

Growing a green economy in China

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Abstract. With the rapid development of economy, resource depletion and environmental degradation have become serious challenges for Chinese sustainable development. Green development is a mode of well environmental and high-quality economic development. It is necessary for China to implement green development. In this review, it discusses the green development problems in China, the international experience and connotation of green development are summarized and identified further. Based on the connotation and experience of green economy development, it puts forward several countermeasures and suggestions for Chinese green development finally.

1. Introduction

The rapid development of Chinese economy has brought enormous pressure on resources and environment. Chinese GDP accounts for less than 10% of the world's total GDP, but it consumes 20% of the world's energy, 30% of the world's iron ore and 54% of the world's cement [1]. Energy consumption, pollutant emissions and carbon emissions per unit GDP are much higher than those of developed countries. In 2005, Chinese economy quickly grows at the expense of resource depletion, environmental pollution, and ecological degradation. It accounts for 13.5% of GDP that equals to 2 trillion and 500 billion yuan in the year. It declines slightly in 2010. The cost of resources and environment for economic growth in 2010 accounts for 12.5% of GDP. However, it is still high, and the proportion of resource consumption changed little [1-3]. In the future, Chinese economy will be faced with the constraints of resources and environment, including energy supply and demand balance, water resources protection, environmental ecological capacity and etc. Because of the non-mobility of water resources and environmental capacity, the constraints of water resources and environmental capacity will have far-reaching impacts on the spatial pattern of economic development. Accelerating the transformation of the mode of economic development and promoting green development are the fundamental outlets for China to break through the constraints of resources and environment [1-3].

At present, Chinese green economy development is faced with a good opportunity. On one hand, China has implemented a five-year plan (2011-2015) that devotes a large portion of its investments to green key sectors, e.g., renewable energy and technologies. China is now in its 13th Five-Year Plan (FYP) period. The plan which was released in March 2016 after the annual National People's Congress (NPC) maps out China's economic and social development in the next five years (2016-2020). The guidelines for the 13th FYP are "innovative development", "coordinated development", "green development", "open development" and "shared development". "Green development" have received particular focus. Ten targets for "green development" are all obligatory, in contrast to other targets that are mostly anticipatory. The next five years may see major breakthroughs in "green development", however, driven by the shift from manufacturing industries to services industries,



particularly its move to cut overcapacity in some high energy consuming and highly polluting industries. The Fifth Plenary Session of the 18th Communist Party of China Central Committee treat the green development as a new strategic height. On the other hand, the concept of green development has drawn more and more attention and recognition from all sectors of society.

This paper analyzes the problems faced by green development in China. It introduces international experience, and summarizes the concept and connotation of green development made by the experts and scholars. It also puts forward several countermeasures and suggestions for green development in China.

2. The problems faced by Chinese green development

People from different fields are forming a consensus on the road of green development. However, some government departments, administrative units and enterprises have incomprehensive understanding or even serious misconception on green development, and the practice of green development is still in the exploratory stage [1, 2].

Firstly, there exists the phenomenon that they often consider that green development is opposed to economic development. Some local governments believe that green development is an obstacle to economic development, and will make GDP fall down. This makes the local government believe that green development will hinder the development of local economy. The wrong understanding of the nature of green development has led to emotional resistance and difficulties in operation in the promotion of the concept of green development.

Secondly, the green development road still stays in the theoretical discussion at present stage. In practice, the local region have not formed the green development strategic plan which has the actual operation and specific time step. It is necessary to formulate an outline of green development strategy and green development plan, and integrate green development idea into production and practice. Through policy guidance, legal protection, science and technology promotion and social diffusion, a thorough green revolution need to be carried out.

Third, the current legal environment construction of green development in China has some problems. Environmental legislation theory and practice are disjointed. Green development has not yet fully become the guiding ideology of environmental resource legislation in China. Chinese environmental legislation system also need to improve the environmental protection law and justice constantly. Law enforcement is facing with many difficulties, such as environmental justice, and environmental law enforcement predicament.

