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Paths for the Coordinated Development of Rural Economy and Environment in Economically Underdeveloped Areas——A Case of Huaian, China

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Abstract Taking Huaian as an example, the rural economic and environmental problems in economically underdeveloped areas are expounded. The results show that rural areas in economically underdeveloped areas confront with lagged economic development, serious environmental pollution and scarce shortage of equipments for treating environmental pollution. The causes of problems are analyzed, including inadequate fiscal support from the local government; unscientific system for assessing government officers' performances; backward ideas in environmental protection and imperfect laws and regulations on environmental protection. Based on these causes, the strategy of employing the circular economy to promote the coordinated development of rural environment and economy in economically underdeveloped areas is put forward. The strategy covers transforming the way of agricultural production; adjusting agricultural production structure; positively collecting funds and increasing the input on handling rural environmental problems; strengthening the efforts on promotion and education, and forming the healthy habits of consumption; enforcing supervision and establishing a professional administration team for protecting rural environment; laying stress on rural technological innovation and strengthening the force of expansion; accelerating the path of industrialization and promoting the industrialization of villages and towns vigorously.

Key words Economically underdeveloped areas, Rural environment, Circular economy, Huaian City, China

With the continuous development of social economy, environmental problems become significant gradually. As for the economically underdeveloped areas, it is even harder for them to solve the environmental problems, for there is no adequate fiscal support. While in rural areas of the economically underdeveloped areas, the environmental problems are much more serious, due to villagers' backward idea of environmental protection, consumption habits and production modes, which have restricted the development of rural economy to a great extent. ZHANG Hong-feng (2009) has conducted empirical analysis on the win-win rules of environmental protection and economic development^[1]. LIU Zhao-zheng (2009), who has specially studied the environmental problems existing in rural areas, pointed out that the restriction of rural environmental problems on rural economic development has become more and more obvious^[2]. There are research results show that it is emergent in solving the problems of coordinated development of rural economy and environmental development, especially for rural areas in the economically underdeveloped areas. Taking Huaian as an example, I probe into the rural economic and environmental problems in economically underdeveloped areas and analyze the causes of these problems, and then I put forward the strategy of applying the circular economy theory to promote the coordinated development of rural environment and economy in the economically underdeveloped areas.

1 Rural economic and environmental problems in economically underdeveloped areas

The economically underdeveloped areas refer to the backward and marginal areas which are not well developed. Their internal development is slow and restrained by external restrictions, and their economic development has not break through the turning point of "take-off". From the perspective of the internal situation and internal circulation, the "low-level trap" still exists, while from the perspectives of external environment and external circulation, the unequal relations between central area and marginal area still have certain influences.

1.1 The lagged economic development The level of economic development is relatively lagged in economically underdeveloped areas, especially in rural areas of the economically underdeveloped areas, which can be seen from their low GDP, low GDP per capita, low net income per capita and the high proportion of the primary industry in the industrial structure. At the end of 2008, the total domicile residents in Huaian is 5.369 million, the GDP is 65.506 billion yuan and the GDP per capita is 17 104 yuan, the disposable income of urban and town residences per capita is 14 007 yuan, and the net income per capita of rural residences is 5 657 yuan^[3]. According to the relevant data in *Huaian Statistical Yearbook*^[4], the comparative table (Table 1) of the per capita GDP in Huaian and Jiangsu Province from 2003 to 2008 can be obtained. In addition, the figure of the proportion to the total amount of GDP taken by the primary industry output of Huaian and Jiangsu Province can be obtained (Fig. 1).

