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# Safeguard Measures for the Development of Agricultural Science and Technology Parks

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**Abstract** Healthy development of agricultural science and technology parks needs perfect operation mechanism. On the basis of current situations, this paper came up with several safeguard measures for improving the operation mechanism of agricultural science and technology parks, mainly including organization operation mechanism, technological guarantee mechanism, fund guarantee mechanism, and talent guarantee mechanism.

**Key words** Agricultural science and technology parks, Operation mechanism, Guarantee mechanism

## 1 Introduction

In recent years, China has made great achievements in the construction of agricultural science and technology parks. However, in the big wave of vigorous construction, there are obvious mistaken ideas. For example, industries of most agricultural science and technology parks are mainly greenhouse vegetables, flowers or industrialized nursery process. There are problems of repeated construction, convergence of industrial structure, and single product, excessive government behavior and administrative intervention, many agricultural science and technology parks become window project or administrative achievement project. Thus, it is difficult to realize standardized enterprise operation. They stress the demonstration but belittle promotion and radiation, and ignore technical guidance and training for farmers. The main reason for the above mistaken ideas lies in the lack of effective management system and operational mechanism. Agricultural science and technology parks belong to knowledge-intensive agricultural science and technology industry with high investment and high risk, so they need high efficient management. At present, most of agricultural science and technology parks are still operating in accordance with operation system and management methods of the planned economy. Their operation and management efficiency is relatively low and they lack vitality. There is still a big gap with actual demands of China's agricultural development and western countries with developed agriculture. Especially in operation mechanism construction, agricultural science and technology parks still lag behind<sup>[1]</sup>. Therefore, in order to ensure the healthy development of agricultural science and technology parks, it is required to establish and improve the operation mechanism.

## 2 Organization operation mechanism

Special spatial structure of agricultural science and technology

parks determines that agricultural science and technology parks, as regional modern agriculture innovation system, must keep coordinated management at macroscopic level, and should also pay attention to integration with local characteristic resources and industry. Therefore, in practice, the management of regional agricultural science and technology parks should establish the organizational mechanism of "government regional agricultural science and technology park development steering committee + business management + association promotion + project enterprise operation". The government regional agricultural science and technology park development steering committee is the common management guiding mechanism consisting main leaders of local government and absorbing universities and research institutions, financial department responsible persons and relevant social persons to participate. The committee sets up offices to implement the guidelines, policies and planning tasks formulated by the steering committee, and provides direct assistance for internal organization coordination in key or major matters. Business management refers to the non-profit business management development company set up by agricultural science and technology demonstration areas and local government. Its main content of management and service is to provide services for enterprises and satisfy individualized demands. It is responsible for infrastructure construction, environment optimization and post-development, carrying out publicity and inviting outside investment. The board of directors of the company may consist of government, university or research institutions, financial institutions, enterprises and local relevant persons. The board shall be responsible for the development of the region's major decision-making and policy, and clearly get involved in the responsibilities and obligations of all parties. The daily management and operation of agricultural science and technology parks are the responsibility of the company manager.

In the corporate governance structure: the main responsibility of the government is to formulate overall development plan for agricultural science and technology parks, appropriate land, and provide fund guarantee for construction of public goods; formulate in-

