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Strength and Weakness of Animal Vaccine Industry in China

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Abstract Based on the introduction of the status of animal vaccine industry in China, the strength, weakness, opportunity and threat of animal vaccine industry are analyzed by SWOT. Among them, strength is mainly reflected in the broad market, and the favorable industrial policy and development environment. Weakness is the irrational structure of product, the nonstandard production inspection, and the irregular market. Opportunity is mainly reflected in improving government's emphasis on animal security, expanding the scope of compulsory immunization, increasing the proportion of scale breeding, upgrading animal vaccine in China, speeding up industry consolidation and improving market concentration. Threat is manifested mainly in the poor market consciousness due to the long-term planned economy. And animal vaccine enterprises in China are at a relatively disadvantage position during the competition with international companies. Based on these, countermeasures to promote the development of animal vaccine enterprises in China are put forward from the aspects of both government and enterprise. On the one hand, government should improve the laws and regulations and promote the healthy development of vaccine industry, strengthen the manufacturers' consciousness of quality and biological safety, and create a favorable environment for market competition. On the other hand, enterprises should adjust the product structure and strengthen research and innovation, improve the brand competitiveness, take the road of common development, enhance the management capacity of the enterprises, and promote customer service.

Key words Veterinary biological products industry, SWOT Analysis method, Enterprise brand, Quality consciousness, China

Veterinary biological products, the biological products applied to animal, is a kind of biological products prepared by micro-organisms, parasites and their metabolites and products from immune response using modern biotechnology means according to the principles of animal immunity, which is used for prevention, diagnosis and treatment of animal infectious disease, parasitic diseases, and other related diseases. In the narrow sense, veterinary biological product mainly refers to the antiserum, veterinary vaccine, and diagnostic agent. Animal vaccine is not only the primary means of prevention and control of animal diseases, but also the necessary condition to protect human and animal health. As a powerful weapon to control animal disease, animal vaccine plays an increasingly important role in the development of animal husbandry. Based on the introduction of the status of animal vaccine industry, we use SWOT Analysis to analyze the strength and weakness, the opportunity and threat of animal vaccine industry. Finally, countermeasures are also put forward.

1 Status of animal vaccine industry in China

Animal vaccine industry is a part of the bio-pharmaceutical industry, having the characteristics of high-tech industry. Due to the relatively high profit, large amount of capital has flowed into the animal vaccine industry in recent years. New company and new workshop have increased sharply with the expanding

production capacity. According to statistics, there are in all 70 animal vaccine manufacturers passing the certification of veterinary drug GMP, an increase of 42 manufacturers compared with the number in the late 1990s. Moreover, the number of animal vaccine manufacturers is increasing. At present, the 70 animal vaccine manufacturers have a total production capacity of over 400 – 500 billion doses. However, the overall market capacity is only 180 – 200 billion doses according to estimation. Thus, the production capacity of enterprises is greater than the market demand, and product homogeneity is serious with increasingly fierce competition in market^[1].

2 SWOT Analysis of animal vaccine industry

SWOT Analysis, known as Superiority Weakness Opportunity Threats Analysis, is put forward by a professor of management in the university of San Francisco in the early 1980s. The four letters in SWOT represent strength, weakness, opportunity and threat, respectively. In general, SWOT can be divided into SW, used to analyze internal conditions, and OT, used to analyze external conditions. Through research, threat or opportunity caused by external change is realized. program guiding the industrial development is made according to the strength and weakness in resource possess and utilization ability^[2].

2.1 Strength

2.1.1 The broad market. China is a large agricultural country. Since the reform and opening up, animal husbandry has achieved rapid development; and China has become the major country of animal husbandry with the most chickens and pigs in

the world. Therefore, China has a broad market of veterinary drug. According to the statistics of FAO, China has contributed to 80% of the annual world meat increase since the 1980s. Total breeding quantity of animal husbandry maintains a steady growth in the future. At the same time, optimization of breeding method and proportion enhancement of scale breeding will stimulate the stable growth of market demand for animal vaccine and will promote the steady growth of the whole industry.

