Research on the Influencing Factors of Rural Low-carbon Economic Development and Government Regulation

OUYANG Bo-wen[1]*, WANG Shao-hui[2]

1. Wu Yuzhang Honors College of Sichuan University, Chengdu 610065, China; 2. Mathematical College, Sichuan University, Chengdu 610065, China

Abstract This paper analyses the main factors causing sluggish development of rural low-carbon economy in China as follows: the rural energy structure is irrational; the infrastructure and technology are relatively backward; system of laws, regulations and policy is not sound; fund-raising mechanism develops slowly; farmers' low-carbon awareness and ability are limited. On the basis of these unfavorable factors, from the perspective of government regulation, feasible strategies are put forward in line with the actual situation of rural low-carbon economic development in China.
Key words Rural low-carbon economy, Influencing factors, Government regulation, China

Rural low-carbon economy is of great significance to promoting the quality of the rural economy, market competitiveness, the upgrading of industrial structure in rural areas, and sustainable development of economy, society and environment. On the basis of analysing the influencing factors in the development of rural low-carbon economy systematically, from the perspective of government regulation, we put forward the strategies with the actual feasibility for the development of China's rural low-carbon economy, in order to provide reference for the theory and practice of development of rural low-carbon economy.

1 The actual value of developing rural low-carbon economy

1.1 Developing low-carbon economy is conducive to promoting rural economic quality and market competitiveness

The traditional economic development mode in rural areas restricts economic growth and quality. Extensive production and management mode makes the technological content in agriculture low and scale operation degree low; overuse of pesticides and fertilizers contaminates farmland and rural environment; small enterprise scale in rural areas, and extensive production and management mode, coupled with lack of supervision, are responsible for excessive exploitation and waste of rural resources. Development of rural low-carbon economy has provided a new opportunity for enhancement of rural economic quality. By virtue of this strategic opportunity that China vigorously advocates and develops low-carbon economy, we can improve the technological content of agricultural production, promote large-srcale operation, regulate the development of small and medium-srized enterprises, provide low-carbon technological support, promote production efficiency and curtail cost. Therefore, the development of rural low-carbon economy is conducive to realizing the transformation of traditional agriculture to modern agriculture, realizing the transformation of extensive production mode of rural small and medium-srized enterprises to intensive production method. It can improve the quality of rural economic development, and enhance market competitiveness of agriculture and rural enterprises.

1.2 Developing low-carbon economy is conducive to propelling optimization and upgrade of rural industrial structure

The optimization and upgrading of industrial structure in rural areas is the objective and requirement of new countryside construction, and effective way to solve issues concerning agriculture, countryside and farmers. However, the industrial structure in China's rural areas is irrational, which includes following aspects: the agricultural production mode is backward and agriculture has a large proportion; the secondary industry in rural areas develops slowly; the tertiary industry, especially the system of modern service industry and financial service industry is not perfect. These factors directly restrict farmers' emancipation from land and farmers' continuous and effective transfer to the city, which makes it difficult to increase farmers' income, and hampers the development of modern agriculture and change of rural appearance. Development of rural low-carbon economy can increase the technological content of three industries in rural areas, save rural labor and resources, achieve optimal allocation of resources, promote upgrading of industrial structure in rural areas, and achieve coordinated development of various industries in rural areas.

1.3 Developing low-carbon economy is conducive to promoting sustainable development of rural economy, society and environment

Harmonious development of human and nature, human and society is the core of vigorously advocating the building of harmonious society in China. In this context,

Received: August 1, 2011 Accepted: September 2, 2011
* Corresponding author. E-mail: tkwfbd@126.com

the development of rural low-carbon economy will be of great significance and value. The development of low-carbon economy in rural areas means the change of rural residents' ideas and thinking, low-carbon objective being as new value pursuit and lifestyle. It also means that the social responsibility awareness of enterprises is elevated, and the enterprises begin to pay more attention to cost saving, rational use of resources, and environmental protection in chains of production, management, and circulation. The development of rural low-carbon economy means the change of local government performance concept, and the change of promotion of the government officials from single economic indicators to overall indicators focusing on balanced development of society, economy and environment. Thus, in the fields of rural economy, society and administration, it forms good low-carbon awareness, promotes the establishment and perfection of government-led, farmers – and – enterprises – participation pattern, and ultimately achieves balanced development of rural economy, society and environment.