Finally, the green development road lacks institutional guarantee. Due to years of the extensive mode of economic development, a variety of Chinese current system's existing policies are formulated based on the extensive mode of economic development. The implementation of these policies has hindered the development of the green road largely. The relevant departments also need to actively explore how to reform the way of green development.

3. The experience and concept of green development

3.1. International experience and practice on green development

The United Nations (UN) conference on the environment and development held in Rio de Janeiro in 1992 formally adopted the concept of sustainable development defined by the Brundtland report as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [4]. Twenty years later, the Rio+20 conference coined the concept "green economy" [5, 6]. This popular concept is perceived as a pathway to sustainability by international organizations such as the World Bank (2012) and the United Nations Environment Program [7].

Moreover, green economy has been widely used to address the financial and climate change crisis [7], and it is also an essential element in achieving the climate mitigation targets refined in the Paris meeting. However, the connections between green economy and climate mitigation still need to be

further explored. On a national scale, several countries are developing green development strategies, policies and program [8]. In Asia, South Korea is one of the forerunners. After the outbreak of the financial crisis in 2008, the Lee Myung-bak administration proposed the green growth strategy, issued a "green energy technology development strategic roadmap", and put the green technology industry as a key development area [9]. In 2009, the country announced a five-year plan to invest approximately 2 percent of its Gross Domestic Product (GDP) in the field of green growth every year.

In the European Union (EU), a range of measures related to the green economy concept are integrated into strategic documents such as the Europe 2020 and the Resource Efficiency Roadmap [10]. The confederation government and various departments of Swiss have formulated several relevant policies and incentives to encourage rural employment and increase income. The northern Navarra region of Spain suffered a severe recession in the 1980s-1990s. The local government immediately issued a green industrial development policy to expand the development of renewable energy and to create new jobs. With the growth in demand for skills, the government has established a public skill training center to ensure the rapid growth of the renewable energy industry [11-13]. At present, more than 2/3 of the electricity in the region comes from renewable energy. Renewable energy employment increased by 183% in 2002-2006. It created 100 enterprises and more than 6000 jobs in 2007, which laid a solid economic foundation for coping with the financial crisis in 2009.

Australia has developed a series of policies to promote green development. Take water resource management decisions as a representative example. The Australian Government Committee (COAG) promulgated the water reform framework in 1994, and promulgated water law in 2007 (Water Act 2007). In 2009, it proposed the establishment of the national water resources market system initiative, etc. These laws and regulations make great contributions to the promotion of green development [12, 13].

In Canada, Canadian environment minister Committee (CCME) and water agenda Development Committee (WADC) formulate the national water resources assessment guidelines to help the federal government and each province to manage water resources. It includes the establishment of water resource allocation and protection strategy, water quality standards, water price formulation, and the compensation scheme [9-13].

3.2. The concept of green development

Compared with the application of green economy in policies, the concept itself has a longer history in the academic world. Green economy was firstly introduced by Pearce et al., 1989 in response to the undervaluation of environmental and social costs in the current price system [11]. Since then, the concept has been broadened. Green economy has been defined by UNEP (2011a) as one that results in improved "well-being and social equity, while significantly reducing environmental risks and ecological scarcities". Green economy can be simply defined as being low-carbon, resource efficient and socially inclusive [7]. UNEP emphasizes the preservation of natural capital, which includes ecosystems and natural resources (EEA, 2014). For a long time, "green growth" only applied to the growth of the eco-industry. However, the term is currently used for the growth of the entire economy [12]. Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and the environmental services which our well-being relies on. To achieve this, it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities [13]. Green growth is a kind of qualitative growth. It is efficient in its use of natural resources, reduces pollution and environmental damages and resilient in natural hazards [14]. All these definitions show that green economy is an "umbrella" concept that encompasses different implications with regard to growth and well-being, or efficiency and risk reduction in the use of natural resources.