2.1.2 Favorable industrial policy and development environment. On January 1, 2008, implementation of a new *Animal Epidemic Prevention Law* has made the development trend of animal vaccine industry more clear. Firstly, the immune system should be further improved by force. Secondly, award the "official veterinarian" in animal health supervision institutions to carry out the quarantine of animal and animal productions and to issue the quarantine certificate. Consolidating the legal status of "official veterinarian" can help to promote the construction of animal epidemic prevention system, to remove the block from sales to use of animal vaccines, and to improve the effectiveness and extensiveness of quarantine. Thirdly, the stress of mandatory pet immunity will greatly enhance the market scale of pet vaccine in the future.

2.2 Weakness

2.2.1 Irrational structure of product. At present, overall level of research on animal vaccine products is relatively low with weak innovation capability. New products developed are mostly imitations or products with improved technology, having low technology content and few independent intellectual properties. Besides, among the approved animal vaccines, conventional vaccine products are in the majority and the types of vaccine are incomplete. Multivalent vaccine is insufficient; vaccines for very virulent or variant diseases are rare, such as Chicken Marek's Disease, infectious bronchitis, and infectious bursal disease. And researches on pet vaccine, bacterial vaccine, and parasite vaccine are not enough. Most of the genetic engineering vaccines are still in the stage of laboratory research; there is a serious lack of rapid, sensitive and specific diagnosis products^[3].

2.2.2 Nonstandard production inspection. At present, some manufacturers are not strictly in accordance with the requirements of GMP in production activities. They change the production line and equipment without approval and use of unqualified production raw materials. Products of a few manufacturers have not carried out all-item test. Approval and supervisions of veterinary biological products in some manufacturers are irregular, such as sale in advance without certificate report.

Driven by the interests, some units and individuals illegally develop, produce and manage veterinary biological products, and illegally produce vaccines of major animal disease and avian influenza inactivation, causing very bad influence. These units and individuals have not carry out operation of pathogenic microorganisms in accordance with the requirements of bio-security level, so the purity, stability, security and effectiveness can hardly be ensured from bacterial and viral strains to final product; and the biological escape of pathogenic microorganism

can hardly be prevented, causing the widespread of pathogens. Thus, many pilot products are short of rigorous laboratory research or clinical trials. Products widely used in field without clinical approval have serious damage.

2.2.3 Irregular marke. In the production of vaccines against classical swine fever, there are some problems in the links from the quality control of raw and auxiliary materials to the vaccine production and test. In most of the enterprises, rabbit hutches for production are irregular and test condition is incompatible with the scale of production. There are also some common problems during the application of veterinary drug GMP, such as the frequent flow of some employees in enterprises, the lag of training of employees, the failure to keep a record after the change of person in charge of quality, the lag of state mark of some production equipment, the damaged or outdated measuring instrument, the risk of strong toxicity diffusion in animal pen, the irregular production and inspection records in many enterprises, the poor traceability of products, the process production vaccine in some enterprises not strictly in accordance with the rules and orders, and the loose inspection of raw and auxiliary materials in many enterprises.

2.3 Opportunity

2.3.1 Gradually improving government's emphasis on animal security. After suffering from the SARS in the year 2003, the avian influenza in 2004, the *Streptococcus suis* in 2005, and the swine influenza in 2009, public health and food safety have increasingly become the focus of public concern. Government has issued a series of related policies in order to prevent the public health events.

Besides, food consumption of Chinese residents has changed from quantity-oriented stage and structure-oriented stage to quality-oriented stage. And the safety of food and agricultural product has gradually become a major demand. Accordingly, aquaculture policy in China has turned from the pursuit of quantity and structure to the pursuit of safety. And animal vaccine industry has become the leading industry related to the safety of livestock products. Thus, safety concern of government, society and consumer will become the fundamental driving force in prompting the rapid growth of industry.