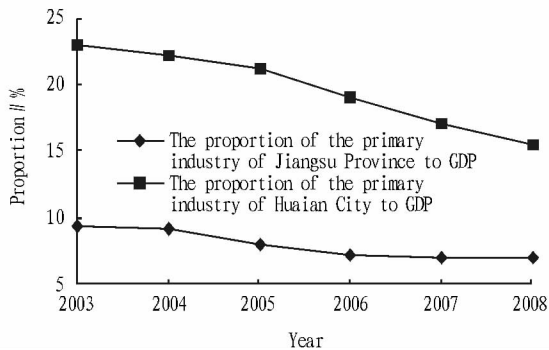
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Table 1 The comparison of GDP per capita in Huaian and Jiangsu Province from 2003 to 2008

Year	GDP per capita of Huaian//Yuan	GDP per capita of Jiangsu Province//Yuan	The proportion of Huaian GDP to the whole province//%
2003	8 108	16 830	48.17
2004	9 597	20 223	47.46
2005	10 683	24 560	43.49
2006	12 278	28 814	42.61
2007	14 347	33 928	42.28
2008	17 104	39 622	43.17

**Fig. 1** The proportion of the primary industry of Huaian City and Jiangsu Province to the GDP from 2003 to 2008

It can be seen from Table 1 that the GDP per capita of Huaian increases annually, but the growth rate has not surpassed that of Jiangsu Province; from 2003 to 2008, the GDP per capita of Huaian has not achieved 1/2 of the GDP per capita of the whole province and its average level is increasingly far from the average level of the whole province; the proportion of GDP per capita of Huaian to that of the whole province has decreased from 48.17% in 2003 to 43.17% in 2008. It can be seen from Fig. 1 that the proportion of the primary industry in Huaian is one time more than that in Jiangsu Province, although the gap is shrinking, it still indicates that the economic development level of Huaian is far behind the whole province.

1.2 The serious environmental pollution Rural pollution mainly covers the surface water pollution, soil pollution and air pollution. The sources of the pollution mainly come from the use of pesticides, fertilizer and agricultural film, the pollution caused by animal feces, household garbage and crop straw burning.

Research shows that in the worldwide area, non-point pollution is the main cause of surface water pollution, among which agricultural non-point pollution has the gravest contribution to the surface water pollution. Around the world, 30% – 50% of the surface water is affected by agricultural non-point pollution and the contribution rate of agricultural non-point pollution to the surface water in western developed countries has achieved over 70%^[5]. In America, over 60% of surface water pollution problems are caused by agricultural pollution^[6]. In Latin America and Arica, the local economic development and environmental quality show the complementary relations and the environmental deterioration and ecological crisis have been

one of the major reasons accounting for the poverty of many developing countries^[7].

China is the biggest country in the world in using fertilizer, pesticide and agricultural film, and the utilization ratio is extremely low. The use of fertilizer, pesticide and agricultural film is excessive in China and the residual and expansion pollution is serious, for example, the emission of CH₄ and N₂O accounts for 80% and 90% respectively of the total emission in China. The direct economic losses arising from the unreasonable use of fertilizer and pesticide have surpassed 30 billion yuan. According to the statistics, the average utilization rate of nitrogenous fertilizer is 30% – 50% in China, phosphate fertilizer is 10% – 20%, potash fertilizer is 35% – 50%, and the average rate is 35%. During the process of production, only 10% – 20% of pesticide is attached to crops, while the rest 80% – 90% runs off to the air, the soil and then permeates the surface of the soil and penetrates to the underground water^[8]. The large amount of pesticide residual left in the natural environment permeate the soil and the water, and it participates the cycle of ecosystem, which gravely threatens the ecological security, water security, water quality and human health. The results of testing the wholesale vegetable market in the capital cities of various provinces in China, conducted by the Environmental Protection Administration show that the total detection rate of pesticide is 20% – 60% and the total exceeding rate is 20% – 45%. In 1999, the survey on the live stocking and poultry industry in China conducted by the Environmental Protection Administration shows that the annual amount of animal feces is about 1.9 billion ton, 2.4 times more than the soil industrial waste; the CO₂ released by the animals has achieved 71.18 million ton, far beyond the total amount of the industrial wastewater and the sanitary wastewater^[9]. According to the measurement, in 2005, the aggregate amount of animal feces in China has surpassed four times of the solid wastes; in 2009, the figure has increased greatly.

