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China–Laos Cooperation in Agricultural Science and Technology under the Belt and Road Initiative

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Abstract: With the continuous advancement of the Belt and Road Initiative, China–Laos cooperation in agricultural science and technology has been deepening. Based on the survey on the "China (Guangxi)–Laos Improved Crop Variety Test Station" project, this paper reviews the development and effects of the cooperation, and summarizes the experience and problems. Thus, the paper proposes some suggestions as developing an enterprise operation mode, pinpointing project objectives, and upgrading the project level. With the consideration of both social and economic benefits, cooperative projects could be evolved to national agricultural cooperative demonstration bases that aim to demonstrate high-level technology trials, hoping to provide some effective advice for the agricultural cooperation among Southeast Asian countries under the Belt and Road Initiative.
Keywords: the Belt and Road; agricultural science and technology cooperation; Laos

1 Introduction

Based on their adjacent geographical locations and the differences in economic development between Southeast Asia and China, combined with the unique advantages of the channel, the countries located in Southeast Asia are regarded as significant fulcrums of the Silk Road Economic Belt and the 21st Century Maritime Silk Road initiative [1]. With the continuous improvement in the top-level design of the Belt and Road, the models of cooperation between China and South Asian countries have developed from economic to cultural, from one country to many, from single output to multiple cooperation [2]. Extensive cooperation has been initiated in various industries in the fields of politics, economics, and culture [1]. As the proportion of agriculture in the economic systems of the Belt and Road countries is higher than the global average, agricultural cooperation is still the top priority of current Belt and Road international cooperation [3]. In particular, in Southeast Asian countries, such as Laos and Myanmar, where agriculture is the pillar industry, improving their level of agricultural science and technology is urgently needed for future development. For the promotion of advanced agricultural science and technology, the Belt and Road initiative can provide new opportunities.

Laos is an inland country located in the Indochina Peninsula, whose northern border is adjacent to the Yunnan province of China. It covers an area of 236 800 square kilometers and a population of 6.77 million. Due to beneficial rain and heat conditions and rich biological resources, agriculture has become its main source of

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national economic development, accounting for more than 20% of its GDP. However, its inland location also creates a shortage of human resources and insufficient educational development. Thus, the foundation of its economic development is weak and the level of its agricultural technology is low. There is, therefore, a demand, for economic and social development supported by the Belt and Road initiative [4,5].

The agricultural science and technology cooperation between China and Laos has developed over many years and has reached a new stage with the continual strengthening of regional cooperation, construction, and sharing in the Belt and Road initiative. Today, it is necessary to review the existing cooperative process and catalog the cooperative experience to form a targeted phased goal and clarify the direction of future cooperation and development. Thus, this study focuses on the "China (Guangxi)–Laos Improved Crop Variety Test Station" project jointly developed by the Guangxi Agricultural Vocational and Technical College, which has been engaged for a long time in the China–Laos agricultural science and technology cooperation, with the Lao National Agricultural and Forestry Research Institute, to provide a clear case for agricultural science and technology cooperation between China and Southeast Asian countries. Based on the project, we evaluate the effects of China–Laos agricultural science and technology cooperation, summarize the basic experience of cooperation and existing problems, and propose feasible strategies for "going global" with China's agricultural science and technology, extending the Belt and Road cooperation between the countries. Optimizing the objectives and strategies of agricultural science and technology cooperation between China and Southeast Asian countries can be beneficial as the Belt and Road initiative can be utilized as the basis for international agricultural science and technology cooperation.

2 Overview of the China–Laos agricultural science and technology cooperative project

When the General Secretary of the CPC Central Committee and State President of the People's Republic of China, Xi Jinping, met with Jumari, the General Secretary of the Lao People's Revolutionary Party's Central Committee and State President of Laos on September 26, 2013, he said that the two countries should expand cooperation in emerging fields such as green agriculture. At the same time, to further implement the construction of high-quality and high-yield crop demonstration fields and the construction of 20 experimental varieties of excellent crop varieties with ASEAN countries, as proposed by Premier Wen Jiabao at the 13th China–ASEAN Leaders Meeting in 2010, the Ministry of Agriculture of China and the Laos Ministry of Agriculture and Forestry agreed that the Guangxi Agricultural Vocational and Technical College, headed by the Guangxi Agriculture Department, should set up the Laos Huaya Jinqiao Agricultural Technology Co., Ltd. in Laos. The China (Guangxi)–Laos Cooperative Crop Variety Test Station was jointly established in the capital Vientiane based on the cooperation between China and the Laos Champasak Agriculture and Forestry Department in Paksong City.

