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Status and Development of Agricultural Public-Private Partnership Program Implementation in China

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Abstract

As the initiator of the Belt and Road Initiative, the Chinese Government's goal in agriculture is to promote the sustainable development of agriculture throughout China and the world. One of the feasible ways to realize this goal is to adopt the Public-Private Partnership (PPP) model. This study aims to analyze the current status of agricultural PPP projects in China and their impacts. This study utilized the Ministry of Finance database to collect 2014 to 2022 data on agricultural PPP projects in China. The collected data were organized and analyzed to analyze the current situation and return mechanism of Chinese agricultural PPP projects. The results show that China's agricultural PPP projects are less attractive than other sectors, government and social-private sector cooperation is less sustainable, and laws and regulations and risk assessment are not well developed. Therefore, this study proposes to promote the development of agricultural PPP projects by standardizing the law, improving the return mechanism, and strengthening the risk assessment. Thus, it further promotes the sustainable development of agriculture and plays a certain positive role.

Keywords: Belt and Road initiative; implementation; investment; public-private partnership (PPP) project

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INTRODUCTION

China is the starting point of the Belt and Road Initiative countries. China plays a role in sharing resources and common development with countries along the Belt and Road Initiative. Chinese President Xi Jinping put forward the strategy of rural revitalization in the 19th National Congress report. The president has called for a strategic goal of basic modernization of agriculture and rural areas for sustainable development by 2035 (China News Network, 2018). Prasada and Masyhuri (2020) argue that the factors affecting the sustainability of agriculture farmers' perceptions as well as access to information. Agriculture needs to improve the quality of land and increase agricultural counseling and training. China is a leading country in agriculture and uses smart agriculture through deep learning for its sustainability (Ryo et al., 2023). Agarwal et al. (2023) believes that the adoption of Public-Private Partnership (PPP) for sustainable agricultural development is crucial. The adoption of the PPP model in agriculture is very important and allows the state and social-private sector to cooperate and develop unused agricultural resources and achieve sustainable development (Dustmurodov et al., 2020). Polushkina et al. (2020) also believes that the adoption of the PPP model makes agriculture

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sustainable, prevents environmental degradation, and improves food security in the country. At the same time, the PPP model solves the problem of agricultural irrigation and improves its efficiency (Nesmyslenov et al., 2020). The most important thing about the adoption of the PPP model in agriculture is to attract social-private enterprises to invest in the agricultural sector, thus improving the modernization and sustainable development of agriculture (Zeldner, 2019; Prasada, 2020). China vigorously builds up agriculture and rural areas, focusing on strengthening the construction of agricultural infrastructure and upgrading the level of public services. Along with the construction, the capital demand for agriculture and rural areas will increase, and the bottleneck of government financial expenditure will be more prominent (Meng et al., 2019). Therefore, the PPP model is adopted to solve the financial problem of sustainable rural agricultural development.

PPP refers to the cooperation between the government and social capitalists in the field of public infrastructure construction (Zhang, 2023). Through the method of project bidding, the government selects from among the social enterprises bidding for the project, social investors with outstanding capabilities in the investment, construction, and operation of the project concerned (Wang and Zhang, 2019). Social investors have the opportunity to participate in the construction of public infrastructure projects, and the government assesses the quality of their services and pays the relevant fees.

