# Ecological Orientation of Technological Innovation of Circular Economy

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**Abstract** The implementation of circular economy requires the support of technological innovation, namely requires to carry out ecological technology innovation. Ecological technology innovation concentrates on developing economy and solving the pressure and damage to resources and ecological environment in the process of economic development, enhancing sustainable support capacity of resources and ecological environment to economic and social development, promoting sustainable development of economic society and ultimately achieving human ecology. The papen analyze the factors obstacles of market failures due to resource environment, path dependence on traditional development model, weak demand of ecological products and public ecology awareness, which can make ecological technology innovation encounter dilemma. The anthors Propose the ways of establishing the enterprises technology innovation alliances that face with circular economy, expanding products innovation fields that face with circular economy, enhancing process innovation level that face with circular economy in order to promote ecological technology innovation under circular economy.
**Key words** Circular economy; Ecological technology innovation; Achieving ways; Ecological benefits

## 1 Introduction

China started to research into circular economy later. Environmental protection experts of china treat circular economy as a professional concept and carried out discussions among the peers. At present, though circular economy has attracted extensive attention in the academic field, which has not attracted extensive attention and concern of relevant departments and enterprises fields, neither with relevant laws and regulations nor carrying out the concrete promotion measures that has been applied to practice. Therefore, china has great gaps between western countries from the angle of the researched theories and practices of circular economy.

Feng Zhijun assumed that circular economy emphasized on overall returns of "ecological values", advocated shifting to ecology in the field of production and consumption, acknowledged the existence of "ecological niche" and respecting natural rights. Advocate intergenerational equity and intergenerational justice of human welfares, implement the reduction, reuse and resources production, carry out innocuous environment management and environmental-friendly consumption. Han Baoping, Sun Xiaofei suggested that china has large population, relatively weak resources, fragile ecological environments. It cannot endure the high-intensity resources consumption and environment pollution in the form of traditional economy in two aspects-resources storage and environmental carrying capacity. Research into circular economy problems have many perspectives, scholars home and abroad published some works and papers about circular economy in the perspective of economy, ecology, management and environment science, such as *Introduction to circular economy*, *Discussion of circular economy*, *Theory and practice of circular economy*, *Clean production and circular economy*, *Circular economy: building well-off society*, etc. These books described the basic theory of circular economy, introduced the overview of circular economy development. Domestic journals had published a number of papers that are similar to the works mentioned above.

Explain circular economy from technology angle, though scholars home and abroad had some discussions, there did not exist research results that had a comprehensive and systematic description about the technological strategy of circular economy, which required us to fully consider resource ecology benefits, fuse the constant usage of resources and ecological protection into the aims of technological innovation effectively in the activity of technological innovation.

## 2 The Meaning and Requirements of Ecological Technology Innovation

### 2.1 The meaning of ecological technology innovation

Ecological technology innovation can be understood in narrow and broad aspects. Narrow ecological technology innovation specifically refers to a series of technological innovation process of products innovation, process innovation and management innovation of environmental protection industry. Broad ecological technology innovation refers to that economic activities may be the ecological orientation of all economic bodies that affected by ecological environment in the process of technological innovation, namely all the economic bodies must take ecological factors into account in the process of technological innovation. In this paper, we adopt the broad concept of ecological technology innovation. Ecological technology innovation is a new interpretation and to orientation change to traditional theory of technological innovation, which requires to introduce ecological consideration comprehensively, consider the impact and role of technology on environment and ecology, which not only ensures the innovation and practice of technology, but also ensures a clean environment and ecological balance, create ecological values while in the realization of commercial value, the ultimate goal is to coordinate human development with natural environment, the ultimate aim is to achieve sustainable development of human beings.

### 2.2 The requirements of ecological technology innovation

First is economic and ecological benefit. Economic and ecological benefits include economy quantity growth and the improvement of quality, which also include the contents, such as economic growth mode, product consumption mode, economic structure, constantly optimizing products distribution and constant improvement of economy system. Namely economic growth rate, quality and scale have a organic unity with efficiency; meanwhile which is also helpful to optimize economic structure, the reasonable product consumption, fair wealth distribution and the quality improvement of people's lives.

Second is resources ecology efficiency. Technological innovation is carried out on the basis of some natural resources, good ecological environment and rich natural resources are the substance premise of constantly carrying out technological innovation in the whole society, therefore, seeking the ecological efficiency of resources and enhancing the coordination development between human and nature are good to the sustainable development of technological innovation itself. This requires constantly enhance the usage rate of substances and energies, reduce waste emission, minimize and reduce the consumption of unit natural material resources and energies, reduce the adverse effects of production activity on ecological environment in the activity of technological innovation.

