

Analyses of Japanese Circular Economy Mode And its inspiration significance for China

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Abstract: In recent years, circular economy has driven extensive discussion as the current economic development is being constrained by ecological environment and resources. Energy conservation and environment protection has been the priority to the seven emerging industries in China as the circular economy is inevitable. Various theories, with their own strong proof, have argued and proved the potentials and possibilities of Chinese circular economy mode. This article will focus on exploring a feasible circular economy developing mode for China. The Japanese mode of circular economy is a good reference.

Key words: Japan; circular economy; developing mode, reference

1. Introduction

1.1 Conception of circular economy

The concept of circular economy can be traced back to middle 1960s. American economist Boulding raised an idea of recycling the waste material in his book *Earth as a Spaceship* (1965) for the first time. He suggested recycling waste materials and turning them into new productions. He didn't use the word "circular economy". The word first appeared in book *Economic of Natural Resources and the Environment* written by English economist David T. Beers

China introduced the concept of circular economy in the end of last century. Integrated with national reality of China, various theories came up from different viewpoints. Among which, ecological economy, technological economy and new developing mode are representative ones.

By analyzing all the features of circular economy, I

believe, circular economy abides by laws of both ecology and economy. It is aimed to enhance the resource and energy utilization, protect the ecological environment as well as promote the economic development. It follows the "3R" rules : Reduce, reuse and recycle. As a sustainable environment-friendly mode, circular economy coordinates the ecological environment with the development of economy and society through enterprises, ecological areas and society.

1.2 The development of circular economy

Recently, circular economy is becoming a growing trend in developed countries. Governments provide support to boost its development with positive response from entrepreneurs. Especially, when facing the crisis of global resources shortage, the research of circular economy development mode, which will be

more efficient and ecology-friendly, is becoming urgent.

Circular economy has been attracting more and more attention in China since last century and today it is a hot topic. Despite the hard effort that China has been made, the development doesn't go smoothly.

There are several successful examples of circular economy: The United States, Germany, Denmark and Japan. These countries have built up virtuous operating models after years of practicing. Each of them has their own advantages and strengths, such as the high-tech production of America, the waste disposal technology of Germany, the ecological industry area of Denmark and the venous industry of Japan. The development of circular economy is a collective consciousness behavior by a whole society, whose culture varied one by one. As there are more shared cultural commons between China and Japan, Japan is taken as a reference mode to do my study.

2. The development mode of Japan circular economy

Since the 1990s, facing the serious natural resource and environment issue, Japan has been vigorously promoting to build a circular economy based society and achieved tremendous results. Japan became the first country to explore the circular economy development mode as well as the country that has the most completed legislation on circular economy. Its resource utilization is also leading the whole world.

Different from the paradigm study, this article will follow a chronological order, tracking its development to find out a possible model that can be adapted for China.

2.1 The background of Japanese circular economy

Japan is an island country of small size and three-fourths of it is mountainous region. The natural disadvantage of resource shortage forces Japan to develop its own circular economy.

In modern times, in order to boost economy

development and realize the plan of "catch up with the western developed countries", Japan waged aggressive wars for resources. After its defeat, it tried to fully explore domestic resources to keep pace with the "GDP-oriented" economic plan. But it stranded because of the expensive extraction costs. Entering into one dollar petrol, Japan was able to surge its development by largely importing oil as the alternative energy of coal, which at the same, the potential risk of over dependence on import was growing. When the oil crisis broke out, Japan had to rethink their developing mode.

2.2 The developing route of Japanese circular economy (three stages)

The economic developing strategies will differ from stages to stages. Japanese historical development status determined its phases of circular economy, which basically divided into three phases. These three stages can be considered as the primary developing route of circular economy.

2.2.1 The transition of strategies on non-renewable resource

During 1870s and 1880s, Japan began its exploration into circular economy in the wake of global financial crisis, which was caused by oil shortage. The prototype of this idea rooted in and developed from its strategies of non-renewable resources, as an efficient utilization of these resources is most fundamental part of circular economy.

According to its developing status, the main changes of strategies were showed on the following aspects: adjust the energy structure, reduce the dependence on single energy (oil), optimize industrial structure, reduce the high energy consumption industries, develop knowledge-intensive industries and improve the efficiency of energy utilization within industries.