For the last ten years, the notion of a green economy has also become increasingly attractive to policy makers. Green development covers a variety of concepts. Its links with sustainability are not always clear. A G Hu believes that green development emphasizes the unity and coordination of economic development and environmental protection, and it is a more active and human-oriented

sustainable development road [15, 16]. H B Ma believes that green development is a comprehensive concept of circular economy, green economy, sustainable development and low-carbon economy [17]. J N Wang believes that green development is a sustainable development of resources and environment, harmony between man and nature, and an internal productive force of environment [18]. D J Zhu believes that green development will innovate social system, improve the scientific and technological content. It is a low-carbon economy that uses high-tech to achieve energy saving and pollution emission reduction [19]. D G Yang believes that green development is to cope with the challenges of global warming, the world financial crisis, domestic resources and environment damage and economic structure adjustment. It relies on scientific and technological progress and green reform to realize the sustainable development [20]. W L Hou believes that green development is to conserve resources and environment bearing capacity. It uses high-tech to replace artificial capital and natural capital environment to improve the production efficiency, and make the economy low carbon emit and low energy consumpt [21]. J J Zhao and F T Yang believe that the ultimate goal of green development is to achieve sustainable development. It emphasizes the harmonious development of economy, society, resources and environment in the process of development. It is necessary to change the way of energy consumption and change the energy consumption structure [22]. Researcher W Y Niu believes that green development is not only about economy and wealth. It has broad connotation. There are at least four stages to green development path: first, no natural green, no better life; the second is the green economy, study the efficiency and interactive influence of natural ecological system in the system; the third is social green, namely fairness and justice, emphasizes the achievements in the inclusive development; the forth is the soul of the green that is to cultivate a healthy and green life [23-26] Green development should be gradually upgraded and expanded. Professor X X Li believes that the main problem of the current constraints of Chinese green economy development is the system. China government should carry out the green finance, green credit, green finance and green related policies and measures to further promote the green development [27].

Mr. OYEBANJI, the director of global detection and Research Department of UN-Habitat (OYEBANJI OYELARAN- OYEYINKA) believes that the implementation of green development, should pay attention to the problem how to define the concept of green development and green economy firstly. Secondly, we should pay attention to the poverty problems in social development, such as poverty, inequality and unemployment. An important prerequisite for achieving green development is sustainable development. We can discuss this topic from many perspectives, including politics, economy, society, environment and so on. We should focus more on the issue of sustainable development from the angle of society. Sustainable development is not only a kind of high-speed development, but also a coordinated development. It is important for more people to benefit from it [28]. In the pursuit of sustainable development, it is important for everyone in society to make their voices heard, and everyone can express their wishes and interests. At the same time, in this process, international coordination is needed, and the developed countries should not outmatch the developing countries, and the developing countries should seek new ways of development in light of their own historical development. Finally, what we should consider is how to keep economy develop better and faster not at the expense of resource and environment. The environment here includes not only the physical environment like buildings and the natural environment, but human beings should also pursue the harmonious development of economy and environment.

The connotation of green development could be summarized as the following three points. First, economic development should take the environment and resources into account. The environment and resources have become the focus of contention among countries all over the world. We should admit that the environment is valuable today. Sustainable development is the ultimate goal of green development. Secondly, the main content of green development is to realize the "green" and "ecological" of economic activities. Thirdly, green economy development requires people to both meet the standard of living and not to reduce the ecological environment quality. It makes the growth under the carrying capacity of resources and environment.