Third is clusters ecological benefit. Achieving ecological benefits of technological innovation clusters require to constantly enhance the degree of its ecological clusters. The key formation mechanism lies in the mutual incentives between technological innovation. This is not only conductive to the sustainable development of technological innovation itself, accelerate the pace of technological innovation clusters, but also expands the scales of technological innovation, expands the scope of technological innovation selected by the main body, is conductive to play the innovation advantages of the main body itself. Therefore, attaching importance to explore the inherent incentives mechanisms of technological innovation, enhancing ecological clusters degrees of technological innovation, are not only conductive to economic development, but also reduces the threshold of people's participation in technological innovation.

Forth is social ecological benefits. Ecological technology innovation will focus on the contradiction between man and man, namely social ecological problems when ecological technology innovation solves the relationship between man and nature, which will make the coordination development between society and nature, attach importance to enhance the quality of people while enhancing life quality of people in order to make social progress adapt to economic development.

## 3 Achieving Circular Economy Based on Ecological Technology Innovation

### 3.1 Ecological technology innovation is the technological foundation for achieving circular economy

Under the pressure of global resources crisis and environmental degradation, countries especially developed countries increase the research into ecological technology, the achievement of circular economy requires technologies support, energy utilization technology, waste recovery, recycling technology, recycling and alternative technology of resources, pollution control technology, environmental monitoring technology, process technology of preventing pollution and so on, these technologies are the substance foundation for constructing circular economy, are technology support for constructing circular economy, transform and develop traditional industries through ecological

technology innovation, before, backward, later spread of high technology industry and penetration effects, upgrading industrial structure is the inevitable choice to convert to intensive growth pattern.

### 3.2 The circular transformation of traditional industry and the development of high technology industry reply on technological innovation

Generally speaking, the industrial structure of china is still dominated by traditional industry, the enterprises that are harmful to environmental pollution account for a large proportion, the high technology industry with broad market prospects, low dependence on resources, small environmental pollution has small scales, which accounts for a low proportion, are lack of the overall promotion role in economic growth. The relatively weak technology level and innovation capacity not only restrict the circular transformation and promotion of traditional industry, but also affect, even restrict the application and promotion of environmental energy-saving technology in enterprises, so promoting scientific and technological progress, developing high technology vigorously and carrying out circular transformation to traditional industry are the key ways to promote the circular usage of raw material and energy, reduce consumption and pollution and achieve double efficiency of economic output and environmental protection.

### 3.3 The recycling usage of resources rely on technological innovation

Resources include non-renewable resources and renewable resources. Non-renewable resources cannot be recycled, which requires to adopt high clean production technology to increase the usage rate of resources, reduce the raw material of non-renewable resources and the consumption rate of energy, the importance is to develop the new substitutes, such as new energy and raw materials with the help of scientific and technological innovation, reduce the waste emission in the production process through scientific technology.

### 3.4 International development trend requires to go the technological innovation ways of circular economy

Under the pressure of global resources crisis and environmental degradation, countries especially developed countries all increase the research into new energy and circular economy. The research and development of circular economy technology represents development direction of future technology. Be on the road to circular economy has already become a new competition on integrated national competition and competing for international development, circular economy has become important factors that can affect the future development potential of a country, what is more, which will extend to many fields, international trade, international investment and international politics through various international standards, environmental protection requirements.

## 4 The Factors Hinder Ecological Technology Innovation of Circular Economy

### 4.1 Environmental policy is not sufficient

Though china has some environment protection laws, the current environment legislation concept in china is confined to the idea mode of “pollution control”, regarding the waste as harmful things simply, placing people in a passive defensing status, which are contrary to the concept of circular economy. The relevant laws and regulations on ecological technology innovation in china is imperfect, the guiding policy about encouraging enterprises to carry out ecological technology innovation is fewer, generally speaking, the environmental protection policy of china still belongs to population prevention type, which are lack of necessary mandatory and technological standards, has poor bindings on the enterprises, cannot promote the ecological technology innovation of enterprises effectively.

### 4.2 The high cost of ecological technology innovation

National situation of china is that china has a large number of labor force, weak economic foundation, insufficient technological conditions, which makes be dependent on importing technology, develops labor-intensive industries, becomes the main developing model of china since reform and opening up. This pattern has promoted rapid development of China during the nearly 20 years, which has caused a lot of sunk costs of traditional industries, the cost of transforming ecological technology of these traditional industries is high. Ecological technology innovation means higher production costs, one-way driven by economic interests, the initiative of carrying out innovation of enterprises is not high, the main body of innovation is difficult to establish.

