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Analysis on the Influence of Scientific and Technological Development on Circular Economy

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***Abstract*—The concept of circular economy is an important topic in nowadays society, which is closely related to human economic and social activities. The efficient utilization and recycling of resources are in line with the concept of sustainable development. The development of circular economy can't be separated from the innovation of science and technology, the progress and development of technology, so as to make the utilization of energy more efficient and scientific.**

Keywords—circular economy; sustainable development; science and technology; transformation and innovation; efficiency and science

I. INTRODUCTION

In the era of big data, innovation-driven science and technology activities emerge one after another. The new generation of information technology, such as cloud computing, big data, Internet of Things, artificial intelligence, has made breakthroughs. It is intermingled with the change of scientific and technological knowledge, which brings new opportunities and challenges to circular economy. At the same time, China's economy and culture are developing rapidly, and China's international status is becoming increasingly important. However, with the development of economy, shortage of resources, severe situation of environmental pollution and ecological transformation, the long-term structural contradictions, and extensive growth mode have not changed fundamentally. The environmental problems in various places have become very prominent.

Therefore, the development of circular economy has become an inevitable choice to promote the sustainable development of economy and society in all provinces. In order to build a resource-saving and environment-friendly society, people must rely on scientific and technological innovation, improve the breadth and depth of energy utilization, and use science and technology to promote resource reduction and improve the efficiency of resource utilization. However, with the rapid development of industry, there are many negative impacts. Obviously, it is the same paradox as circular economy. Social concern and control over environmental issues has become an inevitable choice through the establishment of an economic development model characterized by clean production, ecological industry and comprehensive utilization of waste. China is in the middle stage of industrialization, and the development of circular economy is still lagging behind. There are many problems. Therefore, people need to integrate multi-resources and take measures to develop Chinese production system from the perspective of cleaner production, ecological industry and comprehensive utilization of waste. Realizing the goal of building a well-off society in an all-round way and taking the road of sustainable development in China calls for circular economy, and needs the coordinated development of circular economy. It is of great significance to promote the development of circular economy by science and technology and to improve China's comprehensive national strength.

Therefore, in this context, it is of great theoretical and practical significance to conduct a detailed study on the promotion of industrial circular economy by science and technology under the condition of circular economy in China.

II. THE IMPACT AND SIGNIFICANCE OF SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT ON CIRCULAR ECONOMY

Circular economy is a new mode of development, a new mode of promoting the harmonious coexistence between man and nature, and efficient use of energy, and an important way to achieve sustainable development. Circular economy is a reaction-type cycle process of "resources-products-waste-renewable resources". It is an economic growth mode in which the material cycle process of economic system and natural ecosystem is mutually harmonious by minimizing resource consumption and environmental costs and achieving maximum economic and social benefits. Developing circular economy vigorously is the inevitable requirement and effective carrier for implementing the scientific development concept, embodies the people-oriented development concept, and is the only way for the sustainable development of China's economy and society. Today, it is an era of rapid development of science and technology. The development and innovation of science and technology bring about the change of industrial structure and make new progress in the production and technology of products. Technological innovation and change promotes the capital investment, promotes the development of technological industrialization, and improves the development of circular economy.

Depending on science and technology, the system of green technology design, development and application should be established, and the implementation system of the overall strategy of sustainable development is formed.

Developing circular economy and changing the mode of growth are the fundamental measures to solve the problems of environment and development. The development and application of new technologies for energy saving and consumption reduction can accelerate the comprehensive utilization and recycling of resources. People should focus on actively developing new energy, renewable energy and alternative materials, speed up the research and development of new materials, carry out research and development of "front-end" products, control of "middle-end" products and "tail-end" management of products, speed up the research and development of low-cost and universally applicable resource conservation and substitution technologies, energy cascade utilization technologies, industrial chain extension and linking technologies, zero-emission technologies, recycling and treatment technologies, and green remanufacturing technologies, vigorously promote the transformation of traditional industries into recycling-oriented sustainable industries, and develop and establish a "green technology" system including environmental engineering technology, waste recycling technology, clean production technology and so on. The development of science and technology and economic development complement each other. Technological innovation promotes the rapid development of economy. The development of circular economy needs the innovation of science and technology. In the process of developing circular economy, science and technology continue to innovate and develop, create new technologies, bring technological revolution, and promote the rapid development of technological innovation. Technological innovation has led to the development of enterprises with the characteristics of circular economy industry. The cooperation and reform among enterprises is strengthened. At the same time, a number of new technological enterprises have emerged. Technological innovation improves the utilization rate of resources. The core of circular economy is not to reduce the utilization of resources, but to improve the utilization efficiency of resources so as to maximize the use of resources and create value. The utilization of science and technology can greatly reduce the waste of resources, realize the substitution of resources, and reuse non-renewable resources. The development of science and technology can alleviate the shortage of resources, improve the ecology and living standards, and provide more effective means. Scientific and technological development is becoming a favorable driving force for sustainable development. Ecology and environmental science research is the basis for formulating relevant laws, policies and international conventions. The use of environmental-friendly technology can promote the coordination and win-win between economic growth and environmental protection, effectively improve the utilization of resources, reduce the intensity of pollution emissions, and promote economic growth and create employment opportunities. In the future, many environmental problems will depend on the development of science and technology, and the improvement of economic level will depend on the progress of science and technology.

