Orientation of Government's Role in Building the Technology System of Circular Agriculture

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Abstract This article expounds the economic characteristics of circular agricultural technology. Since the circular agricultural technology has characteristics and externality of public goods, the government participation is necessary in building the technology system of circular agriculture, in order to avoid "free rider" behavior in the consumption of public goods and internalize externality. We analyze the orientation of government's role in building the technology system of circular agriculture: the government is the leader, designer, organizer and regulator in building the technology system of circular agriculture; the government orientates the four roles precisely in building the technology system of circular agriculture, to ensure that they do not cross the line, but be indispensable all the while.

Key words Circular agriculture, Establishment of technology system, Orientation of government's role

The development of circular agriculture is an important strategy for transforming the agricultural development modes, and achieving sustainable agricultural development. Circular agriculture is an inevitable choice for China's sustainable agricultural development, and also the only road to building a new socialist countryside[1]. The 12th Five-Year Plan of China explicitly proposed to vigorously develop the circular agriculture. A prerequisite for the development of circular agriculture is to build a set of perfect technology system of circular agriculture. Government, as an important subject of building the technology system of circular agriculture, plays an important and irreplaceable role in promoting innovation of circular agricultural technology, and propelling the rapid development of circular agriculture.

1 Economic characteristics of circular agricultural technology

1.1 Public goods characteristics of circular agricultural technology In economics, a public good is a good that is non-rival and non-excludable. Non-rivalry means that consumption of the good by one individual does not reduce availability of the good for consumption by others; and non-excludability means that no one can be effectively excluded from using the good. In the real world, there may be no such thing as an absolutely non-rivaled and non-excludable good; but economists think that some goods approximate the concept closely enough for the analysis to be economically useful. Consumers' consumption of public goods does not need to pay any price, resulting in "free rider" behavior in the consumption of public goods[2], which will abate the enthusiasm of companies and individuals to provide public goods, and in the mean time, make the companies and individuals unwilling to pay a fee even if they have consumed the public goods. For example, in the economic realities, both companies and individuals have benefited from harmonious ecological environment, but if it lacks the role of certain mandatory external forces, basically there will be no companies and individuals actively investing human and material resources in the protection of ecological environment. The eco-efficiency of circular agricultural technology savors of public goods. The development of circular agriculture needs a lot of basic, forward-looking technologies, such as the reducing technology of circular agriculture, recycling technology, re-using technology, extension technology of agriculture industry chain, all of which play a very important role in the development of circular agriculture. The research and development of circular agricultural technology is vulnerable to risks, with long cycle and high cost. Thus the main body of supply of circular agricultural technology must be diverse, and if the company is viewed as the "economic man" seeking maximization of economic interests, he would choose the technology with the greatest economic benefit, avoiding the circular agricultural technology with public goods characteristics that can achieve the environmental benefits. Therefore, the development of circular agricultural technology needs joint participation of government, companies, research institutes, and the public, to establish a technical support platform conducive to the development of circular agriculture, and provide better conditions for research, development, and results conversion of circular agricultural technology.

1.2 Externality of circular agricultural technology Technology spillover, technology learning, technology diffusion and other factors, can lead to externality of technological innovation. The externality of technological innovation is not only a demonstration effect, but also an inevitable result of the economic subjects pursuing the economic interests[3]. The externality of technological innovation is also a common phenomenon. For example, with changes in market demand, in order to shorten the technology gap, the technological laggard will use low cost of innovation to obtain the technology owned by the technological pioneer, by imitation, learning, improving, and

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other ways. Therefore, we can say that the innovation of circular agricultural technology not only brings benefit to the innovators, but also brings benefit to others and society. The reason is as follows: as to the agricultural technological achievements, apart from the pesticides, fertilizers, agricultural machinery, agro-processing technologies, and some crop seeds and biotechnologies that can form the results of patentability, other agricultural technologies are mostly public goods, easy to be freely used or imitated and prone to generate free-rider phenomenon, so that the results of agricultural technology cannot be protected by patent like the innovative results of industrial technology, thus having strong externalities. Compared with the general technical innovation in market economy, the negative effect of externality of circular agricultural technology innovation on enterprise technological innovation and incentive is more prominent. General technical innovation only considers the economic benefits, rarely considers the ecological benefits. In the process of production, the companies ignore the ecological service value, so that companies lack awareness of ecological and environmental protection in terms of technological innovation, leading to increasingly severe issues such as the shortage of resources, environmental pollution and ecological crisis. The innovation of circular agricultural technology should take into account the dual goals of economic and ecological benefits, and under the premise of internalizing the ecological environmental cost, the companies should carry out technical innovation to get the greatest economic benefits.

According to the explanation of Ronald Coase (1960), on the correlative relationship between definition of property rights and the effective allocation of resources[3], the fuzziness of property rights of natural resources and ecological environment makes the economic subjects who implement the behavior of protection fail to solely enjoy the ecological benefits arising from protection. In reality, although the government makes reference to the design of Pigouivain tax, and implements a series of measures of internalizing externality, such as environmental resources tax, pollution incidents fine, and the polluter-paying system, to guide enterprises to attach importance to ecological value trend of technological innovation, but the majority of enterprises still lack the inherent power to actively and voluntarily assume the role of achieving eco-efficiency goals. Therefore, the agricultural technology innovation can not be completely oriented by market, and it needs to depend on government funding and subsidies, relying on the government to work out viable system to achieve optimal resource allocation.

