

## **Transforming Process from Traditional Industrialization to Modern Industrialization in China: Ecological Perspective**

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### **ABSTRACT**

The paper analyzes the feature of modern industrialization, points that it is a feasible method to go on a modern industrialized way by building and developing ecological industry according to the principle of recycling ecological economy. As the heavy industry city an example and expounds the fundamental train of thought of fostering the development of ecological industry and building recycling ecological economic mode, then integrate measures like clean production, ecological industry and ecological agriculture to make them a systematic strategy.

**Keywords:** *Ecological Industry, Traditional Industrialization; Modern Industrialization*

## **INTRODUCTION**

**From 2002, China started to drive industrialization by information industry and foster information industry by industrialization and go on a modern industrialization way of high-tech intensiveness, good ecological economic benefit, lower consumption of resource, lower pollution of environment and full use of human resource. To understand modern industrialization , today, people focus more on information industry driving, high-tech industry development and remaking traditional industry. However, seeing from the trend of developed countries, there should be another paralleled way that is to build and develop modern ecological industry according to the principle of recycling ecological economy. The objectives of this study are to explore transforming process from traditional to modern industrialization in China in terms of ecological perspective and to provide the management and public policy makers with insights of modern industrialization. There should be another paralleled way that is to build and develop modern ecological industry according to the principle of recycling ecological economy.**

**In the first section, an introduction deals with the rationale for doing a study on transforming process initiatives of a given target place. In section two, a literature review related to the current study is addressed. Then, in section three, a positive analysis of the way of modern industrialization discusses with varied study aspects. Section four shows a way for building up recycling economy mode. In a final section, a conclusion gives some future directions and summary.**

## **FEATURES DIFFERING MODERN INDUSTRIALIZATION FROM TRADITIONAL INDUSTRIALIZATION**

**The feature of traditional industrialization is the high input and high consumption at the beginning of production system and high**

**pollution during production. This kind of mode relies on natural resource but seldom considers the impact on ecological environment. When dealing with the relationship between ecological economy and environment, we always develop ecological economy first then control pollution or pollute environment first then control pollution. Dong furen, a famous ecological economist, pointed that the difference between modern industrialization and others is: it no longer wastes resource and pollute environment, instead it carries on sustainable development strategy. Traditional industrialization always wastes resource, pollute environment first and then takes measures to control. Modern industrialization is different from traditional industrialization, which was taken by most developed countries and China in the past. Compared with traditional industrialization, the features of modern industrialization are reviewed.**

### **Ecological economic mode of low cost and high effectiveness**

**The modern industrialization makes fully use of the newest science and technology, which focuses on, technology and knowledge and which is low resource consumption and high output. While Traditional industrialization is the extensive ecological economy with high consumption of resource and energy and low output. The output is accomplished by high consumption so the ecological economic benefit is quite low.**

### **Ecological industrial chain**

**In China, Traditional industrialization is one-way linear ecological economy of resource-product-wastes-pollution with a feature of high consumption, high pollution, low utilization and unsustainable development. While modern industrialization builds a kind of ecological chain during producing and consuming, which uses wastes produced by upper-level products as the resource of lower-level products and makes the ecological economic activity a material**

recycled circle process of resource-product-recyclable resource-reproducible products. All resource and energy can be made reasonable use of with a feature of low consumption, low pollution, high utilization and sustainable development in this continual ecological economic recycling.

### **Clean producing way**

Facing high demanding market of industrial products. Traditional industrialization uses extensive producing way, consumes all kinds of cheap resource especially natural resource in a high strength. It changes resource into wastes, which intensifies the environment pollution. While through clean producing way, at the same time it doesn't do any harm to the environment. Modern industrialization makes use of all the resource and energy in the recycling of resource-producing-consuming-recycled resource.

### **The input structure of nonmaterial resource**

In traditional industrialization system, there is a material structure in the basis of resource input especially natural resource, labor force and traditional technology. While the structure of resource input in modern industrialization is a nonmaterial structure of less material and energy consumption in the premise of meeting the need of people's life. In modern industrialization, by less relying on natural resource, the production and life pollution get less and people's living environment gets improved. High-tech and knowledge are the most important resource inputs.