In December 2013, with the support of the Guangxi autonomous regional government, the China (Guangxi)–Laos Improved Crop Variety Test Station was officially established and put into operation. The Lao government provided 100 hectares of land, which included the headquarters of the China (Guangxi)–Laos Improved Crop Variety Test Station and the China (Guangxi)–Laos Cooperative Crop Variety Test Station on 40 hectares in Vientiane and the Paksong substation, which was established on 60 hectares in Paksong City, Champasak Province. The total investment in the project was 12 million yuan with a designated cooperation period between the two parties of 25 years.

The China (Guangxi)–Laos Improved Crop Variety Test Station is the first experimental station for excellent crop varieties established by China in ASEAN countries. It is expected to be completed in five years as a crop test and demonstration base that combines new varieties of crop tests, demonstrations, new technology promotion, agricultural training, and sightseeing. With the construction of the test station, a batch of excellent varieties of rice, corn, and other crops with high yield, high quality, drought and pest resistance, and other traits will be demonstrated, registered, validated, and promoted in Laos. Simultaneously, new technologies that demonstrate organic vegetable cultivation will be promoted. This effort will drive China's agricultural seeds, cultivation techniques, and related agricultural equipment into Laos, contributing to the improvement in Laos' local agricultural productivity and to the good will between China and Laos as well as the development of the world's agriculture.

The construction of the test station has received considerable attention and strong support from leaders at all levels in both China and Laos. The leaders of the Chinese and Lao governments have affirmed and praised the work of the test station. In addition, the results of the construction of the test station have been reported by the Xinhua News Agency, China Radio International, CCTV, Guangxi TV, Lao TV, and other media, which has

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enhanced the influence of the experimental station in the agricultural cooperation between China and Laos. Thanks to the strong support of the relevant departments, after years of hard work, the project implementation has progressed smoothly and achieved remarkable results.

3 Effects of the China–Laos agricultural science and technology cooperative project

3.1 Screening of excellent crop varieties suitable for Laos cultivation

Laos is located in a tropical monsoon climate zone where the temperature is hot and humid throughout the year. It has a large number of plains and basins and is easy to cultivate. However, due to the lack of a scientific and rational farming system arrangement and attention to germplasm resources, food crop production efficiency in Laos is low, and economic crop varieties are complex and lack the selection of good varieties [6]. To improve the agricultural productivity of Laos by optimizing germplasm resources, since 2013, the test station has been testing 165 crop varieties. Based on careful comparison and experimental analysis, 48 varieties have been found that are regarded as suitable for Laotian planting and promotion, including 11 fruit trees, 31 melons, 2 rice varieties, 2 corn varieties, 1 peanut, and 1 pasture.

3.2 Expansion in demonstration and promotion of crop area and significant output increase

To solve the problems of an extensive agricultural farming mode and low efficiency of agricultural technology transformation in Laos, and to make up for the lack of professionals in local agricultural science and technology [6], the test station introduced the excellent varieties and planting techniques to the surrounding areas and farmers; the cumulative application area was 1763 hm^2. The hybrid corn variety LC188 was particularly promoted and planted in many provinces and cities such as Vientiane, Champasak, and Sayaboury. The area of promotion in the Sayaboury Province alone reached 533 hm^2, with an average yield of 6.26 t/ hm^2. Compared with the average local production in Laos of 5.29 t/ hm^2, the increase in production was 18.33%. The positive effect of this has been obvious.

3.3 Facility agricultural technology is exported and applied well

Facility agriculture technology is a practical and applicable high-yield and high-efficiency agricultural technology in China. The project has built 73 steel frame greenhouses at the Vientiane Experimental Station, as well as 112 greenhouses and a tri-fold steel frame greenhouse at the Paksong substation. Cantaloupes, grapes, and vegetables are planted through non-polluted organic production technology utilizing these greenhouses. The demonstration and promotion of plastic greenhouse cultivation and organic substrate cultivation techniques has solved the difficulty of growing vegetables in the rainy season in the past six months and the high cost of buying vegetables, which benefits the welfare of the Lao people. In addition, with standardized research on the cultivation of cantaloupes, pitaya, corn, and tomato, based on their relative technical tests, standardized planting technical regulations for four crop varieties, rice, corn, cantaloupes, and tomato, were developed. This has contributed to improving the level of agricultural production in Laos.