III. Science and Technology Optimize Resource Allocation of Circular Economy

Circular economy is a new economic development mode that replaces the traditional high energy consumption and high pollution, aiming at improving the efficiency of resources and energy utilization in a harmless and eco-friendly way. In order to achieve this goal, people can rely on scientific and technological progress and technological innovation to obtain cleaner and more effective technologies and processes, so as to minimize the consumption of energy and natural resources. Only by adopting environmental-friendly new technologies with less energy consumption and less material consumption, developing new alternative resources and renewable energy resources, and continuously tapping waste recycling technology can resources and energy be reasonably exploited and utilized from the aspects of resource exploitation, production and consumption, waste utilization and social consumption, so as to accelerate the comprehensive utilization and recycling of resources and energy and truly alleviate the contradiction among economic development, environment, resources and energy. Technological progress means the substitution of resources and the improvement of resource utilization. The "reduction" of circular economy is not simply to reduce the utilization of resources and energy, but to improve the productivity and efficiency of energy utilization, which means scientific and technological progress and the comprehensive, coordinated and sustainable development of economy and society. The development and utilization of science and technology not only greatly increases the types and quantities of available resources, but also realizes the substitution of resources, which makes many non-renewable resources have new substitutes, improves the utilization efficiency of resources, promotes recycling, reduces waste of resources, and further meets various human needs. More importantly, science and technology can realize the virtualization and reduction of material resources of circular economy through information technology, ecological technology, 3S technology and so on. Information technology can lead to the substitution of intangible resources for tangible resources in the economic process. The information products and networks can sharply reduce the use of paper, which will avoid more trees being cut down, and effectively avoid the pollution of the environment caused by waste water from papermaking. 3S technology realizes real-time information data transmission and communication of circular economy through information superhighway, investigates and monitors environment and ecology, directs environmental evaluation and management, and provides reliable decision-making basis for national long-term planning. Modern ecological technology represented by clean technology and its application in economy can promote the effective circulation of resources.

IV. Science and Technology Help Circular Economy Through Industrial Restructuring

In order to develop circular economy and build a resource-saving society, both high-tech industries and traditional industries need to optimize their combination according to the principle of circular economy and transition

to a sustainable circular model. All these need to depend on science and technology to speed up the adjustment of industrial structure, attach importance to technological progress and scientific management, and rationally allocate resources and energy. This is an effective way to save energy and reduce consumption, reduce environmental pollution, protect ecology, and promote the development of circular economy from the source. The rationality of industrial structure depends on structural adjustment and optimization and upgrading, while the adjustment, optimization and upgrading of industrial structure depends on scientific and technological progress and innovation, especially the rapid development of high-tech industries. Firstly, science and technology have strengthened workers' abilities to exploit and utilize natural resources and energy in various industrial sectors in breadth and depth. To adjust and upgrade the industrial structure is also to re-optimize the distribution and combination of various new technologies and processes, and to highlight the contribution of technological progress to circular economy as a whole. Secondly, science and technology characterized by the growth of high-tech industries, Internet promotion, and e-commerce expansion, integrate and restructure the original industries and departments, while promoting economic growth, accelerate industrial restructuring, and promote the birth of a large number of new industries and departments related to resource recycling. Thirdly, science and technology promote the transformation and upgrading of traditional industrial sectors, rationalize the industrial structure, and greatly improve the efficiency of the use of resources and energy. The influence of technological innovation ability and technological progress of different industries on circular economy is different. People should use information technology to transform and upgrade the traditional pillar industries with high energy consumption, high material consumption and high pollution, promote the popularization and application of information technology in energy, transportation, metallurgy, machinery and chemical industries, promote the merger and reorganization of enterprises in iron and steel, cement, electrolytic aluminum and coal industries, eliminate and close those backward and extensive enterprises, and strive to reduce energy consumption and material consumption of unit product, and strengthen the supervision and control of environmental pollution so as to make it a cyclic enterprise with high technology content and low energy consumption. High-tech industry cluster and industrial chain construction should be used to promote the industrialization of energy-saving technology to serve the circular economy.

