Sustainable Development and Technological Innovation

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***Abstract*—the key point to achieve sustainable development lies in technology. Sustainable development of a country or region can be summarized as three aspects, that is, economic, social, and ecological development. However, the fundamental role which really takes effect is the scientific and technology. Therefore, a proper understanding of the relationship between technological innovation and sustainable development is conductive for us to achieve sustainable development, thus achieving the harmony of economic, society, natural and ecological development.**

Keywords-sustainable development, technological innovation, economic development

I. INTRODUCTION

In the report of 17th National People's Congress, President Hu Jintao pointed out that: "Science and technology is the leading force of economic and social development. Technological innovation is the fundamental way to solve the new problems and contradictions of China. Therefore, we must hold high the great banner of socialism with Chinese characteristics, thoroughly apply the Scientific Outlook on development, get a clear understanding of objective laws, and conduct the innovation on some key technologies to achieve scientific development and build a harmonious society relying on technology under limited national conditions, thus achieving the modernization. "Therefore, to develop our country in a sustainable way, it is necessary to develop science and technology and cultivate high-tech talents.

II. THE SUSTAINABLE DEVELOPMENT THEORY AND ITS SIGNIFICANCE

Sustainable development is the developmental theory and strategy based on the conservation of natural resources and environment, which aims to stimulate economic development and improve our life quality. It is the new development outlook, moral outlook as well as civilized outlook. 16th National Congress in 2002 regarded "continuously enhance sustainable development" as the goal to build a moderately prosperous society.

The connotation of sustainable development includes: (1) highlight the theme of development. Different from economic growth, development is a complete phenomenon integrated social, technological, cultural, and environmental factors in one, and it is the common and universal human right, which is inalienable and equal for both developed and developing countries; (2) the sustainability of development means that economic and social development cannot exceed the carrying capacity of natural resources and the environment; (3) Impartiality of human relations. Human in the contemporary society should strive to make future generations have the same opportunities in development and consumption. Besides, for people in same generation, we should not prejudice the interests of other people when conducting development; (4) Symbiotic coordination between human and nature. We must create a new moral outlook and value standard, and learn to respect nature, learn from nature, protect nature, and harmoniously coexist with nature. The Scientific Outlook on Development combines the balanced development and sustainable development. Regarding a comprehensive, balanced and sustainable development as the basic requirement, the Scientific Outlook on Development points out that we should promote the harmony between human and nature to achieve the coordination among economics, population, resources and environment, and adopt an enlightened approach to development that results in expanded production, a better life, sound ecological and environmental conditions in order to ensure the sustainable development from generation to generation.

III. THE DEFINITION OF TECHNOLOGICAL INNOVATION

Technology innovation is a generic term for the original scientific research and technological innovation, which refers to the process of creating and applying new knowledge, new technologies, new processes, new production methods and management models to develop new products, improve product quality, and provide new services [3]. Technological innovation can be divided into three types: knowledge innovation, technological innovation and management innovation led by modern technology. Original scientific research or knowledge innovation is to propose new ideas (including new concepts, new ideas, new theories, new methods, new discoveries and new assumptions), which includes to open up new areas of research, or re-understand the known things from a new perspective and so on. The combination of original knowledge and technological innovation not only continuously enrich and improve the human knowledge system and cognitive ability, but also continuously make products constantly updated. As the theme of the current information age, management innovation led by

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information and communication technology development is an important part of the technological innovation.

IV. THE STATUS OF TECHNOLOGICAL INNOVATION IN THE ECONOMIC SYSTEM OF SUSTAINABLE DEVELOPMENT

Sustainable development is an integrated system consisting of three subsystems: sustainable economic, social and ecological development. To achieve sustainable development, the key point lies in science and technology. The capability of a country or region's sustainable development is reflected in all aspects, which can be summarized as economic, social, and ecological development. While the most crucial and fundamental factor is scientific and technological capability. Therefore, no matter in the whole system or the subsystem of sustainable development, science and technology is at the core position [1].

