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Development of Circular Economy of Characteristic Breeding Industry in Guangxi

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Abstract In order to achieve characteristic, high-quality, high-efficiency, low-consumption, healthy and intensive breeding, we use the ecology method to analyze the status quo of development of characteristic breeding industry in Guangxi, from advantages in resources, industrial development, characteristic breeding, and standardized construction. There are some problems existing in the development of characteristic breeding industry in Guangxi; prominent contradiction among human, land and grain; outdated breeding mode; low comprehensive utilization rate of resources; increasingly deteriorating ecological environment. We put forth the following recommendations: based on the ecological and economic principles, introducing "reduce, reuse, recycle" idea of circular economy; striving to choose the development pattern of circular economy adapting to local resource characteristics, planting and breeding habits; in terms of realization path, paying close attention to construction of standardized breeding farm, cultivation of organic fertilizer industry, infrastructure construction, environmental law enforcement, and other parts; reinforcing the policy guidance, adjusting and optimizing industrial structure, strengthening scientific and technological innovation, and advancing industrialization management, to promote steady development of circular economy of characteristic breeding industry in Guangxi, and accelerate the process of rejuvenating province by breeding industry, enriching the people and building up Guangxi.

Key words Breeding industry, Circular economy, Development pattern, Realization path, Guangxi

The circular economy is the dematerialization economic model based on ecological and economic principles, namely, through the reduction of resource use and recycling use of waste, to achieve virtuous cycle "resources – products – waste – renewable resources", avoid a waste of resources and environmental pollution, achieving the goal of resources conservation, environmental protection and economic efficiency improvement. Nowadays, the ecological degradation and environmental pollution is increasingly grave, and the research on circular economy has become the focus of attention of the academia. On the basis of analyzing the concept of agricultural circular economy, coupled with the problems facing agricultural development in Shanxi's building of an ecological province, Wang Jianping (2006) put forth the major countermeasures and recommendations for developing agricultural circular economy in Shanxi Province^[1]. Gu Wuhan (2005) believed that to maintain the sustainable development of agriculture, Shanghai must take resource-saving and recycling-oriented path of development; in accordance with the principle of "three focuses", achieve dynamic balance of cultivated land, implement the combination of consolidation, protection and conservation, enhance the resource utilization rate, strengthen the use of agricultural waste, and vigorously develop green agriculture. At the same time, it should strengthen legislation and law enforcement work of agricultural circular economy^[2]. Some studies have

shown that the implementation of agricultural circular economy can not only reduce environmental pollution and maintain the agricultural ecological balance, but also improve farmers' income and promote rural economic development^[3]; the implementation of forestry circular economy is an effective way to achieve economic, social and natural sustainable development^[4]. Breeding industry is an important part of Guangxi's big agriculture. Since 2008, total output value of breeding industry in Guangxi has maintained more than 100 billion yuan for three consecutive years, becoming an important source of farmers' income in Guangxi following the planting industry^[5]. Guangxi's breeding industry achieves rapid development, but it also brings about resource waste and environmental pollution to some extent, even likely to become the largest constraint on continuous, rapid and healthy development of Guangxi's breeding industry. Therefore, we introduce the concept of "reduction, reuse, recycle" in circular economy, aiming to obtain the highest possible economic and social benefits with the lowest possible consumption of resources and environmental costs; improve resource utilization efficiency; achieve characteristic, high-quality, high-efficiency, low-consumption, ecological, healthy, and intensive breeding. It is not only an important issue urgently to be researched and resolved for Guangxi's breeding industry at present and in the future, but also the fundamental guarantee for accelerating the process of rejuvenating province by breeding industry, and enriching the people and building up Guangxi.

1 The status quo of development of characteristic breeding industry in Guangxi

1.1 It has a unique advantage in natural resources Guangxi has many mountains and limited farmland, with criss-crossing riv-

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ers and long coastline. In particular, it has comprehensive advantages in grassland, water area and marine resources, indispensable to the development of breeding industry. In the region, the area of grassland is 8.667 million hm^2 , accounting for 36.8% of the total land area, ranking first in the southern regions, eighth in the entire country; the average total water resource for many years is 188 billion m^3 , accounting for 7.12% of total water resource, ranking fifth in China; Guangxi has 0.1 million hm^2 of shoals, and 0.749 3 million hm^2 of shallow sea with the depth within 20 m^[6]. Guangxi has a subtropical monsoon climate, mild and humid, with abundant rainfall and long frost-free period, which is suitable for growth of sugar cane, rice, maize, cassava, peanut, soybean, watermelon, banana and other crops. The crop straw resources are rich, and breeding suitability is high. These favorable conditions of natural resources lay the material foundation for the rapid development of characteristic breeding industry in Guangxi.