4. Countermeasures and suggestions for green development in China

4.1. Construct green innovation system

Thomas Friedman, a famous environmental writer, once said, "the most environmentally friendly countries are often the most innovative countries". The 18th CPC National Congress put forward the construction of socialist ecological civilization and the strategy of innovation driven, and pointed out that we should rely more on saving resources and recycling economy to promote the transformation of the mode of economic development. Therefore, the starting point of Chinese ecological civilization construction and green development road is to build a green development and innovation system. The green development abandons the industrial civilization, subverts the traditional scientific paradigm, and the innovation model also requires sustainable, low energy consumption, low pollution. It treats the green science and technology as the core of the scientific paradigm. Therefore, the green development path to innovation put forward new requirements, at the same time, the new innovation paradigm will bring to the green development great power [20-30]. The famous economist Stiglitz once wrote: "It need to reposition Chinese investment, which includes the input of innovation. We should focus on resource conservation. This is part of a series of changes in growth patterns, and we can also call it a new growth model." Furthermore, Chinese green development should establish an innovation system based on green technology. In order to promote the diffusion of green technology, it should take environmental technology factors into consideration in the process of research and development. China should enhance the green technological innovation ability of enterprises, and the joint cooperation between the enterprise and scientific research institutions. Improve green technology and enterprise green innovation incentive system, and actively involves in international competition to break the green technical barriers [20-25].

4.2. Improve the green development policy guarantee

Perfect green laws and regulations construction. We should learn the legislative experience of the well- green countries in the world and introduce advanced legislation methods and techniques for green development to accelerate the implementation of the domestic legislation process. In addition to international standards, the concept of green development should also be incorporated into the domestic legal system. It requires consider green in criminal law, administrative law, civil law and other laws and combine to promote the green domestic law [25-30].

Actively explore green finance channels. Introduce the concept of ecological civilization into the development of financial reform, and form the ecological environment of the real financial policy, which is conducive to the formation of financial growth mode of resource saving and environmental protection. By the use of the financing function of financial system, pour more funds into the development of green industry. Provide effective services for financial policy a new model of green development, promote the development of green economy, play the green financial system at great capacity, and coordinate personal vision and corporate development goals [1-3].

4.3. Cultivate a green atmosphere for the development of society

In the aspect of culture, we should raise people's awareness of green development, train people's special feelings for green development, develop good green civilization behavior, and build a social green culture system. The core of cultivating people's awareness of green culture is to develop the citizens' ecological consciousness of suffering, ecological morality and ecological responsibility consciousness. Promote the construction of re-understanding of civilization pattern in soul, and establish a correct understanding of the green development. Establish strong feelings for the ecological environment of human survival, and put the mode of green development culture into the human psychological structure systems [1-8].

In order to construct green culture system in China, firstly we should start with the study of the green culture theory. We should be good at summing up and exploring the essence of green development in the traditional culture of China. It requires critical thinking in the traditional culture of

green development. Integrate the green culture into the national culture in China discourse system. Secondly, improve the internal creativity, external attraction and market penetration of green culture. Combine the green culture with Chinese science, technology and education. Strengthen the green industry research, and enhance the green culture construction level at the same time. Realize the guiding role of green culture in people's idea and behavior through cultural appeal, and then the public can consciously use advanced ecological culture to make contribution to the green development of China.

4.4. Improve national green technology

The national green development should rely on solid green technology. The green technology is referred to supporting the resource conservation and environment friendly and ecological conservation technology [19]. It aims at achieving the sustainable use of resources, environmental protection, ecological restoration and so on. It includes green energy technology, green transportation technology, green building technology and green manufacturing technology, green agricultural science and technology, green science and technology service. China should drive great attention to the vigorous investments in the Research and development of green technology. In order to develop green technology better, the following aspects should be taken into account, such as promote green technology development, establish and improve the green standards and labeling system, green technology verification system, perfect the intellectual property protection system, preferential tax policy, green technology innovation investment and financing mechanism, the establishment of green procurement system, scientific and green technology innovation investment fund, etc.

5. Conclusions

This article introduces the necessity and opportunities faced with green development in China. There comes with several problems in the process of green development in China, such as the connotation of green development is not clear; the public and the local government always misunderstand the mode of green development, and they may think it will affect their economic situation unfavorably; the study of green development remains at the theoretical stage, and it is lack of the practice of specific measures; green related laws, system guarantee and so on. Therefore, this article presents some foreign green development policy and technological experience, combing the connotation of green development and definition, and finally puts forward several proposals, such as establish green development innovation system and policy guarantee, cultivate green cultural development atmosphere, and improve green technology.

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