2 The influencing factors in the rural low-carbon economic development

2.1 The energy structure has not yet been changed and the rural carbon discharge amount is difficult to control

The energy structure focusing on coal, oil and other " fossil energy" determines that the development of China's rural low-carbon economy is confronted with enormous challenges. The development experience of western developed countries shows that when a country is in the period of rapid economic development and radical social transformation, its demand for energy will also gradually increase. Rapid economic and social development is closely linked to carbon emissions. At present, from urban areas to rural areas, China is undergoing a change: industrialization and urbanization is in the acceleration phase. As China's rural population base is large, and growth inertia is not optimistic, so it brings a series of social, economic and environmental issues, such as employment, housing, and consumption. Meanwhile, the infrastructure construction in rural areas has increased the demand for fossil fuels. According to the information released by International Energy Agency (IEA), China's disposable energy demand, on the average, increases by 3.2% annually, while energy-related carbon emissions will increase by 3.3% annually on the average. China will overtake the United States to be superpower of carbon emissions in the world. Although China has begun to vigorously develop and use new energy sources, China's energy structure is still dominated by coal. The coal, as disposable energy produced and consumed, still accounts for about 65%[1], and this state will be very difficult to change for a long period of time. With China's continuous and steady economic growth in rural areas, coupled with the transformation of rural society and local economic development, the consumption of coal, oil and other energy, and carbon emissions in China's rural areas will continue to increase. The control over carbon emissions in rural areas is still difficult to achieve.

2.2 The infrastructure and technology are relatively backward and rural low-carbon is difficult to be implemented

Sound infrastructure in rural areas is the material basis for the development of rural low-carbon economy. But due to geography, economy and other constraints, the infrastructure building in rural areas is far behind that of the urban areas in China. As the government financial support is not enough, compared to the demand of multitudinous people in rural areas for public goods, infrastructure building has become the obstacle to rural social and economic development, exerting adverse forcing on low-carbon economic development in rural areas. Imperfect and irrational rural drinking water, irrigation, cooking energy equipments, and waste storage sites lead to unscientific use of rural water resources, excessive reliance on coal energy, environmental pollution and so on. Rural low-carbon life, as a slogan, is difficult to be implemented in people's daily life. At the same time, restricted by China's independent innovation capability and level, low-carbon technology, on the whole, lags behind that of the developed countries. From authorization number of patent invention application of main countries in America from 2002 to 2006, we can find that China and the United States and Japan differ greatly. In the year 2006, the authorization number of patent invention application of America was 89 823, while the authorization number of patent invention application of China was 661, even lagging behind the neighboring South Korea significantly (Table 1). The technologies that are applied to China's low-carbon economy are literally rare. Coupled with the constraint of urban-rural dual structure, low-carbon technology in rural areas is relatively weak, or the cost of low-carbon technology in rural areas is high, adding to the difficulties of use and popularization, so low-carbon technology is difficult to provide support for development and sustainability of rural low-carbon economy.

Table 1 Authorization number of patent invention application of the main countries in America from 2002 to 2006[2]

Country	Year				
	2002	2003	2004	2005	2006
America	86 971	87 893	84 271	74 637	89 823
Japan	34 858	35 515	35 348	30 341	36 807
Germany	11 280	11 444	10 779	9 011	10 005
South Korea	3 786	3 944	4 428	4 352	5 908
China	289	297	404	402	661

Note: The data are from United States Patent and Trademark Office.

2.3 The system of laws, regulations and policy is not sound and rural low-carbon is difficult to be implemented

Laws and regulations, as well as the guidance and support of national policy are the prerequisite for the development of low-carbon economy in rural areas. Without the authority and regulation of laws, the indicators of rural low-carbon economy are difficult to be realized; lacking policy incentives and support, rural low-carbon economy will remain at the legal level, difficult to be implemented. At present, in the process of development of China's rural low-carbon economy, the related system of laws and regulation is not sound and relevant policy and guideline are not clear. Although *Environmental Protection Law*,

Resource Protection Act etc. involve low-carbon development in rural areas, there is a shortage of targeted and special provisions, so it is difficult to provide operational specifications for the development of rural low-carbon economy[3]. As the law is not clear and specific, the government departments lack legal basis and authoritative ideological guidance. Thus some related administrative regulations and rules concerning low-carbon economy are not unified and rational, and even in some places, the regulations are conflicting and inconsistent, affecting the authority and implementation effect of regulation. In terms of quantity, related administrative regulations of rural low-carbon economy is still in a state of gap or lack, not sufficient to play the vigorous role in regulating and guiding rural low-carbon behaviours. Due to the local protectionism and the impact of performance evaluation mechanism, the local government is not active in development of rural low-carbon economy, and often run afoul of the low-carbon objectives to seek unitary development, leading to the current situation that low-carbon economy is difficult to be implemented in rural areas.