1.2 Breeding industry maintains the trend of continuous and steady development In recent years, Guangxi's breeding industry maintains continuous and stable development; the product yield grows substantially, and the total output value of breeding industry increases by leaps and bounds. In 2007, the total output of meat in the region was 3.29 million tons; the total output of aquatic products was 2.46 million tons; the total output value of breeding industry was 88.85 billion yuan, accounting for 43.9% of the region's agricultural output value. In 2008, the total output of meat in the region was 3.5 million tons; the total output of aquatic products was 2.5 million tons; the total output value of breeding industry was 107.8 billion yuan, accounting for 45.1% of the region's agricultural output value. In 2009, the total output of meat in the region was 3.71 million tons; the total output of aquatic products was 2.62 million tons; the total output value of breeding industry was 110 billion yuan, accounting for 43.2% of the region's agricultural output value. It is expected in 2015, the region's total output value of breeding industry will reach 203 billion yuan, accounting for more than 50% of the region's agricultural output value^[5, 7].

1.3 The breeding of local characteristic species develops rapidly In Guangxi's breeding industry, the species and resources are rich, with many characteristic species, such as milk buffalo, herbivorous livestock and poultry, lean pigs, high-quality poultry, and competitive aquatic products. Currently, the breeding stock of buffalo and milk buffalo and yield of *Ostrea rivularis* Gould rank No. 1 in China; the yield of prawn and Yellow chicken ranks No. 2 in China; the yield of tilapia ranks No. 3 in China; the yield of poultry ranks No. 4 in China. In addition, the total output of meat, yield of aquatic products, yield of pork, and yield of turtles, rank first in the country. It is expected in 2015 that the total output value of poultry, competitive aquatic products, herbivorous animals, milk buffalo products, and primarily processed products, will exceed 200 billion yuan, promoting the transformation of Guangxi from big breeding region to powerful breeding region^[5].

1.4 Large-scale standardized breeding makes great strides In recent years, Guangxi pays close attention to standardized

construction of breeding industry, and the proportion of standardized, large-scale and healthy breeding has gradually increased. Up to now, the entire region has started to construct 321 standardized large-scale breeding farms; expanded the piggery area more than 0.383 6 m^2 ; the scale breeding level of live hog and poultry reaches 55% and 80%. In 2010, 33 national standardized livestock demonstration farms were established in Guangxi, covering live hogs, hens, cows, chickens, beef cattle, and other varieties. In the region, 800 pollution-free production bases have been certified; 36 export enterprises of aquatic products are registered abroad; 168 breeding farms of aquatic products for export are registered, creating 81 name-brand products with high quality^[5].

2 Problems existing in the development of characteristic breeding industry in Guangxi

2.1 Prominent contradiction among human, land and grain Guangxi has many mountains but few plains. Restricted by arable land, the proportion of basic farmland protection areas in Guangxi's rural areas at present has a large share, with relatively scant land resources that can be used for breeding. With advance of the industrialization and urbanization, and rapid population growth, there is less and less land that can be used to build farms in Guangxi. The incidents of breeding farm land being grabbed or breeding being prohibited occur sometimes, so that the development space of breeding industry is severely squeezed. Although Guangxi is a major agricultural province, it is not China's major grain producing area. With excessively large proportion of pigs, chickens and other livestock and poultry within breeding industry, and excessively small proportion of cattle, sheep and other herbivores, Guangxi's breeding industry is difficult to withstand the pressure of the shortage of feed grain; the feed grain gap continues to expand annually, needing to be supplied by the Northeast and other places or depend on import. Food shortage has become a bottleneck restricting the development of Guangxi's characteristic breeding industry.

2.2 Outdated and extensive breeding mode and low comprehensive utilization rate of resources At present, most of the households engaged in breeding of livestock and poultry in Guangxi are decentralized households, with small scale. It is mainly focused on the traditional breeding, with single species of livestock and poultry, extensive mode of operation, backward technology, and obsolete facilities. It is universal that people live in the backyard with livestock, chickens and rabbits are raised in the same cage, with poor sanitation, high breeding costs, and low benefits, for want of market competitiveness overall. Moreover, under this traditional breeding mode, the level of comprehensive utilization of resources is low; chickens, pigs and other animals feeding on grain predominate, in need of considerable feed, and the conversion rate of product is not high; the development and utilization of high-quality and high-efficiency feed is insufficient, and the level of utilization of crop straw as feed is not high; the level of recycling waste in breeding industry is low, and environmental problems loom large.