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dustrial policies and guide the investment direction; protect the benefits of investors and maintain market order; provide seed funds and policy support for innovation; coordinate the connection between inside and outside, and stimulate the coordination between innovation subjects; promote and guide the construction of entrepreneurship culture in agricultural science and technology parks. Universities and research institutions should be responsible for providing talent, scientific research and the necessary experimental conditions, organizing enterprise management personnel, scientific and technical personnel training, carrying out academic exchange, and providing technology and knowledge support for innovation activities. Financial sectors provide loan support for innovation activities and provide financing services for infrastructure construction within the park. Enterprises and local relevant persons are mainly responsible for giving advice for the development of agricultural science and technology parks. Association promotion refers to promoting the construction and development of the parks with the aid of non-governmental organizations. The association mainly includes trade association and park association. The task of the trade association is to help enterprises or farmers in the park to carry out industry communication, formulate industry standards, promote self-discipline of the industry, maintain and establish brand image, and conduct industry consulting. The park association, sponsored by the government, mainly consists of the management companies within the park and outside technology parks, and absorbs the outside influential leading enterprises, outside large enterprises and other organizations or individuals having international connection. Its function is to establish communication between the enterprises in the park, social circles, and domestic and foreign government, coordinate the relationship between internal enterprises and external enterprises, carry out cooperation, provide assistance for enterprise development; establish a link mechanism with other provinces and foreign science and technology parks, promote horizontal exchange, and coordinate the overall and individual development of agricultural science and technology parks. The project enterprise operation refers to industrialized organization according to "operating company system, investing owner system, science and technology contracting system, and linking farmer contract system". Government and management companies only provide services and the necessary seed funds and real estate rental preferential measures, but do not participate in operation of industrial projects. Marketization of operation services refers to highly professional services necessary for enterprises and entrepreneurs. These services are provided by social intermediaries and various professional technological research and development service organizations, to establish construction objectives and development system for agricultural science and technology parks.

Basic objectives of the construction of agricultural science and technology parks: optimize agricultural economic structure, establish competitive regional characteristic agriculture, and increase farmers' income through market orientation, government support, enterprise operation, industrialized operation, base pro-

motion, and farmer participation. For this, agricultural science and technology parks should establish following development systems<sup>[2]</sup>.

(i) Reasonable organization structure system. It is necessary to build the core area, demonstration area, radiation area and other different levels of the park organization system. In the park system, as park investment and construction subjects, core areas should establish competitive leading industry or enterprise group. Demonstration area belongs to industry driven base as the core area. It conducts specialized and large-scale production according to the development requirements of leading industry of the park. The radiation area is the vast agricultural production and rural economic area involved in and affected by leading industry of core area, or the same type agricultural area with similar characteristics of geographical environment, resource characteristics, production and management characteristics. (ii) Reasonable modern production system. Through bringing into play advantages of regional agricultural products and characteristics, the park has established agricultural product structure with high quality and high efficient products, and established large-scale agricultural and livestock products, safety, standardization of production and management system, to provide model example for adjusting the structure and raising the international market competitiveness. (iii) Reasonable operation and management system. Agricultural science and technology parks should explore and develop industrialized operation system and model according to objective requirements of agricultural industrialization management elements, to realize integrated design of production from source to market, extend rural economic chain, and increase the comprehensive agricultural benefits.

### 3 Technological guarantee mechanism

**3.1 Technology selection** Agricultural science and technology parks should select their own technology system in accordance with local conditions, which is a key factor reflecting characteristics of modern agricultural science and technology parks. The selection of technology system of agricultural science and technology parks should follow the principle of compound pluralism, intelligent principle, high yield and high quality principle and resource conservation principle<sup>[2-4]</sup>.

**3.1.1 Agricultural high and new technology.** It includes following technologies; (i) modern biotechnology, such as genetic technology, cell technology, embryo technology, enzyme technology and fermentation technology; (ii) modern facility agriculture technology. The most typical facility agriculture technology includes modern high-yielding cultivation techniques, industrial seedling technology, industrial aquaculture technology and intensive livestock and poultry breeding technology; (iii) multi-color agricultural technology. At present, green, blue and white agricultural technologies are mainly applied. Green agriculture refers to sustainable and efficient new agricultural technology with ecological agriculture as the main part; blue agriculture refers to the water industry agricultural technology. In agricultural science and tech-

nology parks, technologies mainly used include factory aquatic breeding technology, high-density intensive technology and aquatic plant cultivation technology; white agricultural technology refers to the microbial industry, edible fungus production and processing. At present, many agricultural science and technology parks have bacteria center, edible fungus demonstration area and other projects; (iv) information network technology. Information network technology has been adopted by more and more parks. On the one hand, agricultural science and technology parks use modern information technology means to exchange information with outside; on the other hand, they can realize internal network management<sup>[2-4]</sup>.