Economic sustainable development is not an isolated system, but interlinked and mutually conditioned with the social sustainable development and ecological sustainable development. Science and technology plays the overall role on these three subsystems. In short, science and technology not only have a direct effect on sustainable economic development, but also act on the social and ecological sustainable development system in an indirect way. Therefore, science and technology has a core status in the competence system of sustainable development. In other words, why human society can experience the "Limits of Growth" to "limitless growth", from "you cannot have your cake and eat it too" to "you can have your cake and eat it too", and from non- sustainable development to sustainable development, science and technology plays a crucial role.

V. THE IMPACT OF TECHNOLOGICAL INNOVATION ON SUSTAINABLE DEVELOPMENT SYSTEM

A. The impact of technological innovation on sustainable economic development

- Technological innovation is the main way to improve the efficiency of resource utilization

A basic assumption of economics is scarcity of voluntary, whether for natural resource or social resources. This is because in comparison to human's unlimited demand for resources, the voluntary supply is restricted, mainly including restrictions on resources, quality, time, structure, funding and restrictions on environmental capacity. However, scientific-technical progress can ease the scarcity of resources: on one hand, scientific-technical progress can improve the efficiency of resource utilization to make the output combinations with maximum possibility be close to the production possibility frontier; on the other hand, technological progress can also transform the natural objects whose value cannot be developed a few years ago also into valuable resources, thus promoting the off-line expansion of production possibility frontier curve-line. The current situation of China's resources has determined that the economic development cannot follow the path of higher consumption, waste and extensive management, but must choose the road of low consumption, saving and intensive management. Economic growth is driven by factor inputs and technical progress. In theory, the growth of factor inputs is limited, while technological progress is unlimited. The technological progress can make the resources with same amount produce more product portfolio, so in the case of resource constraints, the growth mode must be transformed from extensive mode to intensive mode to ensure sustainable economic development.

- Technological innovation is the main source of economic growth

Economic growth is the basic guarantee for human beings' continuous improvement of living standard. Therefore, economic growth has received a wide publicity. The basic factors of economic growth include labor, capital, technological progress and institutional innovation, while the contribution of scientific and technological progress to economic growth is implemented by technological innovation, that is, a successful innovation will inevitably lead to changes in industry structure, market structure, foreign trade structure and other aspects, thus affecting a new round of technological innovation. Such a cycle will promote the sustainable economic development. Therefore, technological innovation is an inexhaustible source of economic growth.

- Technological innovation is the dominant force for industrial structure optimization

The industrialization in various countries indicates that the sustained, stable and coordinated economic development in any country is dependent on the upgrading of industrial structure. It means the industrialization of high technology, thus the proper replacement and transformation will be applied in traditional technologies; thereby, the ratio of output and labor productivity continues to increase. Upgrading of industrial structure regards technical innovation as the premise and motivation, for whenever there is new innovation spreading in all aspects of production, the object of labor, means of production and output will take a qualitative change, and then the production factors, production conditions, production organization will be re-combined. The result will have the further cumulative effect and create the new high-tech sector to replace some of the traditional industrial sectors to innovate a country's industrial structure [5].

B. The impact of technological innovation in sustainable development

- Scientific-technical progress is the driving force to promote societal advancement

Civilization is the positive outcome of human activity as well as the sign of social progress and civilized mankind. Every scientific-technological progress of mankind has promoted the advancement of social civilization. The progress of social civilization is proportional to that of technology. Scientific-technological progress can help us to achieve leadership and management, and has a positive impact on people's political life. Moreover, it can also lead to changes in the social structure and promote the adjustment of people's social relations.

