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Research on the Motivations and Paths of Collaborative Technology Innovation for Chinese Creative Agriculture

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Abstract: Creative agriculture is the integration of modern agricultural technology and local culture. As the new emerging agricultural industry, it is regarded as an effective solution to solve the problems of environmental pollution and economics development in rural areas in China. It has been widely developed all over the country, in order to achieve competitive advantages, the creative agricultural companies are trying their best to carry out the projects of technological innovation, however, due to the limitation of the shortage of the innovation funds and the technical staff and the high risk of innovation, most creative agricultural enterprises finally choose a way of cooperative innovation. This paper will first review the theoretical and literary discuss and analysis about the creative agriculture and the cooperative technical innovation of this industry, by further exploring the motivations that why the creative agricultural organizations choose the way of cooperative innovation, the author put forward the paths for the cooperative innovation. The paper then concludes with some suggestions for the technical innovation of the creative agricultural companies.

Key words: Creative agriculture, motivation, path, technological innovation

INTRODUCTION

During the development of the traditional agriculture, chemical pesticides and fertilizers were widely used to maximize the production of the crop, however, this method lead to the deterioration of the ecological environment and also result in the growing shortage of agricultural resources. People gradually realized the serious problems, attention was paid to protect the ecosystem. They began to seek agriculture innovation, trying to find a type of agricultural production that is harmless to the ecological environment and is able to creative income for farmers at same time, for this sake, creative agriculture is put forward and introduced to the modern agriculture.

To produce novel commodity to attract the attention of the consumers by the application of modern agricultural technology is the main economics feature of creative agriculture. And to renew producing technology is essential to the development of the creative agricultural enterprise. In order to decrease the cost of technical innovation, to solve the problem resources shortage, to satisfy the market demand and minimize the spillover effect of the knowledge, the enterprises will select to cooperate with other parties to carry out the innovation projects. Universities and research institutions, competitive companies and consumers are three of the most important partner for the enterprises to cooperate with, because these parties will be able to provide the enterprises with latest technology, sufficient technological talents and innovation funds and the suggestions to improve the product is essential to the success of the innovation.

LITERARURE REVIEW

This part will explore the concept and the attributes of the creative agriculture and the research on collaborative technical innovation, collaborative technical innovation of creative agriculture, which will provide solid theoretical support for the following research.

Concept of creative agriculture: The word of 'creative industries' was first raised in 1997 when 'creative industry working group' was set up by British Prime Minister Tony Blair, the purpose to found the organization was to promote the contribution of human resources to the development of British national economics. This group put forward the definition of 'creative industry', that is any industries that are consist of individual creativity, technology and talent, the potentials and creating wealth and employment by knowledge creation and the usage of intellectual property. Creative Industry could be regarded

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as an industry without boundary by the understanding of its definition. As the new emerging industry and the development trend of modern agriculture, creative agriculture belongs to creative industry.

With the rapid modernization of Chinese agriculture, creative agriculture is playing an increasingly important role in the development of Chinese modern agriculture, since 2007, some research about creative agriculture had been carried out and different definitions of creative agriculture have been raised by various scholars. This study define creative agriculture as follow, based on creativity and intellectual property rights, stick to the business concept of 'production, life, zoology', integrating culture, art, technology in the production process, oriented by market demand and to solve the development problems of rural areas (Fig. 1).

Collaborative technology innovation: The technology innovation has experienced three phases, there are enterpriser centered technologic innovation, innovation by the cooperation of enterprises and national innovation system.

- **Stage 1: Enterpriser centered innovation:** The book of Schumpeter, 1912 'The theory of Economic Development' was published in 1912, the concept of 'innovation' was firstly raised by him. Schumpeter pointed out that innovation is to establish a new production function, to combine the production factors in a new way and trying to introduce the brand new production factors and production conditions to the manufacturing system. According to Schumpeter's view, innovation is the economic behavior that making a new combination of the old production factors. Schumpeter furthered his research and between 1934 and 1944, he put forward the interactive innovation theory which stressed the important of enterpriser during the process of innovation, the theory was regarded as the first stage of the technology innovation theory
- **Stage 2: Technologic innovation by the cooperation of enterprises:** The main attribute of the second stage in technology innovation is the emphasis of cooperation between enterprises. According to the research of Von Hippel (1986), effective innovation should be carried out by the collaboration of companies or the involvement of the final user, including suppliers, installers, producers and consumers. He indicated that in order to avoid the affect of 'sticky information', attention should be paid to the interactive innovation between enterprises or enterprises and users