An agricultural PPP project is a partnership between the government and the private sector to form a Special Purpose Vehicle (SPV). The government agrees in the form of a concession or purchase of services with the SPV, which is responsible for constructing and operating the agricultural project developed by the government. At the same time, other investors participate in co-investment in partnership with the private sector. In terms of financing, a guarantee company provides a guarantee, a financial institution provides a loan to the SPV, and the SPV in turn counter-guarantees to the guarantee company, forming a "closed loop" (Yin et al., 2024) (Figure 1). According to the Chinese Ministry of Finance's circular on the Issuance of Guidelines for Demonstrating the Fiscal Affordability of Government and Social Capital Cooperation Projects, government-private sector cooperation fiscal expenditure shall not exceed 10% of the local fiscal expenditure (Ministry of Finance, 2015). Therefore, according to the cooperation agreement between the government and the private sector, the share of private sector investment is 95 to 100% (Zhang et al., 2022). There are great benefits for the government to bring in the private sector to participate in agricultural PPP projects. Firstly, it can reduce the government's financial pressure and utilize the private sector to invest more money in the agricultural industry. Secondly, it can improve the efficiency of agricultural production by utilizing the technology and management experience of the private sector. Finally, the private sector can be used to generate business opportunities and improve the vitality of rural economic development.

The PPP projects involving agriculture are projects according to the national government's support for the "countryside, agriculture, farmer" as well as key areas of investment concentrating

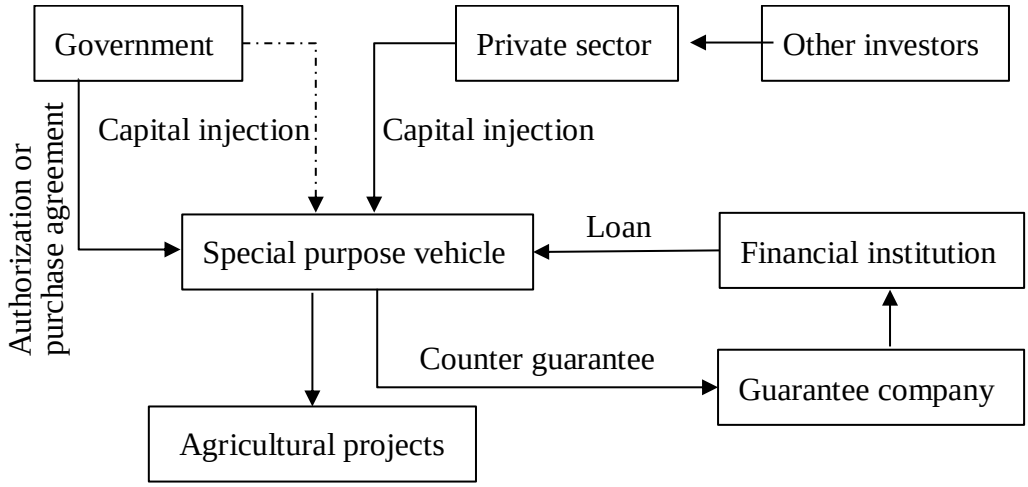

Figure 1. Agricultural PPP project operation model

in various fields. This agricultural PPP project primarily includes agricultural science and technology parks, agricultural breeding parks, agricultural industrial parks, agricultural park demonstration areas, and agricultural ecological parks, covering all kinds of crops. For example, the government of Wuxi City, Jiangsu Province, China, invested 1.209 billion yuan with social capital to build the demonstration area of PPP project of Guzhuang Eco-Agricultural Science and Technology Park using the build-operate-transfer (BOT) mode (Wu et al., 2017). Thus, with the help of the private sector, the agricultural products yielded are further processed, and their value is increased.

The agricultural PPP project is also involved in the construction of an agricultural product processing base, agricultural products trading center construction, various types of agricultural production means of trading venues, warehousing construction, and other projects. For example, the government of Yutian County in Xinjiang, China, has invested 636 million yuan with social capital to build a PPP project of deep processing base for agricultural products using BOT mode to produce various kinds of agricultural products (Pan et al., 2020). In PPP agricultural parks, the private sector utilizes technology and capital to increase research and development of crops, scientific production management of crops, and the yield of agricultural products.

This agricultural PPP project is the most important area of agricultural development and is the most important direction of national policy support, mainly including the production of rural biogas, comprehensive utilization of straw, forestry waste treatment, and other areas. For example, the government of Chifeng City, Neimenggu Province, China, invested 600 million yuan with social capital to build a PPP project for the comprehensive utilization of organic fertilizer and biogas (Zhang et al., 2018).

