



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# Analysis of Impact Factors on Agricultural SMEs' Technological Innovation Capacity——Case Study of Wenzhou City

LI Yan-yan<sup>1\*</sup>, ZENG Wen-jin<sup>2</sup>

1. Wenzhou Vocational College of Science and Technology, Wenzhou 325000, China; 2. Wenzhou Agricultural Bureau, Wenzhou 325000, China

**Abstract** The paper investigates impact factors of agricultural SMEs' technological innovation by questionnaire on the survey of more than 100 agricultural SMEs of Wenzhou City of Jiangsu Province. It selects 14 major factors that influence agricultural SMEs' technological innovation, they are capital source, enterprise culture, support from leaders, government policy support, effect of key research personnel, communication inside organization, enterprise strategy, technological development level, organizing and coordination inside organization, related information acquisition capacity, external cooperation, association and communication with consumers, change of external market and incentive measures to research personnel. Putting these factors in introductionance ordering by scores, we find out comparatively big impact factors influence agricultural SMEs' technological innovation among them, they are technological development level, incentive measures to research personnel, capital source, government policy support and enterprise strategy. The paper also puts forward corresponding measures and suggestions; further enhance innovation consciousness and improve technological innovation level of agricultural SMEs; increase incentive measures, strengthen construction of talents team of technological innovation; express scientific research strength of local scientific research institutes and agricultural institution of higher learning, realize integration of industries, universities and research; sound government guiding and pushing mechanism, improve new policy environment of agricultural SMEs' technological innovation.

**Key words** Agricultural SMEs, Technological innovation capacity, Impact factor, China

Along with the arrival of knowledge economy age, competition among enterprises changes from extensive price competition to scientific and technological competition. Through improving hi-tech innovation capacity of enterprises, accelerate to renovate conventional industries and open up new industries depended on advance of science and technology, and provide great support for restructuring economy and transforming economic growth pattern. Through improving technological innovation capacity of enterprises, strengthen enterprises' ability to develop independently, and provide introductionant guarantee for improving economic competitiveness and anti-risk capability<sup>[1]</sup>. As the main part of agricultural technological innovation, SMEs have strengths of many patents and inventions, extensive aspects of technological innovation, high innovation efficiency, flexible mechanism, strong adaptability to changes, variety of technological innovation, universality of technology sources and so on, but due to the weakness of universally weak consciousness of technological innovation, shortage of technological talents, low level of technological innovation, capital shortage caused by difficult capital raising, comparative weak intellectual property protection, insufficient technology and science support from the State, the improvement of innovation capacity of SMEs is restricted<sup>[2]</sup>. In order to study the main factors influence agricultural SMEs' technological innovation, the author takes SMEs of Wenzhou area as the research sam-

ple, puts these factors in introductionance ordering by scores, finds out comparatively big impact factors among them, and puts forward corresponding measures for improving technological innovation level of agricultural SMEs.

## 1 Selection of target, data sources and research method

**1.1 Selection of target** At the time of designing survey target, according to analysis of existed literature and related theories, we select fourteen options-capital source, enterprise culture, support from leaders, government policy support, effect of key research personnel, communication inside organization, enterprise strategy, technological development level, organizing and coordination inside organization, related information acquisition capacity, external cooperation, association and communication with consumers, change of external market and incentive measures to research personnel, these generally summarize major factors that influence agricultural SMEs' technological innovation capacity.

**1.2 Data sources** Questionnaire survey is taken by the research, it investigates more than 100 agricultural SMEs in Wenzhou from July 1, 2010 to July 20, 2010, the scopes of business include processing, cultivation, food and planting industries, the number of employees is 15 to 300, annual production value is under 20 million RMB. Questionnaires given out are 120 pieces, with 118 recovery and 114 effective questionnaires (the questionnaires are all filled in by department managers and principals of enterprises). The effective rate is 90%.

**1.3 Statistical method** The survey requires that the surveyed people score the target according to its influence degree, the most introductionant one is one point, the second introduc-

Received: August 10, 2010 Accepted: September 6, 2010

Supported by the Scientific Research Program of Zhejiang Province Education Bureau in 2009 – "Research on the Agricultural Technological Innovation System under the Industrial Technological Innovation Alliance Mode of Trilateral Linkage" (Y200909290).

