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STRATEGICAL ANALYSIS OF ACCELERATING THE DEVELOPMENT AND INNOVATION OF CHINA AGRICULTURAL EQUIPMENT INDUSTRY: A CASE OF SHAN DONG PROVINCE

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ABSTRACT This paper analyzed the present situation and obstructive factors of Shandong province agricultural equipment industry, and the type of indigenous innovation during the developing of Shandong agricultural equipment industry ,discussed the coupling mechanism of industrial clusters using empirical analysis on Shandong equipment manufacture industrial clusters1, and brings forward several countermeasures to promote the equipment manufacture industrial cluster coupling in Shandong province. Suggestions on how to improve innovation capacity by building innovative technology systems and the service systems as well as by selecting the model of indigenous innovation are discussed.

Keywords: Agricultural equipment, industrial clusters, development pattern

1 INTRODUCTION

Shandong is the major province where the possessing of agricultural equipment, the level of agricultural mechanization and the output value of agricultural equipment industry are all at the first places of the whole country, In 2004, the output value of the agricultural equipment reached 45.6 billion Yuan and covered over half of that of the whole country, till 2005, reached 49 billion Yuan, the total power 91 million kilowatt, produced the tractors of 2,060,000, which all increased 44.6%, 30.9% and 29.8% respectively, and the integrated level of agricultural equipment reached closely to 70%. Till 2006, the value of agricultural equipment reached 5.21 billion Yuan, covered 40% of that in the country. Many products such as engine, tractor, low-speed vehicle, combine and pump cover 40% of that in the country, some even reached 80%, and occupancy and coverage are all at the first place in the whole country for many years. The comparison between the value of agricultural equipment in Shandong and that in the country is showed as Fig.1; clearly describe the important position of agricultural equipment manufacturing industry in the whole country.

At present, in the world market the demand for agricultural equipments is also increasing, such as in Middle Asia, Southern Africa and Africa countries, the equipment manufacturing industry is relatively weak. Among all those imported electromechanical products, agricultural equipments cover more than 50%. This is an excellent chance for agricultural machinery manufacturing enterprises of our province. So how to seize the

opportunity to accelerate innovation and development of Shandong's agricultural machinery manufacturing industry, how to keep all along leading position of agricultural

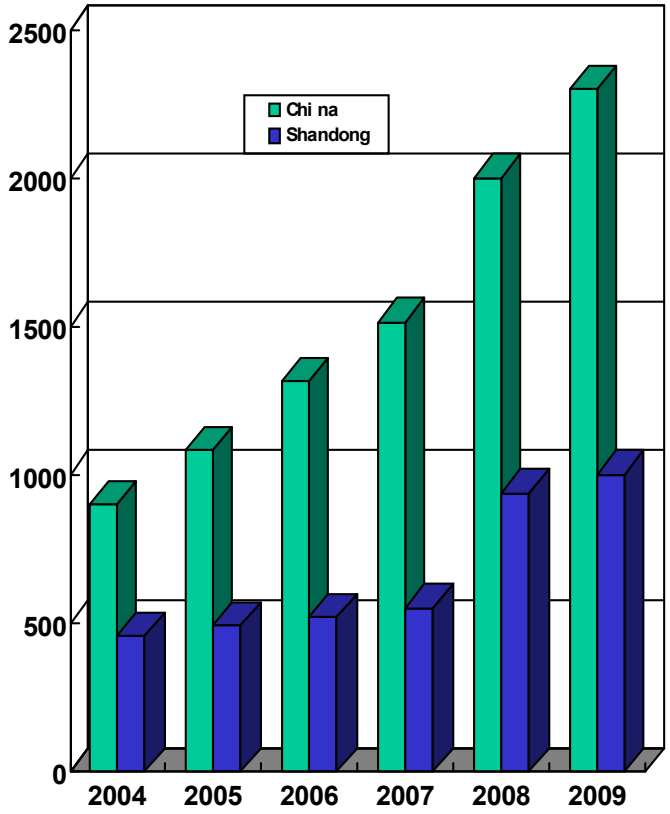

Figure 1 Comparison between the value of agricultural equipment in Shandong and that in the country

mechanization in Shandong Province, how to bring up a batch of key agricultural equipment enterprises and enterprise clusters around core enterprises, and how to improve the competitive power of agricultural equipment industry in Shandong, so as to support the plan about strong province of agricultural equipment industry. All these have significant meaning.