- Science and technology is an important part of spiritual civilization

As an important part of spiritual civilization, science and technology mainly consist of three aspects: scientific-technological thought, scientific-technological spirit, and scientific-technological knowledge. Scientific-technological thought is the essence of science and technology, for it not only changes human outlook on values, but also directly and indirectly determines human ideals and beliefs. Technology is fundamentally antagonistic to theology and superstition, which is the spiritual civilization abstracted from science and technology practice. The core of technical spirit lies in its non-restricted area and no peak in science and technology activities, for it always listens to the voice of practice. It is just this kind of scientific-technological spirit that shows the way to truth and then accelerates human's progress and development. Technical epistemology determines people's thinking mode, which has a fundamental significance in spiritual civilization. Epistemology, as a basic proposition of philosophy, is closely related with the advances in science and technology. When cognizing and changing the world, people always continuously explore and exercise their abilities to cognize and change the world at the same time.

- Science and technology is the important approach to improve the population quality

The core of sustainable development is to improve the population quality, which includes physiological and psychological quality, as well as scientific and cultural quality. Science and technology can improve these 2 qualities. Science and technology is an important guarantee for the prenatal and postnatal care. The progress of medical science has eliminated or reduced the pains of millions of patients, physical defects, and the elderly. Science and technology is the prerequisite to improve people's scientific and cultural quality. Armed with modern science and technology, labors will get improved. The most active factor in productivity -- the role of people is applied to achieve sustainable development, which is a basic cognition of sustainable development.

- Science and technology change people's lifestyle

Science and technology change people's linguistic expression. Logical reasoning and controlled trials are the two cornerstones of modern science. The combination of natural science issues and the appropriate mathematical form makes the nature laws immediately displayed in a harmonious, concise and orderly form, which can make up the shortage of imaginable thinking [3]. This kind of beautiful science not only shocks those natural scientists and promote them to develop natural depth and breadth, but also affects the expression of humanities and social sciences to make it more succinct and profound. Science and technology has changed people's spatial concept and time concept. Modern transportation and communications has narrowed the significance of regional difference. In addition, ever closer cultural exchanges and fierce cultural clash have accelerated the spread of advanced ideas and the birth of new ideas. Science and technology release people from the heavy manual labor and give us more leisure time as well as learning time, thus life becomes more colorful.

C. The effect of technological innovation on ecologically sustainable development

- Technological innovation is premise and basis to awaken people's environmental awareness

Scientific and technological development is conductive to develop people's environmental awareness, thus changing their view on the sustainable economic, social and environmental development. Moreover, science and technology also provide material basis for the awakening of human consciousness. The hierarchy of needs is shown as follows: the lowest layer is the basic necessities of survival. When survival needs are met, people will pursue a higher level of need. People's ecology awareness can be awakened only after their basic needs of food and clothing can be satisfied, which conversely relies on the scientific-technological progress. Only scientific and technological progress can improve efficiency, human condition and human living standards. It is just scientific-technological progress and development that awaken the human environmental awareness, that is, scientific-technological progress make human beings be aware of their situation, realize that they are faced with a choice---adhere to the sustainable development of economics, society, nature, and ecology.

- Technological innovation provides a guarantee for the control of ecological destruction and environmental pollution

Science and technology have made a significant contribution in environmental pollution control. If there is no environmental chemistry and analytical chemistry, we cannot realize the concentration of hazardous substances in pollutants and their impact. But for the birth of modern ecology, can we be aware of the ecological damage. Science and technology have played an important role in environmental management, such as biotechnology, membrane separation technology, high gradient magnetic separation technology, remote sensing technology, nuclear technology, activated carbon technology and so on, which all provide an effective way for environmental protection and have great potentialities [4]. Nowadays, the resources in our country haven't been efficiently utilized, which results in serious energy wasting. In this case, technological progress along with technological innovation can not only improve economic efficiency but also reduce pollutant emissions and excessive consumption of resources.

VI. CONCLUSIONS

A correct understanding of the relationship between technological innovation and sustainable development, which is conductive for us to better control our direction forward the future and adhere to the way of "resource-saving and environment-friendly" society, so that we can avoid to weigh skip west developed country "pollution first, hind processing" mistake, is better for the purpose of achieving sustainable development and realizing economic, social, natural and ecological harmony in essence.

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