By these strategic adjustments, Japan completed its transition from over dependence on oil to an integrated utilization of oil, gas and coal. Its heavy industries like iron and metal manufacture was reduced while the low energy-consumption industries such as car, airplane,

precision instruments and electronics manufactures were expanded. Within various industries, especially heavy industries, the investment to update equipment and to enhance the energy utilization efficiency raised to 20% as the energy-saving became a priority.

A circular economy system of rational energy structures, high efficiency of energy utilization and optimum industrial structures was successfully formed in Japan through these changes.

2.2.2 The development of strategies on renewable resource

Japan completes its first step of developing circular economy with the changes of non-renewable resources utilization strategy. The rapid development of high technology pushed the non-renewable resources utilization to a limit, which was difficult to go further. At the same time, the advancement of technological knowledge made the exploitation of alternative energy possible. Under such a circumstance, Japan started its strategic utilization of renewable resource, which means its circular economy moved to a new stage.

Renewable resources can be divided into two categories based on its regeneration rate: solar power, wind energy, tidal energy and hydro energy are among those with a fast regeneration rate; Forest reserves, fish resources and animal resources are relatively slow, which can be called biomass resources. Japan outlined its plan on alternative energy exploitation in 1994, promoting the utilization of renewable resources nationally to further shape its circular economy system.

The exploitation of renewable resource was a breakthrough to the development of Japanese circular

development. These resources reduce the possible waste from the headstream as well as lower the public cost because of its low-pollution. The ultimate purpose of circular economy is to achieve the coordinated development of economy and resources. The renewable resources provide the necessary source to solve the problem.

2.2.3 Build up an integrated circular economy based society

The strategic changes of renewable resources and the optimum utilization of non-renewable resources were the important two pillars to build a society of circular economy, based on which, Japan integrated social system, economy and its people to fully boost the development.

The core, also the ultimate purpose, of circular economy is to build a society of it. Circular economy surpassed a single economical behavior, evolving into a social behavior. The biggest success of Japan circular economy was that it built a sound top-down social structure. Circular economy became a national living pattern. Under such a system, the economy development was achieved in different aspects and levels.

2.3 The security system for circular economy

2.3.1 A completed law system

Japan has the most complete law system for circular system, which is a powerful support for the national expansion of circular economy. Its rigorousness can be seen from the form below.

Table 1.

Classification of law	Names	Year
Fundamental law	Environmental Law	1993
	Promoting the formation of a recycling society Law	2000
Comprehensive law	Waste disposal law	1970
	Resource efficient law	1991
Special Law	The law of separate collection and recycling of container and packaging	1995

	Special household machine cycle law	1998
	Building construct recycling Law	2000
	Polychlorinated biphenyl wastes properly handle special measures law	2001
	Vehicle recycling law	2002

Supported by its sound law system, Japan built a top-down legislation and regulation, which explicitly stipulate the liable person and the standard of dealing process from generalization to details. It is the first supporting level of its circular economy.

2.3.2 A sound educational system

The instillation of the concept has ensured the national expansion of circular economy as it is a social economic behavior. In the sense of links of circular economy, a conscientious recycling behavior is the basis of its “venous industry” and the key factor to reduce the waste is to expand the service life of durable goods.

Japan set up educational courses in schools, companies and communities to raise people’s awareness to environmental issues, leading them to take part in developing the circular economy. From the recycling labs in schools to enterprises’ circular trading markets, from biological experiment center to rubbish recycling station, Japan instilled the concept into every aspect of people’s daily life; therefore, developing circular economy is not only an economic behavior but also a social behavior.

2.3.3 Technological support

Technological revolution boosts the economic development. When comes to circular economy, the effect is more remarkable. Technology is always a powerful support. No matter in which link of circular economy: from minimization, re-use to recycling, technology plays a key role.

Japan developed a recycling system, which aimed at zero-emission to support its economy. Here were five parts: life cycle assessment system, waste minimization system, resource recycling system, the industry chain of waste recycling and the recycling, transport and trading system of waste.

2.4 The levels of circular economy development

With the support of above security system, Japan gradually built up three levels of circular economy system through it developing route. These three levels went forward one by one. The former level was the base of the upper one while the latter one worked as a platform.

2.4.1 Enterprises

Enterprises were the main implementing body as well as the smallest unit of a circular economy society. On this level, the main task was the material circular within the enterprises to achieve a clean producing process.