2 TO QUICKEN THE DEVELOPMENT OF PRIORITY TECHNOLOGY AREA FOR AGRICULTURAL EQUIPMENT INDUSTRY IN SHANDONG

View on the multi-function agricultural equipments and facilities supported by National Science and Technology Planning Project in the eleventh five-year, which is started by the Ministry of Science and Technology recently, the main developing direction of agricultural equipment is to guarantee agricultural products and benefits increase, to promote efficient utilization of natural resources and sustainable development, to consolidate food safety, and to innovate and promote agricultural equipment industry by means of intelligentize and informatization. The main emphasis should be put on the study about key generic and technology such as the design of digital agricultural equipment, reliability technology and critical technology and equipment of important

products. Specific as building new village in Shandong, the major development and popularization of agricultural equipment and technology during the 11th Five Years are as follows: 1) to realize techniques of corn harvesting mechanization with regardless of the row of cornstalk macerator, and to realize trans-regional operation of farm machinery. 2)To develop equipment production technology for root and stem crops mainly referring to peanut and garlic harvesting and planting potato. 3)To develop equipment production technology for developing vegetable and fruits in factory greenhouse. Mainly referring to the technique of vegetable seedlings and transplanting and mechanized harvest. 4) to develop equipment technology of quality and safety production of farm products such as farm products origin storage, classification and initial processing. 5) To develop technique equipment for sustainable and efficient utilization of natural resources and continuous development of agriculture.

As agricultural equipment industry in Shandong does not only need to meet the demand for the local agricultural production, but also needs to face the domestic and overseas markets, overall consideration must be made while choosing technology and products development. Production equipment for regional economic plants, such as peanut, and garlic, must be imported and developed accurately, so as to form its production capability on large scale as soon as possible. As for corn combine harvester, technique reserve and production capability in Shandong are all at the first place of the country. At present, it is necessary to unify technology standard of products, share national achievement of science and technology, be integrate production capability, divide work by specialization, decrease cost of products, and improve reliability of product operation, so as to make corn combine manufacturing extended and tightened, and have the national production base and the research center of corn combine established in Shandong. The development of production equipment for vegetable and fruits in factory greenhouse should be strengthened, so as to meet the demand for future market, while pump, power machine, spraying machine and garden equipment still keep the first place in our country and import is further enlarged.

With constructing an environment friendly and resources-saving society and developing economical agriculture, the economical agriculture production system, environmental protection system and corresponding technology assurance system must be set up. In order to increase efficiency in utilization of soil, fertilizer, water, seeds and pesticide, it is necessary to apply informationization and intelligentization to agricultural equipment developing, so as to upgrade level of standardization and intelligentization of agricultural equipment. Therefore, it is necessary to strengthen the development of intelligent, precise energy-saving agricultural equipment so as to increase input and output efficiency of natural resources and energy, to make agricultural equipment industry in Shandong owe capability of sustainable development and calmly face market competition both at home and abroad in a long run.

3 TO QUICKEN THE DEVELOPMENT OF TECHNOLOGY INNOVATION SYSTEM OF AGRICULTURAL EQUIPMENT IN SHANDONG

As technology innovation of agricultural equipment is constrained by the natural law, biological law and economic law, large investment and long time are needed, bearing quite big risk, the support and involvement of government is quite necessary. At present, the development of agricultural equipment in Shandong is faster than the other areas in the whole country, but problems still exist such as scientific research achievement and

market disjointed, low efficiency of research and development investment, lack of integration of scientific force and low level of scientific research innovation, etc. On the drive of market economy law, agricultural equipment enterprises, universities and institutions all have desire to reconstruct system of agricultural equipment technology innovation, so as to achieve joint development and win-win by means of adjusting methods such as the government's scientific and research policy guide and support fund.