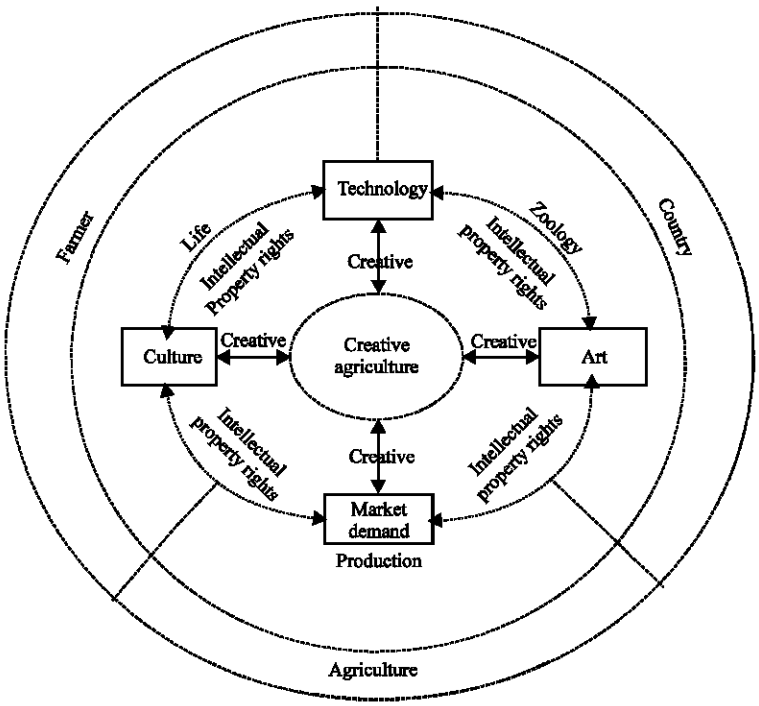

Fig. 1: Concept of creative agriculture

- **Stage 3: National innovation system:** The third stage of technology innovation is called national innovation system, it was original from the theory of economics and innovation and service for competition. 'National innovation system' was first raised by economist Freeman 1987 and till now, the research of national innovation system is mainly consisting of theory of national innovation system that put forward by Richard Nelson, research of national innovation system raised by Patel and Pavitt, theory of national innovation system put forward by Lundvall Bengt-Ake and Michael Porter's research of national innovation

Collaborative technology innovation of creative agriculture organizations: Gao (2003) argued that Chinese government had been playing the role of the leader for technology innovation for a long time, which made negative impact on the development of technology innovation. Along with the further reform of the science and technology system, various innovation modes emerged, some technology innovation are now leading by research institutes, universities and enterprises. According to Qijie Gao's view of point, the technology innovation could be carried out by the leading of one parties and the involvement of other parties and the key issue of the innovation is cooperation and the most important point for the cooperation is the requirement for the investment of human resources and the cooperation of innovation plan and decision making.

When it comes to the technology innovation of creative agriculture, Xia and Hou (2010) indicated that the strategy of technology innovation and cultural creativity is the new concept to develop creative agriculture. Now-a-days, information technology is widely used in many industries, the application of information technology would promote the development of creative agriculture. The latest technology, such as the virtual reality technology, model technology, multimedia information technology would promote the popularity of the science knowledge to the peasantry by the way of voice, image and video.

Wang and Zhang (2009) focused his research on the policy of science and technology for creative agriculture. He argued that the department of science and technology should emphasis their attention on the R and D of the technology for creative agriculture and the protection of property rights. And should also be concern about the project of science and technology, the transformation of the research achievements, construction of the research base, the professional assessment of the creative agriculture. It is necessary for the government to subside the cost of the patent application for creative agriculture.

MOTIVATION OF COLLABORATIVE TECHNOLOGY INNOVATION FRO CREATIVE AGRICULTURE ORGANIZATION

The application of the new technology ensures the constantly development of creative agriculture, therefore, technology innovation is essential to the development of this new industry. Many creative agricultural organizations does realize the important of technology innovation, they try their best to speed up the innovation of the technology, in order to achieve this target, most of them select the way of cooperation with other parties, the reasons why they make this decision would be stated below.