\* Corresponding author. E-mail: frankspiggy@qq.com

tionant one is two point, and so on. Based on practical situation, some enterprises will not just choose one target, so we permit multiterm options and equal introductionance of several terms. In order to better reflect practical situation, use the total points of one option (sum of evaluated points from enterprises selected the target, take technological level as an example, there are 101 enterprises select this term, its total points are the sum of evaluated points got from the 101 enterprises) divide its selected times, the average score of the target is got, at the same time, we figure out the selected rate of the target (selected times divide sum of enterprises, the sum in this statistics is 114), finally, use average scores dividing selected rate

to get the ultimate scores, the smaller the ultimate score is, the more introductionant the target is. Average score reflects the introductionance of the selected term, selected rate reflects universality of the selected term. That means only the target which is universally acceptable and introductionant can reflect the key factor that influence enterprises' innovation capacity<sup>[3]</sup>.

## 2 Results and analysis

According to the data from questionnaire, using the statistical method introduced in 1. 3, statistical result is got by figuring (Table 1).

**Table 1 Table of impact factors on Agriculture SMEs' Technical Innovation Capacity**

Options	Total points	Selected times	Average score	Selected rate	Ultimate score	Ranking
Capital source	262	103	2.54	0.90	2.82	3
Enterprise culture	354	91	3.89	0.80	4.86	7
Support from leaders	342	85	4.02	0.75	5.36	8
Government policy support	252	85	2.96	0.75	3.95	4
Effect of key research personnel	360	98	3.67	0.86	4.27	6
Communication inside organization	486	83	5.86	0.73	8.03	13
Enterprise strategy	276	89	3.10	0.78	3.97	5
Technological development level	222	101	2.20	0.89	2.47	1
Organizing and coordination inside organization	432	86	5.02	0.75	6.69	11
Related information acquisition capacity	342	85	4.02	0.75	5.36	8
External cooperation	402	85	4.73	0.75	6.31	10
Association and communication with consumers	474	76	6.24	0.67	9.31	14
Change of external market	474	85	5.58	0.75	7.44	12
Incentive measures to research personnel	204	97	2.10	0.85	2.47	1

From Table 1, we can know that technological development level, incentive measures to research personnel, capital source, government policy support and enterprise strategy are the major factors that influence agricultural SMEs' technological innovation, they rank the former five place in all the options; there respectively have 101 and 97 enterprises that consider technological development level and incentive measures to research personnel as the most introductionant factors, this is similar to research conclusions from some domestic scholars<sup>[4-5]</sup>. Seen from the attention paid to research talents, majority of enterprises rank incentive measures to research personnel and effect of key research personnel in former place, they are relatively the first and the sixth. It shows that most enterprises have already realized the key effect of talents in technological innovation, cultivation of research talents and utilization and construction of incentive mechanism are the key links of enterprises' technological innovation.

In sharp contrast to the above, most of enterprises think that, in technological innovation activity, association and communication with consumers, communication inside organization and change of external market are no so introductionant. It shows that the emphasis of most agricultural SMEs is input of technology and internal research. The resources of enterprises' innovation mainly come from enterprises themselves or interior of business conglomerate, innovation activities are mainly completed by their own strength, less using external resources. It shows that, in the process of innovation, agricultural SMEs have problems of insufficient utilization of external research strength and undertightened combination of industries, universi-

ties and research institutes. However, under the overall situation of bad foundation of agricultural enterprises and weak accumulation of technology in our country, SMEs are hard to form strength of sustainable development and innovation of technology, and difficult to substantially improve technology competitiveness and innovation capacity in a short time.

In conclusion, majority of enterprises think that technological development level, incentive measures to research personnel, capital source, government policy support and enterprise strategy are the major factors that influence agricultural SMEs' technological innovation, enterprise culture, support from leaders and related information acquisition capacity are not very introductionant, and external cooperation and introduction of technology are not paid attention to or even opposed by most enterprises, they think technology research should give first place to interior, introduction of external technology is high-risk and high-cost.

## 3 Measures and suggestions

### 3.1 Strengthening innovation consciousness of agricultural SMEs, improving technological innovation level

Technological innovation is the inherent driving force of development of agricultural SMEs, concept innovation is precondition of agricultural technological innovation. At present, our agriculture is in the period of transforming from traditional agriculture to modernized and sustainable agriculture. It is necessary for agricultural SMEs to further improve cognition of technological innovation in agricultural development and establish new concept of agricultural technological innovation. We should increase scientific and

technological input, guide enterprise to be the main body of technological innovation, persevere in combination of foundation innovation, integration innovation and innovation after introduction, digestion and absorption. Through the combination of production, teaching and research, push forward innovation after introduction, digestion and absorption. Transform traditional competitive agriculture by using hi-tech and advanced appropriate technology. Form a batch of well-known brands with proprietary intellectual property rights and competitive industries or enterprises with core competitiveness. Improve marketing competitiveness and level of leading industry with independent innovation. Build new system of agricultural technological innovation with local attraction.