At present, the overall productivity of China's rural agricultural sector has a low level of sustainable development, and the added value of the agricultural industry is insufficient (Xing and Lu, 2010). Rational development of agricultural resources is crucial to knowing how the use of the PPP model can maximize the effectiveness of agricultural resources. This paper studies the current implementation status of China's agricultural PPP projects to understand China's utilization of the PPP model, which is government-social capital cooperation to strengthen the development of the rural agricultural sector. It further suggests countermeasures for agricultural PPP projects in providing financial needs and public services. Therefore, it is of great significance to fundamentally solve the problems of agricultural financing and resource use efficiency and provide a practical path to achieve sustainable development of rural revitalization.

MATERIALS AND METHOD

Scope

This study is limited to agricultural PPP project investments and problems. In addition, this study pays special attention to agricultural PPP projects in poor counties in China that have been lifted out of poverty and become prosperous. This study also analyzes the risk factors of agricultural PPP.

Location

The location of this study is the whole of China. The easternmost part of China's territory is in the Fuyuan Delta in Heilongjiang Province, located at 135°05'E, 48°27'N. The westernmost part of China's territory is on the Pamir Plateau in Xinjiang, located at 73°33'E, 39°15'N. The northernmost part of China's territory is in Mohe City, Heilongjiang Province, located at 53°33'E, 124°20'N. The southernmost part of China's territory is in the South China Sea, in the Zengmu Dark Sand of the Spratly Islands, located at 112°16'E, 3°51'N (China Government Website, 2023). Currently, 22 provinces in China have implemented agricultural PPP programs.

Data collection and analysis

The sources of literature are the China Knowledge (CNKI) literature databases and Web of Science (SCI). Literature research was carried out to obtain relevant theories, review the concept and content of rural PPP projects, and provide the theoretical basis for analyzing the current situation (Li et al., 2020).

The data source is the Chinese Ministry of Finance's PPP project database. The data were obtained to understand the current situation of rural PPP projects in China through the data research method, analyze the current situation, discover problems, and provide the decision-making basis for the following countermeasure suggestions.

RESULTS AND DISCUSSION

Agricultural PPP projects are unevenly invested and unattractive

According to the national PPP comprehensive information platform project database, the country began implementing the PPP model in 2014, and as of December 31, 2022, the country's total of 22 provinces used the PPP model to solve the countryside, agriculture, and farmer problems, as well as seek to revitalize the countryside. A total of 97 PPP projects have entered the field of agriculture, with a total investment of 106.763 billion yuan (Ministry of Finance, 2021a; 2021b; 2022). According to the operating guidelines of the Chinese Ministry of Finance, the private sector's share of investment was 95 to 100% (Zhang and Xu, 2022). Table 1 shows that the total investment of the private sector is 105.571 billion yuan. Based on the number of projects, the top three provinces are Jiangxi, Shandong, and Henan, which are number 14, 10, and 9, respectively, accounting for 34.02% of the entire agricultural PPP projects. In terms of investment amount, the top three are Guizhou, Henan, and Jiangsu, with 21.215 billion, 13.351 billion, and 10.813 billion, respectively, accounting for 45.6% of the whole agricultural PPP projects. As of December 2022, 22 provinces in China have implemented agricultural PPP projects.

Comparison between agricultural and industry-wide PPP projects

Since 2014, as of December 2022, there are 14,038 PPP projects in the database. The number of agricultural PPP projects is 97, accounting for only 0.64% of the number of projects in the entire industry sector of PPP projects. The total investment of PPP projects was 20.92 trillion yuan. The investment of agricultural PPP projects was 106.763 billion yuan, accounting for only 0.44% of the project investment amount of the whole industry field. From the 2022 report, there were 1,217 total new projects, with 12 agricultural sectors, accounting for 0.99% of the proportion of the whole industry. The total investment for the entire industry PPP project was 2508.1 billion yuan, while the total investment in agricultural was 15.4 billion yuan, accounting for 0.6% of the project investment in the entire industry sector. Although the number and amount of PPP projects in the agricultural sector in 2022 increased when compared to prior years, the total number and amount in the industry was quite low.