To decrease the cost of technology innovation: After carrying out the research on the feature of the organization that cooperating with other parties, Oliver (1990) concluded that cooperative innovation is the suitable path to increase the rate of return from assets, enhance the efficiency of the organization and reduce the unit cost of the product. Pisano (1991) pointed out that when the enterprise has the certain investment preference, a clear target of the project is essential for the enterprise to decide whether to cooperate with other organization or not.

Some scholars focus their attention on the research of how to minimize the cost of production and the deal, Sobrero and Roberts (2002) pointed out that the competition from the market or the cooperation with other companies would reduce the cost of product, enhancing the competitive capability of the company. Although creative agriculture has achieved great success in China, it is confronted with many problems now. As the creative agriculture organization are mostly small companies or farmers and it is not easy for them to get loan from banks, so they do not have enough money to carry out the big project of technology innovation, in order to enhance the competition of the creative agriculture, most of them prefer to collaborate with other parties, the cooperation would solve the problem of the money shortage, meanwhile, achieve the target of technology innovation.

To solve the problem of resource shortage: The resource of the external environment contributes to the implement of the technology innovation project, without the involvement of other parties, the creative agriculture organizations would not obtain enough

resource (talents, fund, equipment) for the innovation. The cooperation would enable them to acquire the key resource which is essential to the success of the innovation, at the same time, the threat of the project would be decreased to a minimized level. Moreover, all the participant members of the cooperation would reach their own goals. Furthermore, another benefit of the collaboration is to gather the complementary resources from various organizations and make full use of them.

Williams (2005) indicated that enterprises usually seek the organizational cooperation when they engaged in high cost, high risk innovation. And when an industry is constantly expanding and the base of the knowledge is comparatively complex, companies in this industry would also select the way of collaborative innovation to promote the transfer of knowledge. The creative agriculture enjoys high speed development in China, in order to maintain the growth, a lot of new technology is required. However, it is difficult to renew technology in this industry, because it needs various domains of knowledge. The difficulty and complexity of the innovation adds cost and risk to the companies, thus it is wise and suitable for the companies to apply the strategy of cooperation.

Uzzi (1997) argued that the recessive and proprietary knowledge could only be transmit among the cooperative organizations when all the parties fully involvement themselves into the cooperation, due to different purpose, various enterprises would choose diverse cooperative fellows, if the enterprises seeks the goal to reduce the costs and risk, it would looks for those partners that has the similar innovation resource, such as its competitors. And if the enterprise is looking for the partners which could effectively manage the technology, then it would prefer to cooperate with those organization that have the complementary innovation resource, such as the universities and the public research institutions. Chinese creative agriculture companies could choose either way of technology innovation on the basis of their own situation.

To satisfy the market demand: Schmookler (1966) pointed out that the demand is more important than the advancement of knowledge to promote the invention. The change of the sales and the profitability enhance the investment in research and development. The empirical studies of Utterback (1996) showed that 60-80% of the important innovations are brought about and pulled by demand. Nicholas (2007) held the view that in the environment that various demand expanding dramatically, the competition between the large transnational enterprises promote the rapid advancement of the technology. Porter (1990) indicated that the scale of domestic demand can help manufacturers to establish a competitive advantage and the character of the domestic buyers is more important than the scale of the market, the sophisticated and fastidious purchaser would propel the manufacturers to improve and innovative the products continuously.

Researches of the above scholars have shown the important of demand to the innovation of technology. Tracing the development process of creative agriculture, demand had played a significant role for its technology innovation. Creative leisure agriculture is the early mode of creative agriculture, it was firstly appeared in France in the year of 1855 during the period of the first industrial revolution, at that time, the industrial revolution had made great contribution to the development of the social economics, however, the widely use of coal released a large amount of soot, sulfur dioxide, carbon dioxide, carbon monoxide and other harmful pollutants at the same time, the living environment of human beings had been dramatically polluted in cities, people's health was threatened. The dignitaries lived in the city was eager to experience the lifestyle in rural area, then in 1855, a French national senator called O'Barr took some aristocracy to the countries in Paris suburbs, they live, work and eat together with the farmers, experiencing the charming of the nature. Then the creative leisure agriculture was introduced to other European countries and was developed rapidly. Along with the development of the first and second industrial revolution, much new technology was brought about, in order to satisfy the great demand of the domestic consumers, much of those technologies were applied to the development of creative agriculture.

