the collaboration with the MARDI–CABI Joint Lab in Malaysia as well as potential opportunities to set up similar platforms in Pakistan and Kenya.



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