2.4 Fund-raising and management mechanism are irrational, and rural low-carbon is difficult to be continued If we surpass the particular stage of economic development to blindly develop rural low-carbon economy, the result will be counterproductive. Because the achievement of the low-carbon goal is in conflict with corporate profits and local economic development objectives. The most ideal state is to achieve effective balance between the two, which requires a lot of funds to subsidize production costs of enterprises, carry out technology research and development and popularization and so on. The development of China's rural low-carbon economy is in face of funds bottleneck. First, the capital source is mainly dependent on government financial subsidies, but due to pressure of government finances and constraints of financial strength, the proportion of government financial expenditure, especially local public financial expenditure, which is used in low-carbon economic development, is relatively small[4]. In addition, the government regulators sometimes are remiss or the regulatory functions backfire, giving rise to phenomenon of "government failure", thus unable to achieve the expected objective. Second, the market mechanism is imperfect. The enterprises are to seek the goal of maximizing profits, rather than assume the cost arising from low-carbon economic development, more reluctant to provide financial support, which thus reduces the source of funding for rural low-carbon economy, and leads to "malfunction" of market mechanism in development of rural low-carbon economy. Third, the donation of social organizations and individual citizens to the development of rural low-carbon economy is limited, in conjunction with dearth of convenient and smooth fund-raising channels, which makes the social forces with low spirit hard to enter the development of rural low-carbon economy.

2.5 Farmers' low-carbon awareness and ability are limited and rural low-carbon lacks mass foundation Farmers are the direct beneficiaries of development of low-carbon economy in rural areas, and also the major participators, constituting the broadest basis of developing rural low-carbon economy. Currently, China's rural masses are devoid of mature low-carbon awareness and ability. Primarily, with the popularization and application of mechanization, technology and informatization in rural areas and agriculture, there have been a large number of rural surplus labor forces, wherein young man and middle-aged man are the majority. These surplus labour forces transfer to the cities and non-agricultural industries, leading to generally low educational level of surplus labour forces in rural areas, while being that rural low-carbon economy is new matter and phenomenon, the rural masses are difficult to recognize and accept it temporarily. Secondly, the cultural tradition in rural community has fostered farmers' values that they are always nonchalant, inactive and falter in participation, while the development process of rural low-carbon economy is long and rural low-carbon economy fares slowly. It should be noted that rural low-carbon economy does not pose a direct threat to farmers' personal interests, therefore they are not enthusiastic. Again, impacted by educational level and the characteristics of industries the farmers engage in, rural people have not yet been equipped with ability to develop low-carbon economy, such as new irrigation methods, modern agricultural technology, low-carbon lifestyle, and so on, so that the development of rural low-carbon economy remains at the level of planning and policy, difficult to be carried out in depth.

3 The government regulation in rural low-carbon economic development

3.1 Gradually change the energy structure and control rural carbon discharge amount Using wind energy, hydraulic power, solar energy and other new energy to replace coal, oil and other fossil fuels, so as to realize the transformation of energy structure gradually in more fields in rural areas, is an important condition for controlling carbon emissions and promoting development of rural low-carbon economy. The government departments should strongly encourage and support development and utilization of China's new rural energy. First, we can use government investment to set up plants, which are used to develop rural wind energy, hydropower, and solar energy. This will be an effective solution to the predicament that the market is reluctant to invest and the power of individual is limited. It can provide green energy for rural electricity, irrigation, living and so on. The government departments should also let low-carbon energy deep into the countryside, agriculture and farmers' living and production, by dint of new energy use to promote the transformation of rural industrial structure and lifestyle in China. Second, we should increase supervision, gradually transform the extensive mode of operation to avoid environmental pollution and waste of resources of rural small and medium-srized enterprises, and draw on the modes of enterprise merger, enterprise restructuring, and enterprise cooperation, so as to realize standardized scale development of rural small and medium-srized enterprises, and facilitate the registration and regulation. In addition, we should achieve change of energy structure through financial support and technical support. Meanwhile, the government should increase efforts to develop modern agriculture and promote intensive, large-srcale development of agriculture, to achieve low-carbon agriculture.