**3.2 Increasing incentive measure, strengthening construction of talent teams of technological innovation** Agricultural SMEs' technological innovation rely on talents cultivation and incentive measures. So, it is necessary to cultivate and retain high-quality talents, especially inter-disciplinary talents that are good at science and technology, management and operation. Cultivation of innovation talents mainly needs to build and improve mechanism which is good for talent showing itself. First, government departments at all levels and agricultural SMEs should dare to break through all kinds of restrictions when build incentive mechanisms. To the excellent staffs who have brilliant contribution in technological innovation and commercialization of research findings and create great economic benefit for enterprises, enterprises and government departments at all levels should reward them greatly. Through incentive mechanism, arouse innovation enthusiasm of scientific and technical personnel, lead them to develop competitive products. Secondly, vigorously strengthen construction of talent teams of agricultural technological innovation. Enhance cultivation and introduction of agricultural research talents, put forth effort in cultivating agricultural technological management backbone and high-quality technological cadres at basic level. Third, optimize resource integration. Improve service system for high-level technological innovation talents. It includes further educational training system and technology spreading system for high-level technological innovation talents. We should explore operation and management mode of further educational training and knowledge renewal training for high-level technological innovation talents through integrating existing educational training resources and innovating methods and measures of talents cultivation. Meanwhile, we can work out preferential policy to attract and encourage high-level technological innovation talents to go deep into the first line of enterprises and countryside, and carry out various surveys to provide technological and intellectual support for development of high-level technological innovation talents.

**3.3 Expressing scientific research strength of local scientific research institutes and agricultural institution of higher learning, realizing integration of industries, universities and research** The increasing improvement of socialized cooperation of enterprises' production is the tendency of development of world economy. The relationships among enterprises are not only competitive, but more important are cooperation. It said in *Handbook for Technology Import in Developing Coun-*

*tries* compiled by United Nations Industrial Development Organization that the basic principle for technology import to follow is: "Technology import must be effectively absorbed as soon as possible, and make it adapt to local conditions. Digestion, absorption and innovation should be the key link in overall process of technology import. Technology import lacking of digestion, absorption and innovation appears as insufficiency in socialization and industrialization of technology. Such kind of technology has a low effect and bad spreading effect, and also cannot improve integral technological level of the area<sup>[6]</sup>. Research institutions and universities have advanced research instruments and strong research strength. And their achievements in scientific research need to transform into real productivity through enterprises platform. One the one hand, we should substantially support agricultural SMEs' investment in research institutes and joint project of industries, universities and research in universities to cooperate for research and development. On the other hand, we should push forward technologies of universities and research institutes to transform into agricultural SMEs, encourage research talents in institutes to step into enterprises and go deep into market, and give talent, information and technology support for agricultural SMEs' technological innovation.

**3.4 Sounding government guiding and pushing mechanism, improving new policy environment of agricultural SMEs' technological innovation** Government is an important participant in innovation activities, its biggest function is providing policy guarantees and building innovation environment. Government should guide and push enterprises' innovations through macropolicy, and work out related laws, regulations and laws to provide fair environment for agricultural SMEs' technological innovation, protect new techniques and patents and legitimate interests of agricultural SMEs. Through preferential tax policies, encourage agricultural SMEs to increase input to promote development of enterprises' technological innovation. At the same time, we should enhance construction of science and technology consulting service agencies and scientific and technical information platform, improve service system for technological innovation, increase technological information publish, broaden channels of technological information publish, improve work condition and service measures, strengthen cultivation of consultation service talents, enhance quality of consultation service and perfection of information platform to make favorable external environment for agricultural SMEs' technological innovation.

## References

- [1] DAI ZS. Analysis on the factors influencing the sci-tech innovation ability of municipal enterprise and the countermeasures [J]. *Sci-Tech Information Development & Economy*, 2008, 18(6):162–163. (in Chinese).
- [2] CAO CZ, LUO CS. Analysis on strengthening the agricultural sci-tech innovation to promote modern agriculture development—taking Beijing City as the example [J]. *Journal of Anhui Agricultural Sciences*, 2010, 38(1):390–392. (in Chinese).
- [3] GUO MH, YANG XD. Small and medium-sized enterprises' scientific innovation in the new situation [J]. *Journal of Jiangxi Institute of Education*, 2009, 30(6):62–65. (in Chinese).