The enterprises and institutions in Shandong have made a great effort in constructing technology innovation platform with the enterprises as the subject, the market as the guide and a combination of production, learning and research. On the 10th of June, 2007, Shandong Shifeng Group, Wuzhen Group, Futian Leiwo Heavy Industry and Shandong research Institute of Agricultural Machinery all joined Strategy Alliance in Technology Innovation of Agricultural Equipment Industry, which integrated the advantages of sci-tech resources in agricultural machinery industry of the whole country, advanced manufacturing competence and talent industry to promote sustainable innovation capability of this industry. The platform of research and development founded by the alliance can efficiently solve the problems of technology and industrialization with the development of the industry, thus, providing solid foundation for developing agricultural equipment industrial clusters. This operating model of state technology innovation system will give demonstration and promotion effect on constructing technology innovation platform at different levels of agricultural equipment manufacturing industry in Shandong. Shandong Engineering Research Center for Plant Harvester founded by Juming Group and Shandong Engineering Research Center for Farm Wagon by Jufen Group are the typical examples of cooperation between college and enterprises. The establishment of engineering research center optimized the scientific research resources' allocation, clarified orientation of development of products, and could develop new products according to the demands markets, so it is an effective form for settling the problem of input of scientific research separated from market. So the construction of technology research center, which has a clear main direction of attack, prominent core organization, clear regional labor division, ,and scientific management and efficient operation, is the guarantee for the leading agricultural machinery enterprises to keep the advantage for quite a long time.

On the other hand, it is necessary to cultivate technology intermediary agency vigorously and improve technology service system for small and middle enterprises. As the numbers of agricultural equipment manufacturing enterprises in Shandong is big with production scale large or small, many small and middle enterprises are quite weak in technology innovation capability and nuclear competitiveness, so it is still necessary to establish technology innovation system with various forms and flexible operation, such as technology market, regional technology service center and information database of expert's technology service etc., if the whole industry should speed up its development. The government should also guide various serving organizations of technology innovation to carry out open management, to realize network organization, function of socialization and service industrialization while develop services such as marketing information service energetically, technology and management consulting, evaluation of technology and property rights, technology brokerage and risk guarantee, etc., so as to construct multi levels serving system of technology innovation for small and middle enterprises.

4 TO DEVELOP AGRICULTURAL EQUIPMENT MANUFACTURING INDUSTRY CLUSTERS AND TO REALIZE EXCELLENT ALLOCATION OF MEANS OF PRODUCTION TECHNICAL FORCE AND INFORMATION ELEMENTS

The characteristics of leading agricultural equipment manufacturing enterprises in Shandong are quite obvious, the market share of whose products mostly ranks first in the country. Beiqi Futian Weifang Agricultural Equipment Company is the core leading enterprise for large and medium tractor and wheat combine, Changlin Group is the leading one for walking tractor and Shifeng Group is now at the stage of brutal market competition. The enterprises such as Yufen, Juming and Xiangrong all have a better technology and scale of combine, and Futian Weifang Company is also planning to launch new products, so the core leading enterprises of the field are expected to form in the future of two or three years. In order to optimize productivity resources, Shifeng Group recombined Shuangli Company, which had products repeatedly and technical disadvantages, established Shandong Shandong Shifeng Liaocheng Agricultural equipment Limited Co., and the purpose was to strengthen wheat combine produced in the former Shuangli Group. For other agricultural equipment enterprises with scale, some were in regional integration and recombination, some were taking a new road to diversification, and some formed enterprise clusters with ieading enterprises, taking the road of specialized production of fittings.