**3.1.2** Practical technology with high promotion value. It includes: (i) the implementation of efficient cultivation technology, such as CO<sub>2</sub> fertilization technology, compound formula fertilization technology, plant protection technology, pollination technology, fill light technology, environmental control technology, and soilless cultivation technology, three-dimensional cultivation technology, livestock-vegetable symbiosis technology, fish-vegetable symbiosis technology and other advanced new technology; (ii) efficient new technologies for aquaculture; (iii) preservation and processing of agricultural products; and (iv) marketing technologies in agricultural high-tech market development.

**3.1.3** Technology with leading demonstration role. The construction of agricultural science and technology parks has certain regional characteristics. Agricultural science and technology parks will become leader of local agricultural industrialization. Therefore, many parks firstly consider the technology with regional demonstration. For example, there is a ginkgo science and technology demonstration park in Xuzhou of Jiangsu Province. Since there is 200000 mu ginkgo park in Xuzhou, the establishment of demonstration park plays an important driving role in the development of local ginkgo industry.

**3.2 Technological innovation** Scientific and technological innovation is the only way for the development of agricultural science and technology parks. It is required to build a scientific and technological innovation mechanism, to provide support for the development of agricultural science and technology parks. Agricultural scientific and technological innovation mainly includes agricultural scientific research, invention, creation, and promotion and application of scientific and technological achievements<sup>[2]</sup>.

**3.2.1** Establishing a high efficient agricultural science and technology innovation system. It is recommended to deepen reform of agricultural scientific research institutions, allocate scientific research institutes again, increase scientific research efficiency, and raise overall level of agricultural research and innovation in accordance with strategic planning and high science and technology agricultural development requirements of agricultural science and technology parks.

**3.2.2** There are things must be done and things must not be done. It is necessary to catch the key and main points of rural industrial structure, select key high and new technologies concern-

ing cultivation of growth point of new industries and transformation of traditional industries. For these technologies, it is required to concentrate efforts, make key breakthrough, and stress benefits, to practically raise the ability of agricultural science and technology research and development.

**3.2.3** Combining inheritance and innovation. Agricultural science and technology parks should inherit China's traditional agricultural technology system and absorb the essence of the western technology system, adapt to the characteristics of China's agriculture, and take the transformation of traditional agricultural technology as the starting point, to promote penetration of high and new technology to traditional agriculture.

**3.2.4** Strengthening international cooperation and exchanges. Agricultural science and technology parks should realize the gap of China with the international advanced level, set up a correct and effective development concept, and strengthen the introduction work. Besides, it is required to do a good job in technology introduction digestion and absorption, gather and bring into play the newcoming advantage, and make effort to develop agricultural scientific and technological achievements suitable for regional characteristics of China.

**3.2.5** Combining technological progress and leap. Technological progress refers to the technology upgrade following the logical order from low to high of technological efficiency, while technological leap refers to technology leaping technology step following the logical order from low to high of technological efficiency, having important strategic significance.

**3.3 Technological diffusion** The ultimate goal of the development and construction of agricultural science and technology parks is to bring into play their radiation function, and promote surrounding farmers to use new varieties, new facility process and new agricultural technologies, so as to promote development of the regional agricultural economy through agricultural science and technology parks. Therefore, it is required to seriously consider how to establish technology extension and diffusion mechanism, and accelerate application of new technologies, new varieties, and new processes. Generally, the technology extension and diffusion of agricultural science and technology parks should follow the following principles<sup>[3,4]</sup>.

**3.3.1** Technical propaganda. This is the basic method of agricultural high-tech achievements. Through distributing technical data, holding technical publicity meetings, radio and television, science and education film program, newspaper and magazine propaganda, and personal speech, it is necessary to propagate high and new scientific and technological achievements to possible users, and stimulate interests of farmers learning and using science.

**3.3.2** Demonstration by typical examples. At present, farmers in China are decentralized management. They are weak and low in resisting agricultural operation risks. Therefore, in the application of new technologies, new varieties, and new process, they value the practical effect. Agricultural science and technology parks should make effort to obtain significant economic benefits through

application of their new technologies, new varieties, and new processes, to make farmers see and grasp their technologies, then it is possible to get rid of their worry of applying new technologies, new varieties, and new processes.