### **Technology innovation way focusing both on resource development and protection**

American scholars revealed the asymmetry between resource development, technology utilization and the technology development of environment protection in 1960s and 1970s. They

indicated that most technology improvement comes from the reality of resource development, so traditional industrialization puts more emphasis on how to develop and utilize technology, how to lower developing cost, how to raise the utilization rate of resource. These technologies can foster the development and utilization of resource objectively but may do harm to the protection and sustainable development of environment. On the other hand, technology improvement will think less of the protection and sustainable development of environment. Technology improvement should incline to it because of the underdevelopment of environment protection technology.

In a word, the fundamental points of modern industrialization lie in changing old ideas of traditional industrialization, giving new connotation to traditional industrialization, controlling population, saving resource, focusing on ecological construction and environment protection, raising the scientific and technological content of industrial products, lowering resource consumption and environment pollution, realizing the harmonious development of economic construction, population, resource and environment, realizing mutual promotion of industrialization and sustainable development, accelerating our industrialization process on the condition of increasing development level and quality of industrialization and making sure of less environment pollution and low resource consumption.

## **RECYCLING ECONOMY-A NECESSARY WAY OF MODERN**

### **Origin, basic rule and practice of recycling economy**

The recycling economy can be traced back to 1960s when an American economist published an article titled "Economic View of Spaceship" in which he considered the earth as a spaceship which makes its living by consuming its limited resource. The theory of spaceship means that people's social and economic activity should

change from learning the machinery principle featured by linear to the ecology principle featured by feedback. The idea of recycling was considered a theory of forerunner what people consider was how to deal with pollutions to reduce its harm. When produced, which is the so-called end-dealing way. In 1980s, people realized that we should deal with the wastes through a resource way. However, for the fundamental question like whether the production of wastes is reasonable or whether we should prevent pollution in production and consumption, most countries are shortsighted and lack good measures in policies.

In all the environment protection activity in 1970s and 1980s focused more on the ecological result of economic activities but the economic operation system was still out of people's consideration. In 1990s especially in the years when the sustainable development strategy became the dominant idea, people raised series ideas of recycling economy like "non-emission factory", "clean production", "product lifecycle", "designing for environment". The prevention of compass of competency took the place of end dealing and became the main trend in policies of environment and development, recycling utilization and reduction of wastes was integrated to be a recycling economic strategy featured by avoiding wastes production. Three levels focusing on economic activities production level of individual enterprise, intergrowth level of many enterprises and social consumption level, formed three important ideas of material circle economy and made the recycling economy take great improvement in theory and practice.

Traditional industrialization is one-way linear economy is a material recycled circle process of resource-product-recyclable resource-reproducible products. Recycling economy is a great shot and improvement to traditional industrial economic development mode. The real principle of recycling economy is to reduce, reuse and recycle, that is the so-called "3R" principle. Recycling economy provided traditional industrialization changing to sustainable

economy with strategic theory mode and solved the sharp contradictory between environment and development in a fundamental way and made a win-win game between economy and environment. Recycling economy has succeeded in many developed countries from minimize emission in enterprises to the exchange of wastes among enterprises in a regional industrial ecological system and then to the recycling of material and energy in and after products consumption such as the Dupont individual enterprise recycling economy in the level of enterprises. In 1980s DuPont combined “3R” production method in order to reduce emission or realize non-emission. In regional level, there is the ecological industrial region mode, which faces the intergrowth enterprises. The ecological industrial region in Denmark focuses on electricity factory, oil refinery, pharmaceutical factory and gypsum factory. It takes wastes or byproducts of other enterprises through trade as its own production material, sets up industrial alliances like “paper-pulp-paper making”, “fertilizer-cement”, “steelmaking-fertilizer-cement” through the intergrowth and super session among enterprises and in the end realizes “nonpollution” and “non-emission”. In social level there is a double system mode of Germany focusing on emission after consumption. Its DSD is a nongovernmental organization focusing on recycling of coverly wastes. It receives trust of enterprises, recycles and classifies the wastes then takes them to the recycling factory, and wastes, which can be reused, will be sent to the manufacturer. In order to foster the development of recycling economy, countries like Germany and Japan make relative laws, as “dealing ways of coverly wastes” in 1991 and “recycling economy and dealing ways of wastes” in 1996 in Germany and “basic laws fostering building a recycling society”, “promoting laws in utilizing resource effectively”, “laws in reuse of electricity”, “laws in reuse of food”, “purchasing law of environment protected food”, “laws in reuse of construction” and “laws in reuse of holders” in Japan. Its goal is to build a recycling society.