Now-a-days, the situation of China is similar with that of European countries in mid nineteenth century. With the rapid development of Chinese economics, the living standard of Chinese people have been improved greatly, but every coin has two parts, the environment has been polluted tremendously, because the government did not pay much attention to the protection of the environment, due to the continuous deterioration of the environment, the citizen are eager to escape from city, the creative agriculture is full of creativity and it is environmental protection, these attributes suit the needs of the citizen, thus a great amount of domestic demand emerge, the demand is one of the most motivation that drive the development of Chinese creative agriculture. Furthermore, the consumers in China now are becoming more sophisticated and fastidious, these factors would add the competition between creative agriculture companies and would also conduce to the innovation of related technology.

Spillover effects of technology promote the collaborative innovation of the enterprises: Wei Luo (2001) argued the theory of industrial organization explain the reasons why the companies carry out the project of innovation by the way of cooperation. As the spillover effects exists in the technology and the patent system could only protect the patent effectively, therefore, it is little likely for the companies to monopolize the technological achievements of the R and D projects, this would decrease the innovation enthusiasm of the enterprisers, lead to the result that the investment for technology innovation be fewer than the social optimal investment. Therefore, the government should provide more subsidies for the technology innovation and enhance the protection of the patent, however, this action seems not very feasible because it would intervene the market mechanism.

From the perspective of the industrial economics, cooperation and innovation have the following effects: (1) Cooperation possesses the function of internalization of external effects which would increase the R and D expenditures of the members. (2) Cooperation innovation eliminates the duplication of research and investment, the allocation and the sharing of the knowledge, the synergistic effect of the enterprises would enhance the efficiency of the innovation. (3) The joint investment of the members enables the cooperative organization to accomplish those big research projects that could not be fulfilled by a single company. For Chinese creative agriculture companies, in order to avoid the loss from the spillover effects of technology and raise enough money for the big innovation research, to cooperative with other organizations is the best choice for them.

PATH SELECTION OF COLLABORATIVE TECHNOLOGY INNOVATION FOR CREATIVE AGRICULTURE ORGANIZATIONS

The above analysis has shown the research achievement for the cooperative innovation of creative agriculture enterprise and also explores the motivation of the cooperation. From these analysis, we find three paths that how enterprises carry out the research project and achieve their innovation targets.

Figure 2 shows three different paths of cooperation that creative agriculture organization may select to carry out their innovation project, the partners that they may choose are universities or research institutions, competitors, government. AB, AC and AD show the path of cooperation respectively, it is the process of integration of internal and external resources.

Collaborative with the universities or research institutions: Lu (2002) pointed out that the innovation resources of the companies and universities or research

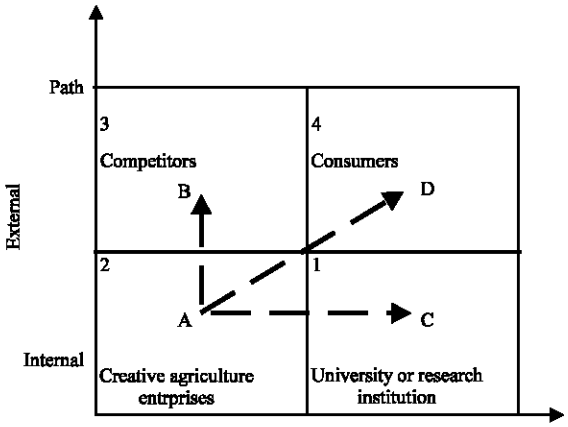

Fig. 2: Path selection of collaborative technology innovation for creative agricultural organizations

institutions are of high complementary and interdependent. The cooperative technical innovation is such kind of cooperation that with a target of technology innovation between academia and industry. It is oriented by the market demand, starting with the research of the academia and then after the successful market sale by the industry, achieving the innovation goals in a high-tech level finally. The essence of the cooperation between enterprises and research institutions is actually an activity of transaction based on the transfer of knowledge. In the environment of market economics, knowledge has the same attributes as other products, it could be freely exchange. The collaborative innovation is a transaction process to achieve the goal of value enhancement in a high efficient way.

Cooperate with the universities or the research institutions is one of the best ways for creative agricultural companies to carry out their technical innovation projects, because in China, it is stated that 80-90% of the science and technology resources are distributed to the universities and research institutions, the research of the universities and research is playing a significant role in the improvement of capability for technological innovation in China. The advantage of the universities is that it is a concentration of intellectual resources and they have a large number of high-level teaching and research talents. Moreover, there are comprehensive disciplines in the universities and it is the important source of power for technological innovation which makes great contribution to the development of modern technology.