of natural ecological environment. Evaluation of land resources, water resource, climate resources and variety resources of main agricultural products are all established on the basis of quantitative analysis. And specific data base of agricultural resource is built to realize dynamic management. So, the determined production areas of characteristic agricultural products are all the best. Characteristic agricultural products areas are also fully considered regional conditions of production place. Selection of agricultural ecological zones are established on the basis of theories like economic geography, resource economics and so on to make selected areas not only can produce high-quality agricultural products but also can produce and sell agricultural products in a comparatively low cost and have strong competitiveness. Scientific agricultural ecological zoning plan is the basis of natural possibility and economic feasibility of development of fine agriculture. Characteristic agricultural products determined by this standard in Liaoning Province often have strong development potential. For instance, dairy products produced in some high-quality production area of animal by-products have already grown from regional brands to influencing products of the whole country in a short time.

### 3.3 Multi-input mechanism guiding by government is the key of formation of agricultural packing effect

In order to make natural condition advantage of agricultural ecological zone transform into comparative advantage of economy, it is necessary to realize effective collection of resources for production. This kind of collection should take different resource combination form according to different functions in each zone. Ecological zone with function of grain safety guarantee, government resources should express important effect to provide fine infrastructure and technology service for grain production and give compensation for positive externalities for society provided by grain producers. To ecological zone with other functions, we should fully express leading function of peasant household and enterprises, especially intensify driving force of leading enterprises of characteristic agricultural products and realize dependable crop and increment of peasant households in the areas. In the aspect of cultivating leading enterprises, government should, on the one hand, attract private capital to enter into selected agricultural zones through policy preference in the aspects of tax, land, plan and so on, on the other hand, take finance discount to guide financial industry to provide enough financial support for enterprise development. Liaoning Province just has taken the measures of setting specific technically improvement and interest subsidies fund for processing industry of agricultural products to promote development of agricultural business model of "leading enterprise + production base + intermediary organization + order from peasants". To the investment

guidance of peasants in the agricultural ecological zone, we can also express demonstration effect of demonstration households. In ecological zone of green house vegetables, Liaoning Province exactly is by means of construction of specialized village of "One Village One Product" and demonstration area of safe production to realize overall spread of some key projects<sup>[4]</sup>. These measures can lead capital collection with less financial capital and improve allocation efficiency of financial capital.

### 3.4 Making integrated agricultural industrial chain is the guarantee of realizing industrialization of ecological zone

Ecological zoning plan determines natural conditions foundation of agricultural development, but in order to realize agriculture revitalization, it is also necessary to break through development patterns with production as the main part. To characteristic agricultural products, we should bring the whole industrial chain of research, production, logistics and *etc.* into development plan to be the supporting object. In this way, we can get rid of disadvantageous position of agriculture of old industrial bases in industrial chain and realize industrialization of high additional value. On the basis of ensuring support for production, Liaoning Province has attached more importance to integration of spread of agricultural scientific research, logistic construction of agricultural products and market development. So, rapid development of agriculture also has vigorously pulled development of related industries, especially some modern service industry. Under general situation, tertiary industry of large agricultural province is relatively backward. If we pay attention to constructions of service industries in earlier stage and latter stage of agricultural production in the process of agriculture revitalization, it can improve transaction conditions between local agricultural products and external economic entity, and also can express absorbing effect of related service industries to agricultural surplus labor power, refine industries division, and make organic combination of optimization of agricultural development, peasant income and the whole economic structure.

## References

- [1] GAO WS. Macro analysis approach and application on agricultural system [M]. Beijing: China Agricultural University Press, 2009:5–8. (in Chinese).
- [2] LIU HX. Research on rural economic development of Liaoning Province in 2008 [M]. Shenyang: Liaoning University Press, 2008:168–237. (in Chinese).
- [3] LIU HX. Research on rural economic development of Liaoning Province in 2007 [M]. Shenyang: Liaoning University Press, 2008:183–276. (in Chinese).
- [4] YANG MH. Analysis on the support theory and policy of leading enterprise of agricultural industrialization [M]. Beijing: Economic Science Press, 2009:210–231. (in Chinese).

(From page 12)

- [4] PI S. Main problems and countermeasures in the construction of agricultural technology innovation system in China [J]. Journal of Hunan Financial and Economic College, 2009, 25(1):59–62. (in Chinese).
- [5] WANG Q. Scientific and technical innovation and its system construction in China's processing industry of agricultural products [J].

Agricultural Science & Technology and Equipment, 2010 (1):3–5. (in Chinese).

- [6] United Nations Industrial Development Organization. A guide to the introduction of technology in developing countries [M]. Beijing: Scientific and Technological Literature Publishing House, 1985. (in Chinese).