2.3.2 Gradually expanding the scope of compulsory immunization. Veterinary biological products can be divided into the veterinary biological products needed for compulsory vaccination and the veterinary biological products not needed for compulsory vaccination. Enterprises for the production of veterinary biological products needed for compulsory vaccination shall be appointed by the Ministry of Agriculture, using government procurement. The biological products shall be distributed by the animal husbandry and veterinary administrative department at provincial level. When major animal epidemic emergencies, disasters or other unexpected events happen, immune biological products shall be allocated by the Ministry of Agriculture. Due to the large farm scale, high stocking density, great scatter-feed proportion and poor stocking condition in China, there is high possibility of disease infection and virus mutation. Thus, prevention becomes more difficult. To guarantee the healthy

development of breeding industry, compulsory immunity will be implemented among the type A diseases classified by Chinese government, except the free compulsory vaccines of avian influenza, foot and mouth disease, highly pathogenic Porcine Reproductive and Respiratory Syndrome, classical swine fever (rabbit origin), peste des petits ruminants.

2.3.3 Increasing the proportion of scale breeding. According to the change of culture policy, proportion of scale breeding will gradually increase in the next 5–10 years, which will promote the market purchase of animal vaccines. At present, the proportions of chicken and swine scale breeding are about 50% and 65%, respectively. With the increase of feeding cost and the support of government, it is estimated that proportion of scale breeding will enter into the stage of rapid growth.

2.3.4 Upgrading the animal vaccine in China. Upgradation of animal vaccine in China is mainly reflected in two aspects. The first is the improvement of vaccine quality and protection rate and the decrease of side effect. The second is the rise of vaccine price. There are two forces promoting the upgradation of animal vaccine, which are the technological innovation and process improvement of vaccine and the sale proportion increase of high-end vaccine products due to the upgradation of market demand. Especially, after the price rise of animal products, proportion of vaccine income in total breeding income falls, as well as the farmers' sensitivity to vaccine price. Therefore, upgradation is the middle and long-term factor that promotes the growth of animal vaccine industry.

2.3.5 Speeding up industry consolidation and improving market concentration. In recent years, animal vaccine manufacturers in China have accelerated the acquisition and restructuring processes in order to improve their competitiveness. In May 2007, Jinyu Group announces purchasing 83.33% equity of Jiangsu Youbang. In June, China Animal Husbandry Industry Co., Ltd. announces the capital increase of Nanjing Tianbang, holding more than 60% equity. Also in June, Xinjiang Tiakang announces an investment of 36 million yuan in the research on sheep and goat Foot and Mouth Disease vaccine together with Shanghai Bio-excellent Company Co., Ltd. At present, animal vaccine industry is still in the disordered phase of competition, causing weak profitability of conventional vaccines and the profit loss of some medium and small enterprises. Therefore, the current purchase of some medium and small enterprises accordingly by leading enterprises can not only run big and strong business at a relatively low cost, but also can improve the competition structure of industry. With the vaccine industry becoming orderly, price of conventional vaccines will rise gradually, so as to enhance the overall profitability of vaccine industry.

2.4 Threat The 28 major enterprises producing animal vaccine, established at the 50s and 60s, have implemented planned economy for a long time, with poor market awareness. Besides, animal vaccine industry has only a small share of the national economy, having not caused enough attention of governments at all levels. After entering the WTO, some deep-rooted problems have become increasingly apparent with the rapid development of animal husbandry and the challenge of in-

ternational animal vaccine industry, which directly affects the survival and development of animal vaccine manufacturers in China. The top-ten animal protection enterprises in foreign countries, such as Merial, Pfizer and Schering-plough, have established representative offices in China due to the huge potential market of China, which is a serious threat to the domestic enterprises of veterinary biological products. Animal vaccines of these multinational corporations are safe, stable and effective with good after-sale services, which are also the weakness of domestic enterprises. There is almost no vaccine for economic animal in domestic enterprises, along with the low-level repeated production of conventional vaccines, and a serious lack of new products and products with urgent needs, all of which lead to the inrush of foreign products and the great threat to the development of domestic animal vaccine industry.