2 Orientation of government's role in building the technology system of circular agriculture

The government plays a very important role in the technology system building of circular agriculture, and is the leader, designer, organizer and regulator of building the technology system of circular agriculture.

2.1 The government is the leader in building the technology system of circular agriculture The government is the leader of building the technology system of circular agriculture. The government formulates and promulgates a variety of policies and regulations to guide and encourage various technical subjects to provide technical support for circular agriculture. Compared with the general technology, circular agricultural technology should take into account the economic goals and ecological goals. In economic activities, the economic subject's pursuit of economic goals is determined by its essential attribute, and the economic subjects pursue maximization of their own economic interests forever. Thus, to achieve ecological goals, circular agriculture deviates from economic goals of the micro economic subjects. "Economic man", such as individuals and companies will maximize their own interests in repeated game and try. However, the natural resources have been in a position of being plundered, consumed and used, and of course, have no rational thought of human, thus the natural resources cannot act as "economic man", and it must have government guidance to achieve environmental goals.

In application and promotion of circular agricultural technology, there are more complexities and uncertainties. In the case of unsound economic market mechanism of circular agriculture, the companies promoting circular agricultural technology show distinct disadvantages in the market competition. For example, when the agricultural companies promote cleaner production technologies, they need to invest money in a lot of environmental protection equipments, use clean energy and raw materials. Thus, in comparison with the prices of the same types of products, the production costs of the products are higher, and it is obvious at a competitive disadvantage. For example, the water reclamation technology in sewage treatment currently has been more mature, but it has not yet been effectively promoted. The fundamental reason is that the cost of sewage disposal is higher than the price of tap water. In another example, the sewage disposal cost per ton in the southern Jiangsu Province is about 2.2 yuan, while the tap water in this region is sold at 0.8 yuan per ton at present, that is to say, under the existing water pricing system, the companies obtain no benefit in saving water, thus promoting the technology of circular economy is "uneconomic". Therefore, through a series of policies and regulations, the government must internalize the resources and the environment benefits in "economic man", so that the ecological goal becomes its necessary internal demand, so as to achieve the unity of economic and environmental objectives.

2.2 The government is the designer in building the technology system of circular agriculture In the process of building the technology system of circular agriculture, the government assumes the role of organizer. In accordance with the requirements of the development of circular agriculture, the government should formulate the development planning of circular agricultural technology, and determine the overall strategy of circular technological development. It should effectively integrate a variety of technical resources, and the technology development planning should pay more attention to the failure field of technical resource allocation. It should make technology development planning for the technology field with great input,

wide application and obvious externality, and the government's top-level planning should be forward looking, playing a crucial role in the formation of the structure of the technology system of circular agriculture.

As the designer of building the technology system of circular agriculture, the government should have scientific and global overall planning of development of circular agricultural technology. The circular-agriculture-oriented technology planning should have focus, in order to improve the use efficiency of national or regional technical resources, comprehensively enhance the technical support function of the circular agricultural technology in China for circular agriculture. *The National Agricultural Technology Development Plan* (2006 –2020) promulgated in 2006, put forward the overall goal of China's agricultural science and technology development in the next 15 years, that is, by 2020, we will form the national agricultural science and technology innovation system with rational layout, complete functions, efficient operation and strong support, and the overall strength of China's agricultural science and technology will take the lead in the world; the share of agricultural research and development input in agricultural GDP will be increased to more than 1.5%, and the contribution rate of agricultural science and technology progress will reach 63%, to promote innovation-oriented agricultural construction as the core of modern agriculture. It pointed out the guidelines of the agricultural scientific and technological work as follows: innovating independently, accelerating the conversion, upgrading the industry, and taking the lead to leap. It crystallized the key tasks of the development of agricultural technology, and also put forward the measures for safeguarding the development of agricultural science and technology. Therefore, on the basis of *The National Agricultural Technology Development Plan* (2006 –2020), we must put forward the development planning of circular agricultural technology, and at the same time, we should adjust measures to local conditions to formulate the regional development planning of circular agricultural technology according to the characteristics of each region.

2.3 The government is the organizer in building the technology system of circular agriculture In the process of building the technology system of circular agriculture, the government is not only a guide, but also a organizer in building the technology system of circular agriculture. The government should efficiently organize the building of the technology system of circular agriculture. It is a complex and systematic project. Due to the property of public goods of circular agricultural technology, the government should take on the role of the organizer. For example, building the technology system of circular agriculture is bound to require the government to organize the basic research, applied research, experiment, development and other stages of innovation of circular agricultural technology.