Table 1. List of agricultural PPP project investments by province, 2014-2022

Region (province)	Number of investments (number)	Amount of investment (billion yuan)	Amount of investment for private (billion yuan)	Percent private (%)
Jiangxi	14	77.559	77.559	100.00
Shandong	10	58.889	58.445	99.25
Henan	9	133.514	130.487	97.73
Guizhou	6	29.699	29.269	98.55
Hebei	6	108.126	107.752	99.65
Neimenggu	6	212.146	210.573	99.26
Guangdong	5	17.880	17.880	100.00
Jiangsu	5	25.844	25.652	99.26
Yunnan	5	45.743	44.594	97.49
Anhui	4	89.597	88.881	99.20
Fujian	4	16.647	16.359	98.27
Guangxi	3	77.946	75.640	97.04
Liaoning	3	27.098	27.098	100.00
Xinjiang	3	27.953	27.515	98.43
Gansu	2	7.702	7.702	100.00
Hubei	2	30.898	29.911	96.81
Hunan	2	27.000	27.000	100.00
Jilin	2	35.409	35.409	100.00
Shanxi	2	6.701	6.701	100.00
Sichuan	2	10.310	10.310	100.00
Ningxia	1	0.614	0.614	100.00
Tianjin	1	0.360	0.360	100.00

The agricultural PPP projects have relatively low profit margins when compared to other industries due to industry and state control issues. The project's limited revenue stream for social capital makes it less appealing for investment (Trotsenko and Slukin, 2020). Second, social capital typically invests less income to see immediate project results because most agricultural PPP projects have a lengthy investment return cycle. This means that social capital is trying to ensure its turnover. China has to improve its agricultural and rural infrastructure, which will require significant financial investment. Rural areas are also more receptive to government direct investment, which will indirectly negate some social capital. Simultaneously, the social capital qualified to participate in the PPP project for agriculture invests excessively, to quickly recover the costs, which causes a transition from long-term to short-term projects (Fu and Huang, 2023). Thus, agricultural PPP projects are not attractive to social capital enterprises.

Therefore, the proportion of government fees and feasibility gap subsidies increase, improving the confidence of social capital investment in agricultural PPP projects (Wang et al., 2021). Second, the Ministry of Agriculture and other pertinent departments should work to improve the policy guidelines for agricultural PPP projects, provide a clear focus, as well as identify emerging areas for these projects, and direct social capital investment. These can be achieved by having the agricultural sector coordinate with the financial, land, tax, and other departments, introducing policies supporting agricultural PPP projects, and giving careful consideration to issues such as user-paid projects, factors and resources, output efficiency, and other issues. These actions will increase the rate at which agricultural PPP projects yield returns on investment, improve the social capital of the investment confidence in the agricultural PPP project, and enhance the investment confidence and attractiveness of social capital. Finally, it is recommended that the Ministry of Finance and other relevant authorities balance the development of the industry, increase support for agricultural PPP projects, and provide additional budget support.

Agricultural PPP projects have fewer national demonstration representatives and poverty eradication projects

Since the beginning of PPP projects in 2014, by the end of December 2022, they have become national demonstration projects totaling 1,003, with an investment amount of nearly 2.25 trillion yuan. Municipal engineering projects ranked first among the demonstration projects, followed by ecological construction and protection projects. There were only 10 agricultural PPP national demonstration projects, accounting for 0.1% of the national demonstration projects. The investment reached 113.2 billion yuan, accounting for 0.5% of the total investment of the national demonstration projects, and the overall share was relatively small. However, agricultural PPP national demonstration projects accounted for 10.31% of agricultural PPP projects, indicating that projects are constructed under the national demonstration standards when they are implemented, as presented in Table 2.