2.3 Increasingly deteriorating ecological environment

First, with the rapid advance of industrialization and urbanization, industrial waste water, waste gases and residues, as well as domestic sewage, are discharged massively, so that the surrounding environment of breeding farm is severely damaged. In addition, excessive use of chemical fertilizers and pesticides makes protection of variety resources and product quality face serious challenges. Second, due to improper breeding behaviors, such as overfishing, high-density breeding, insufficient epidemic prevention, and abuse of veterinary drugs and feed additives, it aggravates the pollution in breeding industry, resulting in sharp decline in the population and the product quality, ultimately affecting sustainable development of the entire industry.

3 Study on the development of circular economy of characteristic breeding industry in Guangxi

3.1 General idea It should be based on ecological and economic principles; follow principles of "reduction, reuse, recycle" in circular economy; take characteristic, high-quality, high-efficiency, low-consumption, ecological, intensive breeding as the goal; rely on advantages in local characteristic resources, and guide the production mode of breeding industry to translate into the mode of "resources – products – renewable resources", through comprehensive development and recycling of resources; build industrial chain of circular economy in breeding industry, and convert resource advantages into industrial advantages, to continuously improve the comprehensive production capacity of breeding industry; build modern breeding industry system adapted to Guangxi's resource endowment conditions, to promote continuous, rapid and healthy development of Guangxi's characteristic breeding industry, and lay solid foundation for accelerating the process of rejuvenating province by breeding industry, enriching the people and building up Guangxi.

3.2 Development pattern The key to the development of circular economy of characteristic breeding industry in Guangxi must be based on ecological and economic principles, coupled with different natural, social and economic conditions in various places, to establish a number of use patterns of circular economy with local characteristics.

3.2.1 Ecological breeding pattern. It is also known as great recycling pattern, namely using the symbiotic relationship between organisms (animals, plants, microorganisms), to transform the waste of one kind of organism into the nourishment or raw materials for another organism, extending the food chain and ecological chain, establishing the complex ecosystem of multi-level material and energy recycling, so as to achieve a virtuous cycle of the ecological environment^[8]. At present, the most widely used pattern is the pattern "ecological breeding industry – biogas – organic fertilizer-efficient cultivation industry", such as "pig – biogas – fruit (vegetable)", "cattle – biogas – grass", and "sugarcane – cow – mushroom".

3.2.2 Three-dimensional breeding pattern. It is to use

mountains, plains, water and other space resources, based on the natures of breeding and planting resources and the recycling characteristics of products, to develop multi-level three-dimensional breeding, to improve the overall operating efficiency. It includes three-dimensional mountainous breeding, such as "fruit – grass – cattle", "forest – grass – rabbit", and "fruit – grass – goose"; three-dimensional plain planting and breeding, such as "rice – fish (crab)", and "rice – duck"; three-dimensional deep-water aquaculture, such as "pearl-sea duck", polyculture of fish, shrimp and crab.

3.2.3 Circular breeding pattern. It is also known as small recycling pattern, mainly using the food chain relations between different animals within the breeding industry to form a complete material circulation system, to achieve comprehensive utilization of breeding industry waste. The current feasible patterns include "chicken – feces – pig – fish", "livestock and poultry – feces-earthworms – fish", "livestock – feces – maggot-chicken – feces – livestock – fish".

3.2.4 Resource utilization pattern. It is to use agriculture, forestry, animal husbandry and fishery by-products and leftovers to produce high-quality feed, fertilizer and other high value-added products, so as to expand the industrial value-added space; achieve industrial integration of agriculture, forestry, animal husbandry, fishery, and processing industry; promote breeding efficiency. The pattern includes "straw – feed – breeding – fertilizer", "chicken manure – protein feed – breeding – fertilizer", "silkworm breeding – silkworm excrement – extraction of the active ingredient – fertilizer", "tilapia – scraps – extraction of fish oil – fish meal feed".