### 4.3 Enterprises are lack of the awareness of ecological technology innovation and innovative products

The majority of Chinese enterprises are lack a sense of urgency of ecological environment and a crisis sense of natural resources, are also lack of social responsibility to protect the environment. In the

minds of many corporation managers, corporation economy is opposite to society, ecological benefits, forced by economic growth and employment pressure, in fact massive social majority and local government set economic growth as the primary goal, environmental problems are always put into fringes. Therefore, carrying out the selection of technological innovation model and direction always adopt the method of quick success, thus which will increase the damage of the enterprises to social and ecological environment.

The products innovation of enterprises in china are mainly on imitation, improvement and substitution, fewer all-product innovation is mainly due to that enterprises cannot grasp economic growth points and products demand market brought about by developing circular economy in time, so the enterprises are lack of core competition cannot cope with the challenges from the adjustment of domestic and international industrial structure.

## 5 The Basic Approach of Ecological Technology Innovation of Circular Economy

### 5.1 Playing the governments roles in the development of ecological technology industry

Government should increase capital input, strengthen the laws and regulations, establish and improve the institutions and policy system that is conductive to ecological technology innovation, grant some privileges in banking loan to the enterprises that carry out ecological technology innovation, ecological technology products can enjoy corresponding tax breaks and tax rebates policy, make the damage of technology application to environment reduce to the lowest point through industrial policy, economic incentives measures, make waste resources and harmless in scientific and reasonable way in order to promote ecological technology innovation of enterprises be carried out smoothly.

### 5.2 Establishing the technological innovation alliance of enterprises that face with circular economy

Enterprises should realize the enterprises behaviors that are conductive to the development of circular economy of single enterprise even industrial level include that the activity of technological innovation is not equal to circular economy. The core content of circular economy is the recycling usage of resources.

The continuous recycling usage process of these resources is not only done by single enterprise and industry, which requires to establish a complete ecological industrial chain. Each enterprise should construct own technological innovation platform according to own characteristics of capital, talents, science and technology, products, join together to face with circular economy to carry out technological innovation.

### 5.3 Expanding the products innovation fields that face with circular economy

The key goal of products innovation lies in offering new value, new utility and function for the constantly changeable social demand and market demand in order to expand and open up new markets, increase products sales and new sources of profits. Enterprises should grasp the opportunities brought about by developing circular economy, develop new products in biology, materials, information, and leisure, health, medical and other fields related to the comprehensive development of human; develop various kinds of raw materials and energy savings, use less expensive and scarce resources, use the products that do not harm or less harm to human health and ecological environment after using and in the process of usage; develop the products that are easy to recycle, reuse and renewable resources. Products design should adopt the requirements of circular economy in order to obtain economic, social and ecological benefits , serve the goal of human; design products in smaller types and lighter types; maximize to use non-toxic materials and recycled materials; reduce the materials types of products using and the used quantity of materials.

### 5.4 Upgrading the process innovation level that face with circular economy

The ecological process innovation that conform to the requirements of circular economy development can not only reduce the generation and emissions of waste and pollution effectively, reduce the threat of industrial activity to environment, but also can reduce the usage cost of resources, reduce material consumption in order to make the products possess stronger market competition in quality and cost. Adopt new process, develop the rich resources that have not yet used in order to replace the scarce resources and nearly scarce resources. Strengthen the research, development and application of new process technology that is conductive to social and ecological benefits. In the meantime, change end treatment of pollution to entire treatment with the help of adopting new process with a view to reduce enterprises costs and obtain social and ecological benefits while enhancing economic benefits.

### 5.5 The construction of ecological evaluation system

Constructing evaluation system is the key part of carrying out feasible analysis of implementing ecological technology innovation, which includes the evaluation of ecological environment benefits, economic benefits evaluation, social benefits evaluation and the evaluation of human development. Among the four evaluation system, the goal function of measuring ecological technology innovation is to maximize economic benefits, the constraints of which are ecological benefits, social effects and human development index.

## 6 Conclusion

Circular economy advocates a economic development model in harmony to environment. Circular economy are aimed at organizing the production and consumption of social economy with the help of substances circulation model, the purpose of which can not only constantly develop social development, but also can avoid the damage and resources abuse of technological and economic development to ecological balance. Ecological technology innovation is the key approach of promoting the recycling utilization of raw materials and energy, reducing the consumption and pollution, achieving the double effects of economic output and environmental protection. The key importance of establishing ecological technology system is to actively adopt clean production technology, adopt harmless and low-harm new process, new technology, reduce the consumption of raw materials and energy, achieve small input, large output, low pollution, make the possible elimination of the emissions of environmental waste in the production process.

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