In general, the agricultural equipment manufacturing industry has already experienced reorganization and integration, but the production mode and organizing forms of the industry are still at the stage of seeking “great and whole” mode, and lack of technology cooperation among large medium and small enterprises and supported products. The management and production mode of some enterprises still remained unchanged that design, exploitation, manufacturing, installation, distribution and service are completed with coordinated process by group company, only the semi-finished product piece, raw materials and fittings in hydraulics are purchasing fittings, and structural parts and machining work-piece are completed by group company itself, including assembling. Thus, a certain gap still exists compared to the industrial clusters, which requires high specialization in divided work and coexistence and co-prosperity between leading enterprises and matching enterprises.

Agricultural equipment manufacturing industry forming clusters still exist the problems such as low enterprise layer coupling degree, low local matching capacity of products, low collaborative cross-industry, less stress on the core position of enterprises. He matching of intermediate products of agricultural equipment industry in Shandong is greatly dependant on exterior region, the structure proportion of large medium and small –sized enterprises in cluster is not proper, and the number of flexible small enterprises which are full of vitality can’t guarantee the environment that large-sized enterprises need for their existence and development; the coupling of large medium and small-sized enterprises purely reflects in the relation of products transaction, technology and knowledge exchange is not active and lack of mechanism and dynamic of innovation and cooperation. Take the diesel engine for making self-propelled wheat combine as example, it should be purchased from Jiangsu and Zhejiang province, tire and hydraulic group for large medium type tractors needed purchasing from Shanghai and Beijing, the manufacturing industry with scale have small influence for the regional manufacturing industry. Therefore, it is quite necessary to establish a batch of manufacturing enterprises

of satellite peripheral matching industry, including all those such as the one for harvester components, large medium tractor functional parts, agricultural vehicles parts and die, and electronic hydraulic fittings, thus, to construct agricultural equipment manufacturing industry in Shandong into the manufacturing industrial clusters, which can have prominent core leading enterprises, high specialization and collaboration of satellite peripheral matching enterprises, the close coupling enterprise clusters, strong competence and maxim contribution to regional economy, etc..

5 CONCLUSIONS

(1) Agricultural equipment manufacturing industry in Shandong must make full use of connected effect of productivity amplification produced by the policy of subsidy on farm machinery, closely follow the main direction of the state agricultural mechanization research during the eleventh Five-year plan period, make corn combine manufacturing industry bigger and stronger, master the key technology of mechanization of earthnut and vegetable production, improve agricultural machinery with precision and energy-saving, so as to make agricultural equipment industry have the ability of sustainable development and leisurely face the competition in international market and home market.
(2) As agricultural equipment manufacturing industry still exists a lot of homologous technology and technology connection, the different industry shares a lot key generic technology and exists new cross of technique and technology. So the flexible and high efficient technology innovation system must be constructed according to the different scale of enterprises. The local government needs fully consideration of the enterprise-university research cooperation and innovation synergy of equipment manufacturing enterprises on generic technology while making plan and policy of development for regional industry, actively fosters technology intermediary agency, and perfects technology innovation service system of medium small enterprises.
(3) The core leading manufacturing enterprises needed by agricultural equipment manufacturing industrial clusters refer to those large manufacturing enterprises whose scale of specialized production of equipment should reach certain level and play leading part for the development of the field, and are the core strength of the equipment manufacturing industrial cluster coupling. The satellite medium small-sized enterprises usually couple and network with large core enterprises by means of products and services. These enterprises are mainly distributed in cluster coupling network, which usually have flexible management and decision, and have fierce competition among them. The various manufacturing enterprises of the cluster coupling system of the whole field can realize scale advantage and revenue maximization of the industry by means of specialized division of labor, playing the role of different links on value chain and acquiring each benefits of division.
Agricultural equipment manufacturing industry has strong matching demand for products and technology, and cluster even has more high demand for industrial relationship. So it is necessary to quicken the development of agricultural equipment manufacturing industry, to foster a complete industry chain for regional core enterprises, to upgrade the level of manufacturing industry cluster coupling, to strengthen the interaction of economy and technology among core leading enterprises, and leading core enterprises with peripheral enterprises.

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