3.2 Strengthen inputs in infrastructure and scientific research provide support for rural low-carbon In view of the reality of unsound infrastructure in China's rural areas, the government departments should strengthen public service function, increase the proportion of the government financial spending in infrastructure building in rural areas, gradually narrow the gap between urban and rural areas, and in particular, improve the building of rural transport, irrigation, waste storage and disposal and other facilities, to effectively mitigate chaotic emissions, waste of resources and so on in rural areas. As for technical support of development of rural low-carbon economy, according to "triple helix theory", the government should actively promote cooperation and interaction in government, universities, and enterprises, realize effective connection of administration, science and technology research and development, and production, so that administration is dominant. The government should draw on human and intellectual advantages of university, to provide low carbon technologies for the development of rural enterprise (Fig. 1). Government departments should take the lead to set up project group, which consists of government departments, university scientific research personnel, and corporate management personnel, and formulate the low-carbon objective and specific planning for the development of rural enterprises through joint consultation and discussion. For agriculture, we should rely on the scientific research strength of agricultural colleges, to research, develop and promote modern agricultural production techniques, such as knowledge and technology on pesticides, fertilizers, irrigation and other aspects. Meanwhile, we should conduct actual survey deep into villages, carry out scientific assessment on the stage and level of development of rural economy, society and enterprises, and on the basis of this, rationally develop rural low-carbon economy.

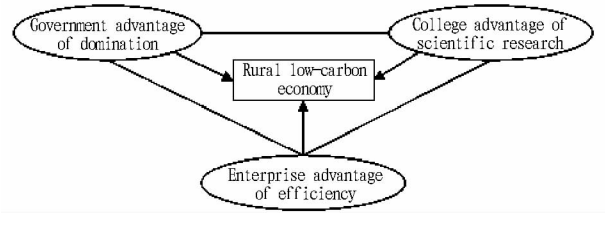

Fig. 1 The cooperation mechanism of government, college and enterprise during the development of rural low-carbon economy

3.3 Improve the system of regulation and policy and guide rural low-carbon behaviour Government departments should emphasize survey, research and data collection, in order to provide comprehensive, accurate and effective information support for legislation of rural low-carbon economy, and help lawmakers to know actual situation of the rural areas as quickly as possible. The laws regarding the development of rural low-carbon economy should be enacted, and especially one special law on rural low-carbon economy should be enacted based on the actual situation of the rural areas, in order to conduct clear, comprehensive and professional definition and regulation on behaviour of rural low-carbon economy. To make the law easier to be implemented, the government departments should speed up administrative legislation work. According to the provisions of the existing legal documents, under their idea guidance, we should formulate administrative regulations on rural low-carbon economy, ensure accuracy, uniformity and consistency of these administrative regulations, maintain authority of these administrative regulations, and reduce implementation obstacles and deviations. Because of relatively stable characteristics of laws and regulations, it determines relative lagging of laws and regulation on rural low-carbon economy, so the government departments should frame the policies and guidelines with flexibility, timeliness and enforceability, according to the actual situation in rural areas in different periods and different regions, to regulate and guide the thought and behaviours of local governments, social organizations and individual citizens in development of rural low-carbon economy. In addition, we should carry out reasonable reform of performance evaluation system on local governments, incorporate the development level of rural low-carbon economy into evaluation, and enhance enthusiasm and sense of responsibility of local governments in developing rural low-carbon economy.

3.4 Establish multiplex fund-raising mechanism and promote continuous development of rural low-carbon To effectively address "government failure" and "market failure" in development of rural low-carbon economy, we must establish diversified fund-raising mechanism, and set up special development fund for rural low-carbon economy, which is used for infrastructure construction, technical research and development, financial subsidies, publicity and education, and other expenditure. One is to increase government support and input for rural low-carbon economy, stipulate the proportion of government financial spending in development of rural low-carbon economy through the mode of government budget, and ceaselessly elevate standard according to the speed and level of economic development in different regions, so as to realize leading role of the government. The second is to foster corporate social responsibility, establish smooth dialogue and fund-raising channels, encourage and support enterprise donation, or participate in technical research and development as well as investing and establishing plants on rural low-carbon economy in the form of becoming a shareholder, to directly or indirectly reduce the government's financial pressure. This is also the requirement of reflecting modern corporate responsibility, and repaying the society. The government departments can guide market mechanism to participation in rural low-carbon economy through methods of material and spiritual incentives. The third is to establish organizations and institutions serving society, strengthen contact with international organizations, social organizations, volunteer organizations, individual citizens and so forth, and reduce donation procedure restriction, so that more social capital and services flow into rural low-carbon economy.

3.5 Foster farmers' low-carbon awareness and ability and promote the rural residents' recognition and support Government departments should step up publicity and education efforts, in particular, change the traditional way of publicity, comprehensively use newspaper, news, bulletin boards, brochures and other forms to publicize the actual situation of environmental

(To page 20)

technological, ecological, fine and green development.