A recycling company requires saving raw materials and energy, eliminating poisonous materials, reducing waste and pollution during the producing process; for the products, it requires minimizing the negative effect during the lifecycle from abstracting the raw material to produce the final products; for the service, it requires considering the environmental issue in it. Recycling enterprises will achieve its profit through intensive management and internal economic growth, which means exchanges of logistics and energy flow, building an ecological industrial chain to maximize the resources utilization while minimize the pollutions.

2.4.2 Industrial parks

An industrial park is a new form of industrial organization. It is similar to a biological community, in which are various enterprises. Within the park, by-products or waste from one enterprise will be transformed into the raw material for another enterprise to achieve a closed circulation of materials and multi-stages use of energy. Enterprises depend and coordinate with each other, forming a

natural-ecological-food-chain-like industrial system to maximize the utilization of materials and energy while minimize the emission.

2.4.3 Society

A society of recycling system is the ultimate goal of circular economy as well as the ultimate integrated pattern. There are four key factors: industrial system, infrastructures, humanities ecology and social consumption, which if describe in details are: an industrial system of material recycle and industrial symbiosis; infrastructures of water recycling system, clean energy utilization and clean public transportation operating system; humanities ecology of green

projects, green landscape and green architectures as well as a social consuming behavior of green and circular consumption.

3. The inspiration significance for China

Through the comprehensive analysis of Japanese circular economy, from its background, process, security system to its developing levels, we can discover several rules: the development of circular economy is a propelling process and it cannot be copied mechanically to every country. For China, it can gradually build up its circular economy system through following processes.

Table 2.

First step (environment)		Second (platforms)		Third (complete)	
Policy guarantee		Industrial structure adjustment			A integrated circular economy
Educational support		Responsibilities and Full participation of Enterprises			
Law and regulations		Industrial parks			
Technological support					

3.1 First step

An integrated circular economy needs the support of security systems, which will be the fundamental premises in the sense of policies, laws and social environment.

Policy guarantee: The government should play a leading role, drawing up a macro-developing plan, raising the public's awareness of circular economy, establishing sound law and regulation system, fostering the key industries, investing capital, providing technic support and purchasing guide to develop the circular economy in all rounds.

Educational support: Setting up educational courses, labs and non-official environment to raise people's awareness, instilling the consciousness of recycle into the public's social behavior. A low awareness of public is one of the obstacles to the circular economy's further development.

Laws and regulations: A law environment is a premise for all economic behavior. A sound law system will ensure every procedure are lawful and therefore will go smoothly. A specific index of industrial pollution and recycle, tax standards, patent protection and subsidy are all necessary.

Technological support: lacking of technology can be a bottleneck for the development of circular economy. The government should intensively invest to enhance the resource utilization and recycle. Many industries in China still have an extensive developing system and their resource utilization has a low efficiency. Rubbish recycling plants have been relying on government's subsidy for a long time and not able to industrialize. From this point of view, a breakthrough of technology is extremely important.

3.2 Second step

The first step is the cornerstone for the developing plan of circular economy. To address the problems occurred in economy, there are aspects to focus on.

Adjustment of industrial structures: An optimization of industrial structure is optional for the circular economy development. But it is necessary for China, who has an unbalanced structure. To boost economic development, China over exploits natural resources and there are too many raw material processing industries of an extensive developments, causing huge waste and pollutions. The purpose of developing a circular economy is to solve these issues. Enhancing the utilization efficiency is more like compensation, but reducing the exploit of resources from the very beginning is the most effective solution. In addition, the “venous industry” is also unbalanced. The “venous industry” has been a priority of circular economy since the concept was brought up by Japanese scholars. China should invest more in it and strike a balance between recycle and production.

Responsibilities and full participation of enterprises: Enterprise is the main implanting body of circular economy. A low participation of them is a serious issue, which is caused by an unclear proprietorship. “The tragedy of the commons” is prominent in a circular economy society. Clarification of the proprietorship and the privatization of the right to pollute are effective methods to drive enterprise positively joining in the development. The participation of enterprise plays a key role in the operation of circular economy system.

Industrial parks: Industrial mode is one of the effective modes to develop circular economy. Building up a virtue industrial park based on ecological biological chain mode will benefit the recycle of resource utilization, reducing the logistic cost and optimize the distribution of resources during the production. Industrial parks are the medium units in circular economy.

3.3 Third step

Based on the first two steps, the development of circular economy is imperative. An environment in which has the support from government policies, laws, technology and public awareness as well as platforms consisted of enterprises, industries and industrial parks, these indispensable elements are the guarantee yet driving force to develop a circular economy, which ultimately help build up a circular economy based society

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