As for Huaian, in terms of production pollution, the main sources are fertilizer, pesticide, agricultural film and the pollution caused by crop straw burning and animal feces. According to the data from the Second Agricultural Census Bulletin, by the end of 2008, the total utilization amount of fertilizer, pesticide and agricultural film has come to 6 944 t, 343 191 t and 5 543 t respectively. According to the survey and measurement conducted by the State Environmental Protection Administration in 2005, the average annual release coefficient of sanitary wastewater of rural residences per capita is 0.812 t, 0.255 t and 22 t respectively in China. In Huaian, there are aggregate 3.146 million rural residences and the annual average per capita release of sanitary wastewater, covering the human feces, household wastes and sanitary wastewater, is 2554 552 t, 802 230 t and 69 212 000 t respectively^[10]. In Huaian, the main fuel of the households is firewood, for 777 300 households use firewood, which account for 81.7% of the total households. Besides, 32 700 households use coal as the main fuel, accounting for 3.4%; 132 400 households use coal gas or natural gas, accounting for 13.9%; 4 200 households use marsh gas, accounting for 0.5%; 4 600 households use electricity, accounting for 0.5% and there are 100 households use the oth-

er kinds of fuel^[10]. A large amount of straw is used as fuel, which caused low efficiency of energy using and the serious air pollution arising from the straw burning.

1.3 Scarcely short of equipments for handling environmental pollution The result of the Second Agricultural Census Bulletin shows (Table 2) that at the end of 2008, the towns which have collectively handled their sanitary wastewater only account for 13% of the total number of towns in Huaian prefecture. Besides, only 26.1% of towns have garbage handling

stations; only 8.8% of villages have conducted collectively handling on wastes; 28.4% have marsh gas and only 37.8% of towns have finished the reform of toilets. Due to the scare shortage of the wastewater handling equipments, huge amount of wastewaters are released to the water body directly without processing, which gravely polluted the water body. At the same time, a large amount of animal feces are released to the water body without processing, which leads to the rapid deterioration of rural water environment.

Table 2 The proportion of the towns and villages which have sanitary handling equipments in Huaian

	The whole city	Qinghe District	Chuzhou District	Huaiyin District	Qingpu District	Lianshui County	Hongze County	Xuyi County	Jinhu County	%
Towns which has collective water supply	90.2	–	100.0	71.4	66.7	88.2	100.0	85.7	100.0	
Towns whose sanitary wastewater has been collectively handled	13.0	–	9.5	7.1	0.0	23.5	16.7	21.4	0.0	
Towns with garbage handling stations	26.1	–	19.0	21.4	0.0	35.3	25.0	28.6	36.4	
Villages whose drinking water has been collectively purified	95.5	100.0	100.0	100.0	100.0	100.0	100.0	71.9	100.0	
Villages whose garbage has been collectively handled	8.8	21.9	11.3	6.0	17.0	2.8	16.7	10.8	6.3	
Villages with marsh gas tank	28.4	12.5	10.7	19.5	35.8	76.0	12.5	6.8	15.7	
Villages which have finished the reform of toilet	37.8	56.3	58.3	25.5	47.2	28.4	89.2	15.3	20.5	

2 The causes of the rural economic and environmental problems in economically underdeveloped areas

In Huaian, the proportion of the primary industry is relatively high to the total output in the area, which leads to the higher dependence on agriculture objectively, so the pollution caused by fertilizer, pesticide and agricultural film in the process of agricultural production increases gradually. As a result of the far lagged GDP per capita comparing with the whole province, the local public finance bears great pressure and the local government does not have enough money to administer the rural environmental pollution. At present, the conflicts between rural economic development and environmental protection in economically underdeveloped areas are fierce increasingly. There are four reasons accounting for these problems as I have concluded.

2.1 Insufficient finance of local government Since the implementation of the reform of system of dividing taxes in 1994, the fiscal situation of local government in China has been confronting more and more problems. Statistics from the authorities show that the debt situation of local government in China is extremely serious, for the average debt in each towns and villages has come to 4 million yuan and many governments have been operating under debt. As for the rural villages and towns in economically underdeveloped areas, the debt phenomenon is even more obvious. For one thing, the government has cancelled the agricultural tax, which led to the larger shrinkage of fiscal income in the agriculture-dominated areas. For another thing, the government should input financial assistance on the public utilities, such as repairing roads, constructing the garbage handling equipments, building irrigation system

and so on. Under the tight fiscal finance, the government inevitably input less finance on handling local environmental problems. Taking Huaian as an example, most villages and towns' governments input no money on environmental protection.