Through developing circular economy, the major patterns achieving remarkable results in Guangxi's breeding industry at present include the pattern "pig – biogas – fertilizer – farming" implemented by Guangxi Judong Cultivation and Breeding Co., Ltd.; the pattern "fruit – grass – cattle" promoted by Beiliu City in Guangxi; the pattern "sugarcane – cow – mushroom" popularized by Chongzuo City in Guangxi; the pattern "winemaking – lees – livestock raising – biogas production-organic fertilizer – grass (fruit, vegetables)" created by Guangxi Dongyuan Ecological Agricultural Science and Technology Co., Ltd.; the pattern "grass growing – rabbit breeding – processing" promoted by Guangxi Yifeng Xinyu Agricultural Development Co., Ltd. Taking the case of methane boiler and biogas power in Guangxi Dongyuan Ecological Agricultural Science and Technology Co., Ltd., it can save and increase benefit more than 6 million yuan, achieving regional cleaner production and the coordinated development of economic efficiency and environmental efficiency^[9], showing huge vitality of circular economy.

3.3 Realization path By analyzing the reasons for the success of the above pattern, three kinds of common understanding should be noted: first, we should strictly abide by the inherent law of circular economy, which is the core; second, we should give full play to the local characteristic advantages in resources, which is the basis; third, we should show respect for the local farming and breeding habits, which is the precondition. In a certain sense, in order to advance the construction of

Guangxi's characteristic breeding industry, we must vigorously develop the circular economy, enhance resource conservation and comprehensive utilization, and make every effort to resolve the issues of high energy consumption, high pollution and high emissions in the breeding industry, but the development of circular economy cannot deviate from the characteristics of local resources and the tradition of farming and breeding industry, and engage in "arbitrarily arranged" and "one size fits all". Only by organically combining circular economy, local resource characteristics and the tradition of farming and breeding industry, can we ensure mutual coordination in material recycling process between the economic system and the natural ecosystem, promote the sustainable use of resources and sustainable development of the entire industry. The top priority is to focus on regulating the construction and operation of breeding farm; focus on cultivating the organic fertilizer industry; focus on promoting the construction of infrastructure; focus on the implementation of environmental law enforcement.

3.3.1 Focusing on regulation of comprehensive utilization as a threshold of the construction and operation of scale breeding farm. Breeding industry waste was once one of the main sources of manure for China's agriculture, making enormous contribution to agricultural development in China. With the continuous expansion of the breeding scale and incessant emergence of professional breeding farms, there is divorce between production and utilization of breeding industry waste. At the same time, since total excretion is concentrated, a small area can not completely utilize it, beyond the local environmental carrying capacity. In some areas, the waste even rises to one of the most important sources of agricultural area-source pollution, becoming an important issue to be solved in the development process of the modern breeding industry. At present, in terms of the inside of breeding industry, few people would agree that strict environmental system should be imposed on the emissions of large-scale breeding farms. However, this is an inevitable requirement for future development, and also the temporary pains that we must experience in changing the breeding mode. After all, it is very beneficial to the sustainable development of breeding industry. Furthermore, the technology requirement on the comprehensive utilization of breeding industry waste is not high, thus the breeding industry should not become a target of public attack, but become the major leader, practitioner and promoter in constructing Guangxi as an ecological civilization province.

3.3.2 Focusing on cultivation of organic fertilizer industry as the emerging strategic industry. The reason for pollution by breeding industry in Guangxi at present is that the excrement in large-scale breeding farms is directly discharged without use or disposal. Therefore, the current breeding industry in Guangxi is not circular. Guangxi has made the strategic decision to build an ecological province, develop ecological agriculture. The organic agriculture has been the fundamental way for farming development in Guangxi, but if without the organic fertilizer industry as a support, ecological agriculture and organic agriculture is just empty talk. The development of organic fertilizer industry

is not only promising, but also an effective measure to improve the economic benefits of breeding industry and resolve the market volatility.

3.3.3 Focusing on advancing infrastructure construction as one of the areas supported by government project funds. After years of government guidance and funding support, Guangxi's breeding industry has achieved good results in the variety protection and innovation, standardized breeding and so on, but comprehensive utilization of resources has become the bottleneck for today's breeding industry development. At present, the government mainly offers certain funds to support the large-scale biogas use, but offers no funds for other utilization patterns and other raisers, showing insufficient support. The government is proposed to implement ten-year comprehensive utilization infrastructure construction project of breeding industry, in order to achieve the strategic change in the production pattern, growth pattern and development pattern of Guangxi's breeding industry within a decade.