The results at the stage of basic research are knowledge, which has the nature of public goods; the "patent results" at the stage of applied research have mixed nature; the "material results" at the stage of experiment and development have nature of the private product. Therefore, the government should interfere with the first two to different extents. Especially for the circular agricultural technology projects with long research and development cycle, great technical difficulty, many costs and inputs, wide application prospect and strategic importance, the government should organize companies to cooperate with research and development institutions (including universities). Or the government takes the lead, to commission the special research and development institutions or companies to undertake key technological program. Through careful organization and implementation, the government should provide supportive technology products for circular agriculture.

2.4 The government is the regulator in building the technology system of circular agriculture The government is the supervisor in building the technology system of circular agriculture. In the technology market, the government's administrative intervention is less and less, but the government functions in the technology market are not weakened. Since the technology market of circular agriculture has the areas of failure and glitch, the government supervision is particularly important. The main body of agricultural technology takes the pursuit of the maximization of interests as the goal, thus it is inevitable that there will be adverse competition and monopolistic competition, leading to chaotic state of economy. For example, due to the public goods characteristics of circular agricultural technology, the "free-rider" phenomenon occurs occasionally. Then the government should fulfill the functions of supervision, establish effective mechanism and adopt measures to protect intellectual property rights and protect the achievements of innovators of circular agricultural technology, so that others can pay to use, therefore, the technological innovation will have inexhaustible power.

Again, for political achievements, some government departments turn on the green light to some agricultural enterprises, lacking strong intervention and involvement in the companies with high consumption of resources and serious pollution. They do not require these companies to use energy-saving and emission-reducing circular agricultural technology, but give the reins to them. Some local governments are only concerned about the growth of economic aggregate in the region, ignore changes in the mode of economic development, and optimization of economic structure; neglect the coordinated and sustainable development of economy, population, resources, environment, and ignore the improvement in overall quality of economic development. Such partial and short-sighted behavior is not conducive to economic, social and environmental sustainability. Therefore, the development of circular agriculture needs the regulation of the government, the visible hand, and the building of circular agricultural technology can not do without government supervision. The government supervision does not mean that the government can arbitrarily intervene in corporate management, to play the role of the market, randomly distorting the market price. Through the establishment of favorable market mechanism, the government should improve laws and regulations, establish multi-level regulatory system that many

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based on milk yielding animals, Qinchuan cattle, strong gluten wheat, characteristic vegetables, kiwi fruit.

Drought, ditch and hilly have always been a major obstacle to large-scale and efficient development of agriculture in Yulin, but according to the operating mode of "government helping enterprises, enterprises building parks, parks leading farmers, farmers connecting with markets", Yulin introduces private enterprises to establish efficient agricultural demonstration park, and carries out the construction of agricultural infrastructure, such as rainwater harvesting facilities, irrigation facilities, wind break forest, wide paths for tractors in the countryside, wide row of terraces in accordance with the division of zones, effectively improving agricultural investment environment, so that it becomes a an important production base of the famous cereals, potatoes, facility vegetables. Yan'an forms the northern Shaanxi agricultural industrial belt based on white cashmere goat and big jujube.

Shaanxi economic zone includes Hanzhong, Ankang and Shangluo, located in Qinba mountainous area, with land area of 696 000 km^2, accounting for 34% of whole province, and the area of farmland accounts for 20% of that of whole province. In the southern Shaanxi Province, the score of Hanzhong, Ankang and Shangluo is low, but the climate here is warm and humid, with abundant natural resources, and the forest area accounts for more than 66% of the province's forest area. The forest products include lacquer, citrus, Chinese wood oil, walnuts, fungus, mulberry; the precious herbal medicines include bark of eucommia, Gynostemma and gastrodia tuber, thus it should focus on the development of characteristic agriculture. And a land of milk and honey, Hanzhong basin, is also the important grain and oil base in whole province. Southern Shaanxi economic zone has formed southern Shaanxi industrial belt of characteristic agriculture based on herbs, pigs, agriculture, silkworm, tea, edible fungus, and "double low" rape[3].

In terms of the industrial base of agriculture, farmland resource conditions, investment capacity of capital and the level of input of means of production, Tongchuan has no advantages, but it is close to Xi'an, with convenient transportation, and its advantages of geographic location will gradually loom large in the context of ceaseless development of the cities and counties surrounding Xi'an City, therefore, on the basis of continuous development of the fruit industry, it should strive to be the vegetable basket supply base in Xi'an.

Yangling scores little, because its economy is small, but the investment capacity of capital is strong. A great deal of capital-intensive facility agriculture clusters in Yangling which is as the state-level agricultural high-tech industrial demonstration zone. Yangling is limited by the size of economy, making it difficult to attract more investors, but as the promotion base of new technology, new varieties, and new crop modes, it plays a significant role in leading the exploration and innovation of modern agriculture in the province.

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subjects participate in, so as to ultimately promote the development of circular agricultural technology through the joint efforts of the visible hand (government) and invisible hand (market).

3 Conclusion

The circular agriculture is an inevitable choice for sustainable agricultural development, and the role of the government in building the technology system of circular agriculture is important. As the circular agricultural technology has characteristics and externalities of public goods, therefore, the government has also become the important main body of in the development of circular agricultural technology. In the development of circular agricultural technology, the government should play four roles well (leader, designer, organizer and regulator), to ensure that they do not cross the line, but be indispensable all the while.

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