In 2014, China's National Poverty Alleviation Office reported that the country had 832 poverty-stricken counties. Poverty alleviation was projected to be completed and PPP projects would also made a significant contribution in 2020. By the end of December 2022, 1,611 projects involving poor counties had received a total investment of 1.35 trillion yuan. There were

Table 2. List of national demonstration projects for agricultural PPPs

City	Number of investments (number)	Amount of investment (billion dollars)
Dingzhou City, Hebei Province	1	2.64
Xinyang City, Henan Province	1	2.74
Xiangyang, Hubei Province	1	19.78
Xiangtan City, Hunan Province	1	15.61
Jilin City, Jilin Province	1	16.20
Nanchang, Jiangxi Province	1	2.18
Heze City, Shandong Province	1	10.91
Liaocheng, Shandong Province	1	25.00
Fuyang, Anhui Province	1	2.53
Shaotong, Yunnan Province	1	15.61
Total	10	113.20

only 14 agricultural PPP projects involving poor counties, which accounted for 14.43% of all agricultural PPP projects and 0.1% of all industry projects. The total investment amounted to 8.81 billion yuan, representing 8.25% of all agricultural PPP projects and 0.04% of all industrial projects. The data show that, while agricultural PPP projects have some effect on poverty alleviation, the impact on other industries appears to be weak, as presented in Table 3.

To explore the reasons, the country is promoting PPP program in various industries. The agricultural industry is unique due to its geographical location, and it is less effective in terms of national promotion than other industries. Therefore, there are fewer national demonstration projects (Wu and Wang, 2021). Meanwhile, Chen et al. (2020) believes that PPP projects for poverty alleviation are one of the paths to help alleviate poverty, but the government and laws and regulations are the guarantee for their operation and implementation; otherwise, they will easily fail. Liu et al. (2020) also recognizes that the PPP mode of poverty alleviation improves the efficiency of poverty alleviation, but because of the lack of certain laws and regulations, it leads to failure.

Poor sustainability of government-private sector cooperation and high share of gap subsidies

In December 2022, the Ministry of Finance's PPP Project Center released quarterly data found that the government and social capital parties did not follow up on PPP projects in a timely manner, resulting in an increase in the risk of the implementation of PPP projects, the implementation of which was difficult to sustain, and the state forcibly declined a number of unqualified PPP projects, which led to a decrease in the overall number of projects in the report for the current period (Bao et al., 2019). The collaboration between the government and social capital has not been standardized, and although both have signed contracts, many cooperative agricultural PPP projects have not been followed up on by the government or the project company after the government approved the investment, resulting in sluggishness on the part of social capital in the operation of agricultural PPP projects (Liu et al., 2014). In addition to the government's excessive control over agricultural PPP projects, the feasibility gap subsidy mechanism is overused, resulting in unequal project investment and benefits, and the social capital lacks sufficient profit guarantees, resulting in poor project continuity.

Based on the data analysis, as of December 31, 2022, the national agricultural PPP project's compensation mechanism was primarily based on the feasibility gap subsidy method of return. The number of feasibility gap grants reached 51, totaling 71.778 billion yuan, or 67.23% of the total amount, which is less than the proportion of 66.63% of the whole industry's investment. The data indicate that agricultural PPP projects need to invest in the return mechanism of government payment and increase the government payment. The 27.2% share of the return mechanism of user payment is much larger than the share of the whole industry, and most of the agricultural PPP projects ask for user payment, indicating that the government's investment is small, and it mainly relies on the return of the operation of the user, as depicted in Table 4.