3.3.4 Focusing on implementation of environmental law enforcement as one of the main regulatory measures. Elevating the environmental access standards of breeding industry is an inevitable trend, but the key is to implement. We should punish and shut down the breeding industry that should be punished, and realize that it is the temporary pains that we must experience in changing the breeding mode. If we are merciful to this, it is detrimental to Guangxi's breeding industry, therefore, it is necessary to launch publicity for the entire industry and unify thinking, to make the farm planning, construction and operation starting, stride in tandem; at the same time, according to the actual situation, it should adopt the method "farmers offer more inputs, the government strengthens sufficient support, and the consumers bear a little", to help farmers to take the development path of circular economy.

3.4 Safeguard measures

3.4.1 Reinforcing the policy guidance. The government at all levels should firmly establish the concept of development of circular economy; based on the actual situation of local resources and industrial development, reasonably work out and promulgate relevant policies and measures, to do really good job in the work of organizing, guiding, serving and promoting for the development of breeding industry circular economy. Aquaculture and animal husbandry departments at all levels should strengthen the job responsibilities; innovate upon the institution; collaborate with development and reform department, science and technology department, environmental protection department, poverty alleviation department, agricultural department, financial department, taxation department, prices department, agricultural machinery department, water conservancy department, land department, forestry department, construction department, educational department, and other departments, to effectively increase the proportion of input into circular economy; foster the conditions and atmosphere conducive to promoting the development of circular economy, to provide strong policy guarantee for achieving the coordinated development of characteristic breeding industry and the ecological

environment in Guangxi.

3.4.2 Adjusting and optimizing industrial structure. The development of circular economy of breeding industry is a coordinating and coupling process involving agriculture, forestry, animal husbandry, fisheries, processing industry, commerce and other industries. We must conduct adjustment and optimization within the industry and between the industries, and establish high-efficiency recycling industry chain, in order to ensure continuous, stable and healthy development of circular economy of breeding industry. Taking the case of the pattern " sugarcane-cow – mushroom" , Chongzuo City is a major producing area of sugar cane in Guangxi. In recent years, through the development of circular economy " the sugar cane industry – animal husbandry – biogas industry – mushroom" , it not only greatly reduces the production costs of sugar sugarcane, but also drives the great development of breeding industry, biogas industry, and mushroom industry in local areas. At present, the home access of biogas in the city reaches 54% , in the high level in the whole region. Therefore, according to the principle of both following the inherent laws of the eco-economy and following the requirements of upgrading the industrial level, based on the needs of development of breeding industry circular economy in all regions, we should adjust and optimize the industrial structure of agriculture, forestry, animal husbandry, fisheries, processing industry, commerce and other industries; establish the recycling industry chain " resources – products – renewable resources – recycled products" , combining cultivation, breeding, and processing, to achieve the coordinated development of economic and ecological benefits.

3.4.3 Strengthening scientific and technological innovation. The development of circular economy of breeding industry, involves many links, with high technical requirements, so we must focus on improving scientific and technological innovation ability of breeding industry, enhancing the supporting level of industrial development, and speeding up the conversion of scientific and technological achievements. Government and relevant departments at all levels should focus on enhancing the technological level of the circular economy of breeding industry, take promoting the market competitiveness of product as the core, integrate the existing scientific and technological research and development resources, innovate upon research incentives, and establish new platform conducive to technological innovation, technology promotion, and farmers' training and education; promote the home access rate of fine breeding, bio-organic fertilizer development, disease prevention and control, product quality safety, and other key technologies; promote industrial scientific and technological progress, using science and technology to support continuous and steady development of circular economy of breeding industry.

3.4.4 Advancing industrialization management. A large number of practices prove that the implementation of industrialization management is an effective way to resolve the contradiction between " small production" and " big market" , and improve the scale merit of breeding. Governments at all levels and rele-

vant departments should focus on the production of specialty products, extension of the industrial chain, and brand building; strengthen support in terms of loans, taxation and financial discount, not only for the existing leading enterprises to make them become stronger and bigger, but also for the large local breeding households, private owners and economic genius to set up large-scale production, processing and marketing companies, the trading markets, and production and marketing associations, forming the industrialization management pattern " guided by the government, driven by enterprises, dominated by rural households, operated by associations" . At the same time, we must actively guide and encourage leading enterprises to establish large-scale supporting industrial production bases in the rural areas; through contract orders, joint stock partnership, insurance, interests returning and other forms, combine enterprises and farmers into risk-sharing, benefit-sharing community of interests; properly resolve dislocation of production and sales, and other problems in the process of farmers' production, to promote healthy economic development of the circular economy of breeding industry.

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