**China has entered the trial process of recycling economy. Liaoning province and Guiyang city of Guizhou province were made trial province of developing recycling economy by National Environment Protection Bureau. Driven by National Environment Protection Bureau, the construction of ecological industrial region is in the ascendant like Guigang Guangxi National ecological industrial region (in sugar refining), Nanhai Guangdong National ecological industrial region, Baotou city, an important city of Inner Mongolia National ecological industrial region (in aluminum production), Shihezi National ecological industrial region (in papermaking).**

### **Developing recycling economy is the right choice of practicing modern industrialization**

**According to the prediction by a study team on sustainable development of Chinese Academy of Science, the overall trend of environment worsening in China will still last for about 50 years. That is to say, we cannot stop this trend and go on a healthy development way until 2050. Today out emission of industrial wastes is still in a high level especially in some areas, it is far above the bearing capacity of environment. Take Baotou city, an old industrial base, heavy chemical industrial city for example. In 2002, the total consumption of coal in Baotou city was 12,000,000 tons, up 820,000 tons over 2001, among which, the industrial consumption covers over 82% of the total, up 830,000 tons over 2001. The total emission of industrial waste gas was 80,000,000 tons. Industrial solid wastes were 12,000,000 tons, among which, slag, waste residue coal ash cover over 90% while utilization rate was less 15%. The waste residue factory formed in these years covers an area of 21 km<sup>2</sup>, about 1/6 of the constructed area of the city. When old factories accelerate to expand, new important projects are built in Baotou city such as 1,000,000-ton aluminum factory, 10,000,000 KW electricity power, 200,000-400,000 tons copper, 830,000 tons methanol, and 300,000 tons acetic acid. During the introduction of there new and large projects, advanced production technology was**



taken but if there is no rational distribution and effective utilization of wastes, they must be great pressure to the environment bearing capacity of the city. And the question of city bearing capacity forces many countries in China like Baotou City to take large-scale measures to change their economic developing mode.

Developing recycling economy is the right and typical reflection of modern industrialization and also a strategic decision. It not only can solve the problem of resource and environment, reach the goal of “ low resource cost, low environment pollution ”, but also can improve enterprises’ operation, offer job opportunities, and reach the goal of “ good economic benefit”, and “full use of human resource”. Meanwhile, developing recycling economy requires and fosters technology improvement. It also meets the requirement of high technology intensiveness. Therefore, modern industrialization requires recycling economy and developing recycling economy is the requirement and certain choice.

## **PUSHING ON THE DEVELOPMENT OF ECOLOGICAL INDUSTRY, BUILDING UP RECYCLING ECONOMY MODE**

### **Ecological industry is the basic way to develop recycling economy**

The manufacturing process of enterprises is independent in traditional industry, which is the important reason of pollution and high resource consumption. Ecological industry emphasizes the material circle process of industry system of which an important way is to build intergrowth among different industries and manufacturing process according to the mode of natural ecological system. Through the intergrowth and inter-sharing among different enterprises or manufacturing process, we can find decomposition for wastes, build the food chain or food net for industrial ecological system and control the pollution during the process manufacturing. This can make regional manufacturing process clean, minimize wastes and maximize the utilization of resource and reach the goal