To investigate the reasons, Castelblanco et al. (2022), by analyzing the contractual terms and legal frameworks of PPP projects in Chile and Colombia, argue that the sustainability of PPP projects is fragile, and there is a need to shift from holistic legitimacy to societal legitimacy and to include stakeholders in the system of governance of the PPP projects. Amović et al. (2020) suggest that establishing compatible legal and regulatory frameworks is crucial for sustainable development. Zhang and Chen (2013) discovered that one of the unsuccessful factors in sponge city PPP projects is an inadequate regulatory system, as well as insufficient laws and

Table 3. Status of agricultural PPP projects supporting poor counties

Province	Number of investments (number)	Amount of investment (billion dollars)
Anhui	1	10.44
Guizhou	3	18.95
Henan	3	11.60
Neimenggu	1	1.67
Xinjiang	1	21.90
Yunnan	5	23.54
Total	14	88.10

Table 4. Distribution of return mechanisms for agricultural PPP projects, 2014-2022

Compensation mechanism	User payments	Feasibility gap grants	Government payments
Number of agricultural PPP projects (number)	29	51	17
Investment amount of agricultural PPP projects (billion yuan)	290.42	717.78	59.43
Share of investment amount in agricultural PPP projects	27.2%	67.23%	5.57%
Percentage of investment amount in the whole industry	9.05%	66.63%	24.32%

regulations. Meanwhile, Zhang and Xu (2022) argues that PPP projects for poverty alleviation are one way to help alleviate poverty, but the government and laws and regulations must ensure their operation and implementation; otherwise, they are doomed to fail. Liu et al. (2020) also acknowledges that the PPP model for poverty alleviation improves efficiency, but it fails due to a lack of specific laws and regulations.

According to Bruce and Costa (2019), who conducted a sectoral diagnosis of the policy, legal, and regulatory framework of PPPs in agricultural extension in the Republic of Uganda, strengthening the law can promote agricultural development through PPPs. Jurčík (2006) analyzed agriculture in the Czech Republic and legally mandated the use of concessions for agricultural PPP projects to promote the development of agriculture. Fatka (2021) discovered that it was difficult for farmers to obtain private-sector financing support, and legislation was used to achieve this goal. The American Farm Bureau Federation strongly advocated for this legislation. As a result, the development of agricultural PPP projects needs to standardize the laws and regulations guiding agricultural PPP projects and increase the cost of contract breaches from the national to the local government levels, fundamentally solve the problem of social capital's supremacy, emphasize the social responsibility of the social capital party, and encourage the social capital of agricultural PPP project cooperation to continue until contract performance is completed, and then hand over the project to the government (Hermans et al., 2019). The second requirement for participation in agricultural PPP projects is social capital. The first PPP project for scientific development and logical planning of agricultural construction is determined by cooperation, rather than blind investment that led to financial loss. The project is also supported by preliminary research, which increases the investment success rate of agricultural PPP projects and increases the continuity of cooperation (Cao et al., 2022). The government's primary goal in strengthening the social capital access qualification review is to maximize the benefits of land investment, or the actual benefit to the people. On the one hand, the capital review verifies the social capital's strength and the investment's purpose, as well as the project prospects. On the other hand, social capital allows the government to be tracked and monitored, ensuring that project cooperation continues until the project's completion.

Agricultural PPP investment environment mismatch

Regarding the investment climate for agricultural PPP projects, China has comparatively few land resources available, and policy changes have made land disputes more common. Additionally, it is particularly challenging to use land for agricultural infrastructure, which significantly limits the growth of agricultural PPP projects. Second, there is a mismatch between talents and services, and labor costs in China are on the rise. The majority of young adults in rural areas leave their homes to earn a living, leaving the elderly and children making up the other half. This results in a low labor force. The development of agricultural PPP projects requires talent as the primary resource, which raises labor costs. The current labor shortage in agricultural projects, coupled with high labor costs, is the primary challenge to social capital, which harms project investment returns and shrinks profit margins. The last factor of this phenomenon is that social capital lacks collateral when building agricultural project land, which prevents financial institutions from lending to it and raises the risk of social capital in a straight line. As a result, it is difficult for social capital to borrow from financial institutions

or the loan procedure is complicated. Thus, one of the major issues with the current development of agricultural PPP projects is that, from the perspective of social capital, the investment environment is not supportive.