3.4 Agricultural technician training and cooperation between China and Laos achieved remarkable results

Based on the platform of the test station, the Chinese technical staff has organized 19 training courses for Laos and trained 822 agricultural technicians. The themes of the courses included crop seed production and management, modern agricultural technology and food safety, Lao vegetable cultivation and management, cantaloupe planting technology, pitaya standardized planting, corn and peanut water–fertilizer integration technology, and hybrid pennisetum seed production, among others. Meanwhile, four tours and 76 people were invited to come to China to obtain relative training and enhance their further understanding of Chinese agriculture. The test station also accepted 230 graduates from Laos universities as interns and provided technical guidance; recommended seven Lao agricultural technicians to study at Guangxi University; and, invited members of Laos' central and local agricultural departments, the Lao National Agricultural and Forestry Research Institute, the Lao National University Agricultural College, the Laos Champasak Agriculture and Forestry College, and agriculture-related enterprises to visit China to explore effective agricultural cooperation. A number of large-scale exchange activities were also held, such as the Vientiane Cantaloupe Festival, the 40th Anniversary Celebration of Laos, and the China–Laos Cooperative Crop Variety Test Station Technical Achievement Exhibition, which effectively promoted the cooperation and exchange between China and Laos.

3.5 An important platform for China to demonstrate overseas poverty reduction

To promote external poverty reduction cooperation, the China International Poverty Alleviation Center and the Guangxi Foreign Investment Poverty Project Management Center entrusted Guangxi Huaya Jinqiao Agricultural Science and Technology Development Co., Ltd. to develop a poverty alleviation demonstration project for the China–Laos cooperative community relying on the China–Laos Improved Variety Test Station. The project's aim was the research and demonstration of agricultural industrial poverty alleviation in Laos. As such, an agricultural industrial poverty reduction demonstration project was constructed in Jinhua Village, Seyani County, Vientiane, and a trial for training and seminar activities on agricultural technology and poverty alleviation were developed. These activities serve as a platform for the agricultural science and technology demonstration base.

3.6 An important platform to promote agricultural cooperation and domestic agricultural science and technology globally

The China (Guangxi)–Laos Cooperative Agricultural Science and Technology Demonstration Base together with related organizations in China, such as the Guangxi Academy of Agricultural Sciences, have developed extensive experiments in agricultural science and technology in Laos. Scientific experiments on corn and peanut water–fertilizer integration have been carried out at the station. To globalize China's agricultural standards, the Guangxi Standard Technology Research Institute was introduced in Laos to promote an applicability study of Chinese standards in Laos and agricultural standardization planting. Guangxi Beihai Jinpin ASEAN Baihua Technology Co., Ltd. was introduced to work on the breeding of forage seeds. Guangxi Agricultural Machinery Research Institute was introduced to promote installation and technical demonstration of facilities such as steel frame greenhouses. Kunming Yunhai Environmental Engineering Co., Ltd. was introduced to guide the planting and variety testing of flowers. It also hosted more than 40 agriculture-related enterprises and institutions, such as Beidahuang Group, Guangxi Academy of Sciences, Baise National Agricultural Science and Technology Park, Guangxi Fuward Agricultural Technology Co., Ltd., Guangxi Zhaohe Seed Industry Co., Ltd., that visited Laos. Thus, the station provides an important platform for the globalization of China's agricultural technology, varieties, and facilities, and also national cooperation among ASEAN countries.

4 Experience of the China–Laos agricultural science and technology cooperative project

The "China (Guangxi)–Laos Improved Crop Variety Test Station" project achieved fruitful results. This is mainly thanks to a sound working mechanism, a strong technical team, and a scientific management system. The specific work process reflects the following main aspects.

4.1 A sound working mechanism

Both technical output and technical input must be coordinated for the project to be successfully implemented and benefit both countries. Thus, a strong working mechanism is required to promote the implementation of the project. In May 2013, before the start of the project, the Chinese Working Group of the China–Old Crops Improved Crop Variety Test Station and the Lao Working Group were established. The Chinese working group included the lead group, the chief expert group, and the Lao working group. The leader of the project team was the person in charge of the project implementation on the Chinese side. The deputy team leader was the specific responsible implementer and another leader of the unit. The members included relevant departments and project participants. The project expert group hired relevant academicians and professors to guide the technical problems encountered in project implementation. The Lao government established the Lao Work Steering Group, headed by the Dean of the Lao National Agricultural and Forestry Research Institute, and included four appointed staff members as liaison officers to maintain communication and contact with the Chinese group at any time. A deputy stationmaster was assigned to the test station to coordinate the implementation of the project with the Chinese personnel.

4.2 A strong technical team

According to the project operational needs, the project implementation group hired the particular experts and set up the chief expert group, including: Rong Tingzhao, the corn chief expert and member of the Chinese Academy of Engineering; Cao Liyong, the rice chief expert from the China Rice Research Institute; Li Wenjia, the chief expert

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of melons from the Guangxi Academy of Agricultural Sciences; Xie Taili, the chief expert of grapes and researcher from the Grape and Wine Research Institute of Guangxi Academy of Agricultural Sciences; and Bai Shuzhen, the chief expert of pasture and researcher from the Jiangsu Academy of Agricultural Sciences. Meanwhile, the university and other scientific research departments also hired many scientific and technical personnel with strong capabilities in areas such as rice, corn, cantaloupes, vegetables, fruit trees, and flowers, to provide necessary scientific and technological support for project implementation.