**of changing pollution negative effectiveness into resource positive effectiveness.**

**Because the recycling of wastes can bring about economic benefit and make pollution controlling a conscious behavior driven by economic benefit, pushing on building ecological industry system will foster the change of economic developing mode and become the recycling economy developing mode. The most idea thought of developing ecological industry is the coupling of industrial ecological system and natural ecological system, which is a complex systematic project, and provincial government should play an important role in it. First, they should propose in a high voice, set up a typical example, keep close touch with the advancement of international recycling, release relative information to the public in time and build a media environment that is beneficial to the ecological and recycling economy development. Second, they should make a plan in developing local ecological industry especially the development plan for ecological industry region, help the region build a high-effective management system and design the industry distribution according to the adjustment of economic structure and the requirement of recycling economy. Third is to pursue technology innovation, organize technology working team and continually develop recycling economy technology in order to meet the need of ecological industry. Fourth is to lead consuming and market behaviors beneficial to ecological industry and recycling economy, so to set up recycling management system in policy-making, regulate and limit those behaviors that do not meet the requirement of recycling economy.**

### **Ideas on developing ecological industry and building recycling economy in Baotou city**

**High cost, high energy consumption and high pollution are the main features and limitation factors in Baotou city, which is an old industrial city dominated by traditional industry. Building**

ecological industry can really combine economy with pollution prevention and environment protection so to realize the win-win game, which is the inevitable choice for regional economy to carry on healthy development. Guided by theory of ecological industry, combined with resource and industry advantage in Baotou city and with industry structure, the catenation and combination among enterprises and industries, and the building of ecological industrial system, which is relative to each other, fosters and develops together, can fully develop Baotou city's resource and industry advantage, realize coordinated growth between environment and economy and accelerate economic construction. Developing ecological industry must be reflected through certain way, which is the carrier-ecological industrial exemplary area. First we should set up a good example and make the Baotou city national ecological industrial exemplary area a innovation example of practice. It is designed according to the principle of cross coupling, vertical close, regional integration, soft structure and function-orientation. It has three functional areas-core area, broadening area and radiation area; and it also has 5 ecological chain and two production systems-electrical power and aluminum. In the electrical power system, there are several industrial systems like carbon, electrolytic aluminum and so on. Cross coupling relationship will be formed between the two systems through electricity and waste water so that a stable ecological industrial netcentred with combination of aluminum and transforming in Donghe district, we take measures of withdrawing from the second industry and enter new industry and in the end realize the coordinated growth of economy, society and environment there.

It's the certain requirement to make a general plan, carry it out step by step and develop ecological industry in the area of the whole city. First we should have a general plan. In distribution, (1) building the "rebuild able ecological industry" in a high starting point in the south rural part like copper industry or natural gas chemicals; (2) building the "remaking ecological industry" in

traditional steel industry, electrical power industry and machinery manufacturing; (3) building the “fictitious ecological industry” in other areas. This kind of distribution has a starting point of “west Yellow River industrial corridor”, will be centered by the Baotou Steel & Iron Company and stretch its several industrial chains to southwest and northwest. For example, we can combine the waste gas from Baotou Steel & Iron Company with the natural gas introduced to the city and develop it into natural gas chemicals; the waste residue can be used as the raw material of cement; construction material made of coal ash can be combined with rare earth to make complex deoxidation material; the scatter of steam from the blast furnace can be used to produce lysine forage to further develop milk cow feeding...On conclusion, the east, west, south and north of the city should be built into an ecological industrial region, and city industry and suburban industry should be put into the distribution of recycling economy.

## **CONCLUSION**

It is a systematic project to develop recycling economy among which the ecological enterprises are the mini-recycling; the ecological industrial region is the midre cycling and ecological city is the big recycling. The ultimate object of the co-development of city construction and ecological industry is to build an ecological city. The building of ecological city includes infrastructures, traditional and modern industries, eco system, ecological agriculture, electricity power, environment-friendly consuming and ecological housing. Therefore, on the basis of building Baotou into a national park city, we should develop this construction together with ecological industry, and according to the requirement of recycling economy; we should integrate measures like clean production, ecological industry and ecological agriculture to make them a systematic strategy. Through the inner material recycling among subsidiary systems, we can finally set up recycling economic operation system with high effective utilization of energy, full sharing of information, the

**adjustment of city space distribution and rearrangement of economic regional structure in the whole city.**

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