2.2 Unscientific assessment system for governmental officers' performances The assessment system of local government for assessing the government officers' performances is still single and the main standard is the speed of economic growth. In order to accelerate the speed of economic growth, many towns' governments in economically underdeveloped areas try their best to attract investment, and they want to speed up the local economic growth through attracting foreign capitals to show off their performances. However, in the process of focusing on economic growth in many economically underdeveloped areas, the environmental protection is neglected or ignored. In some areas, the government knows that the items are lagged and high-pollution items, which are eliminated by the economically developed areas, but they still introduce into them, which leads to the temporary increase of economic growth but great decrease of environmental quality.

2.3 The backward idea of environmental protection As for many residences in the rural areas of the economically underdeveloped areas, the idea of environmental protection has not been formed. The overwhelming majority of them are working for increasing their incomes and the awareness of environmental protection has not been formed. For one thing, there is no garbage handling equipments in rural areas; for another thing, many residences do not have the awareness of environmental protection, the phenomenon of littering everywhere is prevalent. For example, the phenomenon of burning straw at will, releasing sanitary wastewater without restriction, and emitting wastewater arising from the production process everywhere

and so on are very common in rural areas.

2.4 The imperfect laws and regulations for environmental protection Because there are no specialized laws and regulations for normalizing the governing of rural environment, the work of the governing rural environment has not been taken into the agenda by the local government. Meanwhile, the government from the upper level pays much attention to the rural economic growth rather than to environmental governing in the new village construction, and there are no laws to abide by in governing rural environment. Hence, the environmental problems are more and more serious in the economically underdeveloped areas.

3 Countermeasures and suggestions

In order to realize the coordinated development of environment handling and economic development of rural areas in economically underdeveloped areas, the government should transfer the way of economic development and develop circular economy in rural areas. Circular economy is a kind of ecological economy in essence and it is a new economic development way decoupling from the traditional mode of "polluting-handling". The appearance of circular economy is "resources-products-renewable resources". The thought train of it is using fewer resources to achieve more economic output and decrease the consumption of resources as well as pollution in the process of production^[11]. It should be conducted from the following aspects.

3.1 The government should transfer the ways of agricultural production and adjust agricultural industrial structure The agriculture should be operated under the theory of circular economy by the way of modern agricultural production. Hence, as for the economically underdeveloped areas, they should fully make use of their own advantages and seek the way of developing circular economy suited to the local distinct features. Huanian, located in the plain between Yangtze River and Huai River, is the natural lands for the production of improved rice with its fertile soil and dense network of water. In recent years, dozens of production bases for the improved rice are established in the area. The modes such as "breeding-marsh gas produced by feces-fertilizer made of the marsh gas residual", "breeding-fertilizer for cultivating crops-power making by straw" and other modes have become mature and been spread to other areas, which have obtained good economic and environmental interests. Meanwhile, after the continuous efforts, a host of famous rice brands have formed, such as Hongze Lake Rice. In the future, the government should further strengthen the construction of agricultural brands and improve the added value of agricultural products through constructing more agricultural brands, thus to better promote the development of rural economy.

3.2 The government should positively collect funds and strengthen the investment in the handling of rural environment The government should positively collect funds, construct the garbage disposing stations and strengthen the reform on rural toilets. The government should stipulate the overall plan for disposing rural environment and take the overall plan into the local financial budget. In distributing the capitals for disposing environmental problems, the government should share the larger amount of money, the towns should share the middle amount and the farmers take the smallest share of money, so

as to reasonably distribute the proportion of capitals. By this way, the shortage of capitals in disposing the environmental problems in rural areas of the economically underdeveloped areas can be effectively solved, at the same time, rural residences' responsibilities and awareness of environmental protection can be strengthened and their habits of environmental protection may be formed as well.