3 Countermeasures and suggestions

3.1 Suggestions for government in China

3.1.1 Improving the laws and regulations and promoting the healthy development of vaccine industry. Government should further improve the laws and regulations about the management of veterinary drug, strengthen the quality supervision of veterinary drug, make supporting regulations based on the *Management Regulation of the Veterinary Medicine*, formulate the Good Clinical Practice (GCP) and Good Laboratory Practice (GLP), issue the standards for raw and auxiliary materials, and carry out unified management and quality supervision of manufacturers supplying auxiliary and raw material.

Meanwhile, government should strengthen the clinical trial management of veterinary biological products, rigorously punish the illegitimacy problems of animal vaccines production and sale taking field test and the regional test as an excuse, and severely crack down on counterfeit and low-quality vaccines in order to promote the healthy development of industry^[4].

3.1.2 Strengthening the manufacturers' consciousness of quality and biological safety, which is a very serious problem for vaccine industry at present. In order to strengthen the biological safety of pathogenic microbiology laboratory and to protect the health of workers in laboratory, the State Council has promulgated the *Biosafety Management Regulation of Laboratories for Micro-organisms*; the Ministry of Agriculture has also formulated the *Veterinary Laboratory Biosafety Guidelines*, and the *Measures for the Examination and Approval of the Bio-safety Administration of Highly Pathogenic Animal Pathogenic Microbe Labs*. In the aspects of isolation, identification and utilization of strong bacteria and virus, especially during the vaccine research and manufacture, proliferation of pathogenic pollution in the surrounding environment should be strictly controlled. Laboratory and production workshop not reaching the corresponding level are not allowed to produce and test the vaccine.

In the aspect of quality management, government should strengthen the management of raw materials and diagnostic reagents for the production of vaccine, strictly control and improve the quality of raw materials, and promote the SPF

process of poultry vaccine production, strengthen the supervision on production enterprises and products wholesale, adopt the supervision on workshop, tape "two-in-one" anti-counterfeiting label, and implement the dynamic management system of designated production enterprise.

3.1.3 Creating a favorable environment for market competition. Healthy development of animal vaccine industry in China needs a fair competition and an orderly market. However, in recent years, there have been confusions in the production, management and utilization of animal vaccine products in China. Vicious competition of enterprises still exists, such as the malicious price squeeze and the opaque procedure of vaccine bidding, which seriously affects the healthy development of animal vaccine industry and damages the interests of farmers to a certain extent.

At present, vaccines for foot and mouth disease, classical swine fever, and highly pathogenic Porcine Reproductive and Respiratory Syndrome are brought into government procurement. However, there is a price war among the vaccine enterprises during bidding process. Since the ultimate goal of enterprises is to win profit, price war will lead to the low quality of products, and the standard reduction of raw materials. Once not obtaining the expected profits, enterprises will reduce the quality of vaccine and will not offer a good after-sale service. Therefore, central government and corresponding departments at provincial level should further regulate the bidding of vaccine, combat the reduction of product price by sacrificing the quality of vaccine, maintain the orderly market competition, ensure the open, equal and fair environment during the bidding of vaccine, and create a favorable environment for market competition.

3.2 Suggestions for enterprises

3.2.1 Adjusting the product structure and strengthening research and innovation. Research and development capacity is weak in most of the enterprises producing animal vaccine in China. Traditional animal vaccine plays an important role in the control of animal disease. Therefore, enterprises should firstly improve the variety and structure of traditional vaccine. Secondly, enterprises should develop different serotype or subtype vaccines, multiple vaccine with high inactivation efficacy, new bacteria, parasite vaccine, pet vaccine, and new veterinary vaccine based on modern molecular biology techniques. At the same time, enterprises should reinforce the research on new adjuvants, immunopotentiator, and thermostable protectants in order to improve the quality of products and to extend the period of validity.

Secondly, with the emergence of new technology, new material and new method, research on diagnostic products will become unusually active. Therefore, it is urgent to develop the rapid, sensitive and specific diagnostic kits. Meanwhile, new disease vaccine or diagnostic products should also be developed for the new infectious diseases seriously damaging the breeding industry, such as chicken infectious anemia, highly pathogenic avian influenza, porcine reproductive and respiratory syndrome, and postweaning multisystemic wasting syndrome.