V. Science and Technology Contribute to the Public Effective Participation in the Construction of Circular Economy

Science and technology broaden people's horizons of understanding, and break through the limitations of public understanding, which not only clears the ideological barriers for the development of circular economy, but also provides specific means of technological understanding for its development. Without environmental chemistry, it is impossible for human beings to carry out environmental monitoring and water quality inspection, to identify new substances without analytical chemistry, to understand the structure and properties of new substances, and to detect and analyze mineral resources development, evaluation of industrial raw materials, process control, product quality monitoring, treatment and utilization of waste from factories and mines in industrial and agricultural production. They can’t well understand the concentration and harm of harmful substances in environmental pollution. With the advent of modern ecological theory, people have gradually mastered the law of pollutant migration and transformation in the environment, and have a clear understanding of the scope, ways and extent of environmental hazards caused by pollutant migration, transformation, accumulation and enrichment, so that the society can construct a targeted circular economy. Science and technology cultivate the consciousness of self-participation of the subject of science and technology. Scientific progress constantly fosters scientific spirit, improves the quality of workers, and strengthens the consciousness of circular economy, especially the scientific spirits of truth-seeking, pragmatism, doubt and innovation of the main body of science and technology. These spirits are internalized into behavioral norms, which restrict and guide the scientific and technological subjects engaged in scientific research and technological development in circular economy, and prevent the phenomenon of abusing science and technology, such as betraying scientific conscience for the benefit, and relying on political or economic power in the scientific community. At the same time, the circular economy strategy and a series of major high-tech projects implemented by various countries should guide and encourage scientific and technological personnel to standardize scientific behavior from the social, ethical and legal levels, take into account the sustainability of resources and energy and intergenerational equity, consciously follow the circular economy road in production and life, stimulate their patriotism, dedication and struggle spirit, and enhance national cohesion. And the circular economy can be achieved under the joint effect of heteronomy and self-discipline. Science and technology are important carriers of public participation in the construction of circular economy. Public participation in the construction of circular economy is mainly reflected in the fields of legislation, administrative decision-making and government management, as well as grass-roots governance and personal consumption. The participation in such fields is often manifested by means of science and technology. Taking the network as an example, there are hundreds of millions of netizens all over the world, and it is growing. The development of e-government and e-commerce is in full swing. The on-line interaction between government and public is further strengthened. All these provide new impetus for the public to participate in the management of circular economy. The network has become a new way for the public to participate in government decision-making and management, and to supervise the behavior of government and enterprises, which has promoted the scientificalization and democratization of government decision-making on circular economy. Through science and technology, the public has paid more attention to circular economy, so as to

encourage enterprises to fulfill their social responsibilities and establish a green corporate image. Exposure of seriously polluted and bad reputable enterprises on the Internet and other media can curb their environmental pollution and ecological damage, and also enable the general public, such as community residents, news media, non-governmental organizations, to supervise all enterprises in an all-round way, resulting in law enforcement pressure, ethical pressure and market pressure. If the public purchases and consumes products that meet the environmental protection standards and refuses non-green products to enter the circulation market by means of "consumers saying no", a huge trend of environmental protection consumption can be formed in the market. At the same time, with the sustainable green consumption mode and green procurement system, enterprises can be guided to study green technology, produce green products. Under the pressure of supervision, social environmental ethics and national laws, enterprises voluntarily and actively promote cleaner production and circular economy, promote green management and marketing, and fulfill their social responsibilities. At the same time, public participation in large-scale scientific research projects and project decision-making of circular economy can reduce risks. Public attention to these projects can not only improve the safety factor of project technology, but also question the ecological safety problems such as geology, ecology, local microclimate and species extinction that may be caused by such projects, so as to bring public voice and opinion into the decision-making reference of governments at all levels, which will help the decision-making of circular economy to be more scientific and reasonable, and avoid the financial problems and the serious waste of resources caused by wrong decisions of governments at all levels. In short, science and technology have led to transparency and openness of all kinds of information, broadening personal horizons and scope of choice, enabling the public to timely access to relevant information resources, and to participate in the development of circular economy extensively.

VI. CONCLUSION

Science and technology can effectively promote the development of circular economy, but is far from enough. Human's cognitive ability to science is limited rather than infinite, and the approach to truth is relative rather than absolute. The application of science and technology to nature and the service for circular economy are also limited. The limitations are as follows: the total consumption of human resources does not decrease with the progress of science and technology; the progress of science and technology can’t make the limited resources infinite; the progress of science and technology can’t meet the consumption of resources by high consumption; as long as the population grows exponentially, the progress of science and technology can’t meet the demand of human resources; the application of science and technology will produce new environmental problems, and the application of science and technology will have delayed effect on the environment; the cost of the application of environmental science and technology is increasing gradually; the application of science and technology to environmental protection is subject to other factors, such as political, economic and other constraints. Science and technology is a double-edged sword. In addition, human beings can’t effectively predict the possible crises in the development of each new technology. Due to the uncertainty and asymmetry of science and technology, it may be misused or abused in the construction of circular economy, presenting negative effects and producing unforeseeable social consequences, even exceeding the development of social means controlling it. This is not alarmism, and we should arouse everyone's attention. Of course, in order to keep pace with the times, science and technology must develop all kinds of new technologies needed for circular economy. These new technologies are innovative and exploratory, and may also have obvious or hidden problems that endanger the environment or human beings. Therefore, human beings should rationally use science and technology in the practice of developing circular economy, give full play to its unique role, restrain its adverse effects, and make science and technology become an important force to promote the development of circular economy.

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