3.3 The government should strengthen the promotion and encourage farmers to form the civilized way of consumption Through strengthening the promotion, the government tries to let rural residences know the importance of civilized way of consumption on environmental protection. In addition, the government should strengthen the promotion of the laws and regulations on environmental protection, such as *Environmental Protection Law*, *Energy Conservation Law*, *Renewable Energy Law* and so on. The promotion way should apply the popular means, such as programs, performances at farmers' leisure time and collective time, window-promoting and so on. Through promoting, the government attends to let the rural residences to form good awareness of environmental protection and the habits of protecting environment. For example, rural residences should reduce the use of plastic bags in shopping terms; reduce the use of packed goods; form the habit of disposing garbage collectively and throwing rubbish to a specialized site so as to give convenience to disposing.

3.4 The government should enforce the supervision and establish a professional team for administrating rural environment The professional team for administrating rural environment should obey the principles of combining the dominance of the government and the participation of farmers. The governmental environmental protection department should distribute the specialized force to administrate the disposition of rural environment. Besides, the government should distribute the professional or part time personnel of environmental administration to assist the management personnel from the governmental department to administrate the environment. The government should combine punishment with rewards and as for problems detected in the process of supervision should order it to make rectification, for example, the units which do not throw rubbish according to the rules will be educated or economically punished; as for the villages which well protect the environment or villagers who do well in protecting environment, the government should give certain rewards, so as to stimulate the villagers.

3.5 The government should lay stress on the technological innovation and strengthen the spreading of technology The related department should cultivate improved new species through technological innovation. At the same time of improving new species, the government should reduce the demands on fertilizer, pesticides, water agricultural film and some other agricultural resources. By this way, environment pollution can be reduced at the same time of reducing the resource consumption. In terms of spreading the agricultural technology, the more advanced technology should be adopted, such as the soil measurement technology. The fertilizers are formulated according to the actual demands of the soil, which not only can save resources but also can reduce the pollution of fertilizers. In agricultural irrigation technology terms, if villagers shifting from

the extensive irrigation to intensive irrigation, then large amounts of agricultural water will be saved. The spreading of agricultural technologies needs the guidance of government, so the government should train the villagers, arrange agricultural technical staff to go to villages to guide the villagers and apply other ways to ensure the efficiency of these technologies.

3.6 The urbanization should be accelerated and the industrialization of villages and towns should be vigorously promoted Cities are the places with the highest efficiency of fully display the functions of resources, so for the economically underdeveloped areas, speeding up the path of urbanization is an effective way of realizing the coordinated development of rural environment and economy. Under the construction of new village, the main way of realizing urbanization is strengthening the construction of small and medium cities and towns. The villages can conduct the concentration of population through strengthening the construction of urbanization, which is convenient for the concentrated disposition of rubbish and helpful for the centralization of production factors to fully display their functions. Relative to the rural areas in the economically underdeveloped areas, speeding up the path of industrialization is an important way for promoting the economic development in this region. However in the process of industrialization, the impacts of environmental factors must be paid attention to. The program must be planned well and the admittance of enterprises should be strictly planned. Only these enterprises with high added value, advanced technology and which can greatly stimulate the development of the local economy and do not cause negative influences, can be allowed to enter. Only by this way, the quality of environment could be maintained at the same time of

improving the development of local economy.

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(From page 41)

broadcasting way in helping industries establish green images of green farms products, which plays an important part in cultivating green consumption awareness and accelerating the sales of green farms products which cannot be replaced by the traditional promotion activities. It helps industries widely to broadcast the green information to more detailed markets where the advertisement cannot reach to benefit industries in competition. There are many ways to build good relations, for example, getting involved in poverty alleviation, supporting, and disaster aiding non-profitable social activities. Through the activities of industries and contacting with the public widely, the industries should tell the green contributions and the values created by the industries to the public, establish the green industrial images, and earn the goodwill of the public to build a wide social base of green farm products sales and accelerate the healthy development of green farm products market.

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