Finally, enterprises have made no breakthrough in the aspect of process technology, such as Suspension Culture Technology, Antigen Concentration Technology and Inoculation and Harvest Technology. Innovation in these fields can help enterprises to reduce cost and to occupy the commanding heights of the industry.

3.2.2 Improving the brand competitiveness. At present, brand has become the comprehensive display of quality symbol, technical level, customer service, competitive layer, enterprise demand, and industry status. Animal vaccine product does not belong to consumer goods. Customers pay more attention to the safety and input efficiency of products, as well as the carry-over effect brought by products. Brand image comes from the reputation in the industry. Brand equity of an enterprise will bring more benefits, such as higher loyalty, expansion of profit margins, more opportunities for brand extension, and getting free of marketing crisis and the attack by marketing activities of opponent. Therefore, enterprises should focus on the upgrading of brand in a longer period of time.

3.2.3 Taking the road of common development. At present, among the 68 enterprises producing animal vaccine, some have large scale but their backward management and operation idea can not keep up with the market developments. Some have new system and good hardware facilities, but are lack of brand and market. Other enterprises with strong research capability are restricted by the operation mechanism. Therefore, we suggest enterprises to seek partners so as to maximize favorable factors and minimize unfavorable ones. Combination among the strong ones can help to exert their own resource advantages and to improve the overall competitiveness of enterprises.

3.2.4 Enhancing the management capacity of enterprises. Most animal vaccine manufacturers in China are newly established or are set up through system reform. Among them, the newly established manufacturers are far behind other industries from the perspective of enterprise nature. Most enterprises have weak anti-risk ability. Therefore, enterprises should learn from the management methods of foreign advanced enterprises, change the mechanism, and strengthen the training of human resources and the construction of personnel and enterprise culture. At the same time, enterprise should consolidate self-discipline, strictly carry out production in accordance with the GMP requirements, and never allow unqualified products coming into the next link.

3.2.5 Enhancing customer service. Enterprises should enhance customer service, analyze the demand, create demand and satisfy the demand. Currently, customer service has extended from the veterinary technology service to expert consultation and matched supporting system. Customers pay attention to the service experience and pursue psychological comfort in both distribution process and policy humanization. Rapid response capability of enterprises to diseases reflects the comprehensive quality of company. However, most animal vaccine manufacturers have paid attention to the products and neglected the service for a long time, lacking the effective technical

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have a significant catalytic role in the development of agricultural economy and other economies, which also explains that the agricultural economic growth depends largely on the investment in agricultural science and technology.

(2) As the index of labor object, the total sown area of crops has no significant similarity correlation with the regional GDP, which, however, is higher than the similarity correlation between the total sown area of crops and the investment in rural water and electricity construction as the index of tools. In recent years, the government continues to strengthen the management of agricultural lands so that the change range of the cultivated area is narrowed, so there is a small similarity correlation between cultivated area and regional GDP, but it should not be denied that the cultivated land is still a prerequisite for agricultural and national economic growth.

(3) As the index of labor tools, the investment in rural water and electricity construction has the smallest similarity correlation degree with the regional GDP, as shown in the data during 2004 – 2008, the investment in rural water and electricity construction saw a continuous declining trend, and the national economy shows a good momentum of growth, this is because as labor tools, rural water and electricity construction brings long-term benefits, which means, the benefits from the investment could be enjoyed within a few years or even decades after the inputs. Therefore, although the investment in agricultural water and electricity of Anhui Province is declining, the total investment in agricultural science and technology is still increasing in the years after 2004.

3.2 Suggestions In the future, Anhui provincial government should continue to increase the investment in agricultural science and technology, enhance the protection of cultivated lands, keep the total sown area of crops and properly maintain rural water and electricity construction, that is to say, the economic work should focus on increasing the investment in the "subjective part", maintaining the state of the "objective part" and keeping the good operation of the "tools" so as to guarantee the sustainable and coordinated development of the overall society in Anhui.

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services support of products. On the contrary, multinational enterprises have relatively perfect technical service system, which increases the added value of products, as well as the price. Therefore, domestic enterprises should learn from the multinational enterprises and try to enhance customer service for a longer period of time in future.

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