When cooperating with the research institutions, creative agriculture companies should fully integrate both technical and marketing resources of all the involvement parties and try to improve the ability to grasp the demand of the market, which is essential to the success of the innovation projects. When it comes to the cooperative

modes, there are several ways for creative agriculture companies to cooperate with the research institutions. (1) Building an engineering and technical center, the center would be able to provide the enterprises with the needed research talents and achievements from the universities, which would be more effective than the single and temporary cooperation. (2) Establishing a shared laboratory together that operated by a professional research company which is responsible for the employment of required professionals and the training for the company employees. (3) Founding a high-tech enterprise and the universities could get their company shares by the investment of their technology.

Collaborative with the competitive firms: Zilong and Qingmei (2004) argued that it is much more difficult for modern enterprises to achieve technology or product innovation, especially those IT products that are consist of high technology which generally require various advanced design technology, manufacturing technology and quality assurance technology during the developing process. Those projects call for large amount of investment, but the risk is increased at the same time, the effect of technology spillover would be more obviously and the cooperative innovations between companies would enable them to avoid the repeatability of the R and D project and the high risk, thus improving the efficiency of the innovation.

Compared with the cooperation with the agricultural universities and research institutions, the cooperation among creative agriculture enterprises enjoys a lot of merits. To begin with, it would conductive to the establishment of a better contact between the market demand and the innovation activities, enhancing the effect of industrialization of the innovation achievement, thus creating economics and social benefits. Furthermore, the mode of technological innovation between creative agricultural firms would also help these enterprises to change the situation that obtaining new technology solely from the outside environment. Thirdly, the cooperation would also help the companies to cultivate a sense of innovation and risk awareness as well as the improvement of the capability for the management of innovation, meantime, the overall technological level of the company would be enhanced distinctly which is essential to the construction of competitiveness for creative agricultural companies.

Collaborative with the consumers: All the innovation projects need to focus on the needs of customers in the market. Franke and Shah (2003) pointed out that the customers plays an significant strategic role in the process of cooperative innovation. The expectations and demands of the customers are the starting point of the innovation network and the end point for the innovation to achieve the targets of market-orient and create the market value for the products. The expectations and the demands are also the originals of the cooperative innovation which produces great influences to the innovation project. In the traditional innovation mode, the companies usually exploit the knowledge of the users without the involvement of the consumers, however, new concept of 'create knowledge together' is introduced to the process of the cooperative technical innovation between companies and consumers.

For creative agricultural companies, they should pay attention to the feedback of the customers, which would conduce to the improvement of their products. It is necessary for creative agricultural enterprises to establish a partnership with their consumers and hire them to participate in the process of technology innovation. During the process of cooperative innovation, all the involved parties need to assume different responsibilities, risks and tasks. The responsibility and task of the consumers is to provide improvement suggestions for the products which is an important reference and standard for the innovation project. Only the product accepted and identified by the customers can the creative agricultural enterprises acquire market demand. Especially in the market which is filed with diverse customer needs, enterprises need to pay more to serve the majority of customers. When the creative agricultural companies are conducting a R and D project, the requirements and suggestions of the consumers for innovation should be taken into account during the process of cooperative innovation, therefore, the companies should try their best to make the consumer to be fully involvement in the innovation. The participation of the users would provide a wider range of knowledge resources and more opportunities for innovation.

CONCLUSION

This study has attempted to provide a broad overview of the motivations for the creative agricultural companies to carry out the cooperative innovation projects and also put forward some cooperation paths that are conduce to the enhancement of the efficiency of the innovation. As we have seen, enterprises in other industries have achieved their business success by the strategy of cooperative innovation. As a new industry, the technical innovation process is similar with other high developed industries, new industry always confront with the difficulties of the shortage of funds and talents, it is

too weak for them to take any failure risk of the innovation. Creative agricultural firms will beneficial from the cooperation with universities and research institutions, competitive companies and consumers, these organizations are able to provide them with the complementary innovation resources. However, how to carry out the cooperation and what kind of role they are going to play in the cooperation are the key points should be taken into account by the involvement parties. Moreover, Chinese government has shown great interests in creative agriculture industry, as we know, the government is sufficient in investments funds and it is playing the role of policy-making, therefore, seeking to cooperate with the government for technical innovation may be another choice for the creative agricultural companies.

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