**3.3.3 Education and training.** (i) Improving quality of farmers through scientific and technical training. It is necessary to organize scientific and technological personnel, technology promotion cadres to send science and technology to the countryside, and provide training for farmers through popular science assembly, science and technology training class, green certificate project, television lectures, and printed materials. (ii) Improving quality of farmers through scientific and technological activities. It is recommended to carry out "science marrying technology" to encourage and guide scientific and technical personnel to sign technical contract with farmers; (iii) Extending specific scientific and technological achievements. Scientific and technical personnel should explain, demonstrate and answer questions in job site.

**3.3.4 Follow-up services.** In the process of technology diffusion and extension, follow-up service is very important. Farmers will encounter various difficult problems in the application of new technologies. Therefore, in the process of application of new technologies, scientific and technological personnel of agricultural science and technology parks should provide one-stop services, take overall consideration for farmers, and solve various practical problems.

## 4 Fund guarantee mechanism

Agricultural science and technology park is the project with high input and high output. Therefore, cleverly using rules of market economy, following the principle of "who invests and who benefits", and establishing multi-level, multi-channel, and diversified financing mechanism are preconditions for effective operation of agricultural science and technology parks<sup>[3,4]</sup>.

**4.1 Government investment** Agricultural science and technology parks with social benefits and ecological benefits as main part or some key agricultural science and technology parks concerning national economy and the people's livelihood are usually established by government. Their construction requires all levels of government to invest a certain amount of start-up and guidance funds. Since the "Eighth Five-Year Plan", China has invested a large amount of funds in the implementation of a series of agricultural science and technology projects such as "harvest plan" and "seed project", which has accelerated the progress of agricultural science and technology. At present, the contribution rate of agricultural science and technology progress to agricultural growth has reached about 45%. According to estimation by Food and Agriculture Organization of the United Nations, only when the percentage of agricultural research investment to domestic agricultural production reaches 2%, may it be able to reach coordinated development between agriculture and other sectors of national economy. In the Ninth Five-Year Plan period, the percentage of China's agricultural scientific research input was lower than 4%. In the same period, the intensity of agricultural research investment in developed

countries was higher than 4%, and the intensity of investment in agricultural research in developing countries was generally higher than that of China. In order to speed up the progress of agricultural science and technology, both the local and central finance should increase the intensity of investment in agricultural research in the 21st century. It is recommended to concentrate on improving the scientific research and extension system of agricultural science, strengthen the construction of scientific research bases, support the core technology research, accelerate the transformation of scientific research achievements and the industrialization of high and new agricultural technologies, strengthen the training of farmers and improve the quality of laborers.

**4.2 Relying on social investment entities** It is recommended to take various measures to absorb social circles to make investment. At the early stage, government investment in agricultural science and technology parks is necessary. However, in accordance with the principles of market economy, it is a fundamental financing measure to rely on social legal persons, individuals and foreign investment. First, it is recommended to absorb farmers to make investment through the contract, leasing, auction, and share cooperation, and also allow farmers or other individuals to join through taking land and technology management as shares, to improve the investment mechanism. Secondly, through the improvement of the investment environment within the park, the formulation of supporting preferential policies, through holding news conference, it is expected to widely attract enterprises and institutions, corporate legal persons and various merchants, to promote development of agricultural science and technology parks.

## 4.3 Establishing the venture capital investment mechanism

Venture capital is mainly raised through establishing venture capital funds. It is an innovative trend of financing mechanism of agricultural science and technology parks in China to establish venture capital investment system, raise funds for the science and technology parks and promote the innovation and transformation of new and high agricultural technology. The specific measures are as follows. First, it is recommended to establish the venture capital investment fund with local and state finance as main part. Second, it is recommended to establish venture capital investment companies, whose funds mainly come from state technological transformation funds, venture capital funds accumulated by themselves, social fund raising, and absorption of outside investment. It is recommended to attract private capital to improve the capital structure of rural credit cooperatives and other commercial financial institutions, actively encourage financial innovation, product innovation, and product innovation, provide deposit and loan, securities financing, securities trading, property guarantee, leasing, life and re-insurance and payment settlement, so as to adapt to diversified rural financial demands.