4.3 A scientific management system

To ensure the efficiency and effectiveness of the project, according to the relevant national regulations and in combination with the needs and characteristics of the project site, the project implementation group formulated a series of management systems such as *Measures for Personnel Subsidy for Projects (Trial)* and *Measures for Management of Business Trip of Station Staff in Laos (Trial)*" to ensure that project implementation had effective guidelines. In terms of specific operations, the members of the working group in Laos adhered to a weekly meeting system during which they explored and solved issues around the technology of variety trials, variety screening, variety breeding, water and fertilizer management, pest and disease prevention and control, test station development planning, and work coordination between the two countries.

4.4 A strong coordination mode

A two-tier system was established using the capital city of Vientiane as the headquarters and Paksong, in the strong agricultural province of Champasak, as the substation. The test station headquarters in the capital city of Vientiane were established to facilitate communication with the Lao Ministry of Agriculture and Forestry and other departments and to disseminate information and influence the whole country. The establishment of a test substation in the strong agricultural province and the main producing areas of Paksong City was conducive to expanding the project's influence and filing a technical demonstration role. The coordination between the terminus and the substation was clear, which played an important part in magnifying the influence of the new agricultural technology. Meanwhile, a clear division in the coordination mechanism was established as well as part of the main operations. Guangxi Agricultural Vocational and Technical College, as the main implementing body, provided strong talent and technical support. Its subsidiary company, Guangxi Huaya Jinqiao Agricultural Science and Technology Development Co., Ltd., implemented the project construction in the form of an enterprise. This "college + company" operational mode achieved complementary advantages and win-win cooperation.

5 Problems and countermeasures

5.1 Existing problems

The economic benefits of the Lao project still need to be improved. Although the implementation of the project has achieved many social benefits, due to infrastructure construction in the early stage of the project, the current economic income comes mainly from crop harvesting in the project trial, demonstration, and production, while there is still a lag period for the fruit tree planting in the park, which takes a longer time to reap economic benefits. Thus, from a current status perspective, the economic income generated by the project does not meet the basic operational needs of the test station.

A modern enterprise operational mode has not been established. Due to the influence of national policies and regulations, the Laos project is operated almost as an administrative agency or institution. At present, the test stations operate mainly in accordance with the administrative management mode of the college, thereby, failing to operate in accordance with modern enterprise methods. As a result, there are problems such as heavy social benefits but light economic ones. Therefore, once there is no more project funding support, the sustainable development of the project will be at risk.

5.2 Countermeasures

It is essential to establish an enterprise operational mechanism. As this foreign aid agricultural project is a long-term and costly investment, a sustainable cooperative mechanism that enables the project to survive and develop is critical. That is, there is a need to create adaptability in the market and an enterprise-oriented operational mechanism. At the end of the project, as the relative departments will no longer arrange project funding support, Laos Huaya Jinqiao Agricultural Science and Technology Co., Ltd. should receive help in

establishing a modern enterprise system to operate in a market-oriented mode. This approach will effectively reduce the disadvantages of operating according to administrative departments and institutions, consider the social and economic benefits of the market, and allow more flexibility to achieve the sustainable development of the project.

Thus, the target requirements for project implementation need to be clarified. As Laos' agricultural science and technology level is relatively backward and a potential technological difference is inevitable during the introduction of any varieties and agricultural technology, to form better social and economic benefits and build a regional linkage and common development pattern, the project should follow the concept of "upper scale, upper grade, high input, high level, high efficiency, distinctive features." This is in line with China's globalization and can help China's agricultural science and technology support the vision of the Belt and Road.

Thus, it is crucial to upgrade the project level. In November 2016, Guangxi Agricultural Department and the Laos Ministry of Agriculture and Forestry held a discussion and idea exchange to advance the China (Guangxi)–Laos Improved Crop Variety Test Station and upgrade it to a national level while promoting the it as a demonstration base for agricultural cooperation between China and Laos. The Department of Agriculture and the Department of Commerce of the Autonomous Region have applied jointly for the establishment of the "China–Laos Modern Agriculture Demonstration Park" based on the China (Guangxi)–Laos Improved Crop Variety Test Station. The station project will be upgraded to a national level assistance project to play a greater role in international cooperation in agricultural science and technology under the Belt and Road initiative and make a greater contribution to serving overall Chinese diplomacy.

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