3.3.9 Technological development and equipment manufacturing works for circular economy. We should focus on supporting construction of research centers and technical centers for circular economic works, and promoting scientific and technical innovation combined with production, teaching and research of circular economy. Besides, we should develop and popularize advanced suitable technologies and equipments that have certain application foundation, to accelerate development of circular economic equipment manufacturing industry.

3.4 Take institutional construction as guarantee of circular economic development

3.4.1 Strengthen institutional guarantee and push forward rule-of-law of circular economy. It is required to practically implement policies made by the State for supporting development of circular economy, including income tax and value-added tax reduction policy, market access and government green purchase policy, *etc*. In addition, we should perfect local supporting systems of laws and regulations, accelerate the formulation and promulgation of the *Ordinance on Circular Economy Promotion of Anhui Province*, and build and develop comprehensive and long-term mechanism suitable for circular economy. The idea of circular economy should be manifested fully in production, circulation and consumption. And it is recommended to research and formulate appropriate policies for promoting development of circular economy from industry, finance, investment, and credit, *etc*.

3.4.2 Enhance planning and guiding, and put into practice of scientific development. We should firstly formulate overall plan for development of circular economy. Then, we should make specific plans for circular economy in major industries such as steel, nonferrous, coal, chemical, and building materials, comprehensive utilization of waste, construction of terminal markets for renewable resources, and utilization of recycled metals. Besides, we should make definite developing goals, tasks and safeguard measures of circular economy, propose assessment indexes for resource output rate, and waste reusing and recycling rate, and arrange major areas and key projects for promoting development of circular economy.

3.4.3 Intensify scientific and technological support and innovate technical service. It is proposed to quicken development, popularization and application of technologies for conserving, replacing, recycling and "Zero" emission. We should intensify construction of enterprises' independent innovation system with technological development center as major points, to support construction of technical service system for circular economy. Besides, we can bring into play functions of associations, scientific research institutions, universities and colleges, energy saving technical service center, cleaner production center, and circular economic center, establish and perfect consultant service system for information system and technology of circular economy, timely disclose information about technology, management and policy of circular economy, and carry out propaganda, consultation, training and popularization works.

3.4.4 Advocate all people participation to form joint forces of many parties. We should start with family, community and school education, continue to carry out in-depth propaganda of circular economy, popularize circular economic knowledge, increase the social acceptance, and set up ecological civilization concept in the whole society. Besides, we should actively encourage masses to participate in activities, supervision and management that are favorable to development of circular economy, and to practically guarantee peoples' rights to know, participate and supervise.

References

[1] XIE ZH. China Circular Economy Yearbook (2010)[M]. Beijing: China Financial and Economic Publishing House, 2011: 35-111. (in Chinese).

[2] QI JG. China Circula Economy Development Report (2009-2010)[M]. Beijing: Social Sciences Academic Press, 2010: 225-312. (in Chinese).

(From page 14)

pollution and resource depletion at home and abroad, and take into account the rural residents' interests, to publicize the importance of rural low-carbon economy and the benefit it can bring to individual farmers. We should let the people understand the current situation, accept low-carbon economy, and regulate their own thinking and behaviour in accordance with the objectives and requirements of low-carbon economy. The low-carbon economy not only includes unitary main body of government, but also includes social organizations, and individual farmers, and so on. The development of rural low-carbon economy is a issue involving joint governance by multiple subjects. According to thinking of "multi-center governance theory", the government departments should establish diversified participation mechanisms, gradually nurture farmers' sense of participation and skills, achieve the great development of rural low-carbon economy, so that the benefits are shared by the masses. Finally, the government departments should invite the experts who engage in research on issues concerning agriculture, countryside and farmers, to provide farmers with knowledge and technical training on modern agricultural production and living for free, in order to gradually strengthen farmers' low-carbon capacity so that the farmers become participants and implementer of rural low-carbon economy.

References

[1] YU L. China's policy orientation of the development of low-carbon economy[J]. Ecological Economy, 2010(11): 94-97. (in Chinese).

[2] LI M. Chinese model and the dilemma of low-carbon economy[J]. The Journal of Humanities, 2011(1): 57-61. (in Chinese).

[3] WEI Q. Discussion on the construction of environmental protection legal system in new rural areas under the idea of "Low Carbon Economy"[J]. Journal of Anhui Agricultural Sciences, 2010(16): 8756-8758. (in Chinese).

[4] ZHANG SW. The government responsibility and its achieving methods in low carbon economical development[J]. Journal of Anhui Agricultural Sciences, 2010(29): 16613-16614, 16617. (in Chinese).