## 5 Talent guarantee mechanism

High technology industry is knowledge intensive industry. Foreign researches have shown that, in elements of the new and high tech-

nology industrialization, the concentration of high-tech talents is the primary factor affecting the industrialization of high technology, accounting for about 33%. According to linear regression analysis on factors influencing the income of 53 new and high technology, industry and trade, the talent is the key factor influencing the income of high technology, industry and trade, especially the number of personnel with middle and high academic title has the highest influence on whole year income of new and high technology zone. Thus, in the development and construction of agricultural science and technology parks, introducing high science and technology personnel and bringing into play their ability are of great significance<sup>[3,4]</sup>.

### 5.1 Establishing new and high agricultural technology talent aggregation mechanism

(i) It is recommended to strengthen the construction of personnel information network, establish a set of high efficient information system and high quality talent return supply and demand information network as soon as possible, and grasp the supply and demand situations of foreign agricultural technology talents and personnel flow within the park, to build agricultural science and technology parks into the "special zone for talent return". (ii) It is recommended to maximally encourage and absorb numerous students abroad to return homeland, to make effort to create a relaxed working and living environment for them. For example, for those talents with high-quality precision and sophisticated technology, agricultural science and technology parks should provide scientific research funds and experiment facilities; in evaluation of professional titles, it is required to take the academic achievements and level as the basis and break the concept of "arranging in the order of seniority"; in the living conditions, it is recommended to provide those talents with certain expert apartments, communication devices, and cars in the form of underselling or renting.

### 5.2 Improving the talent benefit driving mechanism

(i) Agricultural science and technology parks should establish the mechanism of coupling agricultural science and technology personnel remuneration and contribution. It is recommended to encourage agricultural science and technology personnel to get better off earlier, allow them to obtain extra income from signing contract, establishing new and high technology enterprises, and transfer of technological achievements. For example, for agricultural scientists and entrepreneurs with significant contribution, it is possible to provide timely reward, promotion and salary increase. (ii) Agricultural science and technology parks may give ample rewards to science and technology personnel who have obtained significant economic and social benefits in new and high agricultural technology research and development, achievement promotion, and technological innovation.

### 5.3 Promoting the talent management mechanism

(i) It is recommended to stimulate the flow of talents, break the barrier of departments, regions, units, disciplines, and ownership, and dredge the talent flow channel. (ii) It is recommended to implement the appointment system, contractual system and guest system

for science and technology personnel engaged in new and high agricultural technology research and development. Science and technology personnel may hold two or more posts concurrently, retain the job but suspend the salary, or take resignation, and implement "expert free industry system". (iii) It is recommended to actively encourage and help young talents to show their talents and create comfortable working environment and favorable conditions for in-service study. For example, Huaiyin municipal Party Committee and city government formulated policies to encourage science and technology personnel to participate in construction of the park in the form of contractual management, fund investment, technology investment, and technology transfer, and provide support in technology, funds, and talents. In the whole city, 239 science and technology personnel went to the countryside to contract and participate in the construction of agricultural science and technology parks, which promoted the changes in agricultural science and technology personnel from verbal to manual types and transformed agricultural service methods.

### 5.4 Cultivating agricultural entrepreneurs for agricultural science and technology parks

Agricultural entrepreneurs are axis personnel of agricultural science and technology parks. Their operation capacity and level have direct connection with the production construction and operation effect of agricultural science and technology enterprises. (i) It is recommended to carry out regular education and lay a solid foundation for growth of new and high agricultural entrepreneurs. (ii) It is recommended to select science and technology entrepreneurs from agricultural colleges and universities or scientific research institutes, and cultivate their risk awareness and operation and management ability, to build them into talents good at scientific research and management. (iii) It is recommended to strengthen exercise of entrepreneurs in directly participating in technology development, production operation, market management, and financial management, to gradually raise their risk awareness, leadership art, organization level, and strategic decision-making ability. (iv) It is recommended to strive to create excellent social environment favorable for formation of agricultural science and technology entrepreneurs, create cultural environment favorable for innovation, to provide fertile soil and nutrition for growth of agricultural science and technology entrepreneurs.

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