Consequently, in order to effectively implement agricultural PPP projects, the environment in which they are implemented must be strengthened and improved. Examples of the efforts include enhancing land policy changes, streamlining the approval process for the use of land resources, and providing favorable prerequisites for social capital investment in agricultural PPP projects (Yang et al., 2020). Second, the agricultural PPP project needs to continue to be actively published to the social capital; in particular, the supporting implementation needs to be made public so that the social capital is aware of the project. Third, when the project is still in the construction phase, it needs to be introduced and made public so that the project's stakeholders are aware of it and can accurately understand it. This will help to lower the likelihood that cognitive errors will increase project risks (Li et al., 2019). Finally, to strengthen the agricultural PPP project training for government departments, the relevant departments involved in the projects should acknowledge that agriculture is a crucial area for national support, take part in the larger agricultural PPP projects, and collaborate fully with their implementation in order to maximize the investment environment and enhance supporting services through government support.

Agricultural PPP project risk assessment is difficult

The whole life cycle of agricultural PPP projects consists of four stages, including the preparation, procurement, execution, and handover stages. Each stage involves a diverse range of people, property, and materials, as well as a large number of interested parties, and the cycle of each stage is very long, resulting in too many variables, and increasing project risk (Zhang and Leiringer, 2023). Second, the government and social capital parties collaborate to set up a company to build agricultural PPP projects, which is called the PPP project company. The PPP project company takes the identity of the main body of the loan to the financial institutions. The project company's operating conditions and liabilities will have a direct impact on the amount of financing, and the credit risk is also related to it. The project company needs to assess the risks of the project. However, due to the issue of professionalism, the assessment is more challenging. The project company must evaluate the risks of project design, construction, and operation, but this is challenging due to specialization. Additionally, the project company assesses the risk of the government side; the cycle of an agricultural PPP project is longer than that of a general project; policy adjustments are required; financial subsidies cannot be implemented on time; and other issues arise (Zhang et al., 2019). As a result, many social capitalists are hesitant to participate in agricultural PPP projects because assessing the risks is difficult.

Therefore, by using authoritative PPP project consulting firms in society or government assessment agencies, the entire project will be reasonably and comprehensively assessed, and the assessment results will provide feedback to the government to determine whether or not to implement agricultural PPP projects (Zhang, 2005). Moreover, management of agricultural PPP projects will be strengthened, particularly throughout the whole process and all aspects of project operation. Third, the management of agricultural PPP projects should be improved, particularly throughout the entire process and aspects of project operation. Continuous and effective monitoring of agricultural PPP project progress, funding use, and other key steps is recommended (Bao et al., 2018). A clear understanding of the corresponding work allocation and fund proportion is required to realize the key steps of the various aspects. The project establishes and improves the project supervision and management system, as well as ensures a clear division of labor and transparent funds.

CONCLUSIONS

As China is the starting country of the Belt and Road Initiative, sustainable agricultural development is also an important element of co-development, utilizing PPP projects to promote sustainable agricultural development. China's agricultural PPP project investment is not evenly distributed by region, and the proportion of investment is relatively low. The reasonableness of laws and regulations, the sustainability of collaboration between the government and social private capital, the attractiveness of investment, the investment environment, and risk assessment are the primary factors influencing the

development of agricultural PPP projects. To promote agriculture's long-term development, it is necessary to standardize agricultural PPP project laws and regulations, improve the return mechanism, strengthen the implementation support, and improve agricultural PPP project risk assessment and management. Thus, this approach has the potential to greatly promote the development of agricultural PPP projects as well as agricultural sustainability.

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