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Discussion on the Relationship between Green Technological Innovation and System Innovation

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Abstract

Green technological innovation is an economic activity according with the ecological law, which has important significance to achieve the technical, economic, social and natural sustainable development. Green technological innovation with the characteristics of external effects, uncertainty, particularity and market failure decide that the green technology innovation needs proper system arrangement. The incentive, restrictive and guiding function of system innovation to green technology innovation is mainly realized by the secondary function by eliminating uncertainties, the internalization of economic externalities and saving the transaction cost.

Keywords: Green Technological Innovation, System Innovation, Relationship;

1. Introduction

In the academic research on how to build and cultivate green technological innovation capability, many scholars have made discussion on how system creation promotes green technological innovation. Wu Jinglian thought that the main strength of promoting technical development is not the rigorous technology itself, but the system arrangement that is favor able to technological innovation. Wang Yingzi etc. pointed out that technological innovation is a comprehensive innovation process, which is started from concept innovation and ensured by system innovation. However, Wang Yi hold that the roles of system innovation on technology innovation are reducing transaction costs, forming the incentive

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mechanism and reducing behavior risk. Yu Guoping analyzed the system barrier of green technology innovation and put forward the view that system innovation was the key of green technology innovation [3]. But all these are still immature. Placing innovation activities in the framework of sustainable development, from the point of green technological innovation system demand, from the mutual relationship of motivation, restrain and guiding between system innovations to green technology innovation are an important topic which needs to further study.

2. Institutional Demands of Green technological innovation

Economic theory development has ended the history of ignoring system or pure technical without system. In the past few decades, economists had paid more and more attention on the role of system variables in the economic system. Marx attached great importance to the interaction of technology and system, although he also emphasized productivity development level and decision system stability and change. Enoch had said in the existing, detailed description of the long-term change theories; Marxist's analysis framework is the most persuasive, because it included all the factors which were neglected by New Classic analysis, such as system, property, countries and ideology. Marx stressed the important function of property right in the effective economic organization, and the inadaptability of existing property system and new technology of productive potential. This was a fundamental question [4]. New institutional economics thought that technical changes depended on the system and the change system; effective system and system change decide technology progress, while ineffective system restricted technological progress. North in his works such as "Structure and Change of Economic History" and "the Rising of Western World" hold that it was the system change that paved the road for technology change and economic revolution [5]. Development experts Lewis believed that one of the important ways to reforming traditional sectors was modern department had an effective on traditional department, which makes the traditional department ideas and system modernization, so as to stimulate the traditional department to make progress in technology.

The characteristics of green technological innovation is different from general technology innovation's [6], which determine the green technological innovation purely based on enterprises supplies under the market incentive mechanism is impossible. Therefore, green technological innovation more needs an appropriate system arrangement, and creates an incentive, restrictive and guide mechanism to encourage green technological innovation.

2.1 External Effects of Green Technological Innovation

In the real life, there are different degrees of external effects in economic activities, that is economic activities, without market transaction, bring others unpaid positive or negative effects. Green technological innovation also has external effects, however, because the green technological innovation with some certain public product property, which is non-exclusive, while the external effects bring to others "free-rider" benefits. The enterprises that owned the technology innovation right are often free used "free-rider" by other companies or society. This will be bound to cause enterprise innovation investment lack of enthusiasm. Green technological innovation essentially is the process of technical knowledge production. No matter its results are new products, new technologies or new organization, they all contain the new knowledge. And when these carriers that reflected technology innovation enter the field of market production and circulation, it bring inevitably the spillover effects, and lead that the whole social income far outweigh the private gains. Private costs of technology innovation are cannot be totally compensated in some cases, so that they lack motivation participating in such activities.

2.2 Uncertainty of Green Technological Innovation

Compared with the usage of mature technology, green technological innovation has passed through several stages with a higher uncertainty degree, which includes technical uncertainties such as research and development uncertainty, test and trial production phase uncertainty and market uncertainty, etc. Technology and market uncertainty increase the risk of green technology innovation, reduce its expected earning, so as to slow down the technology innovation process to a large extent.

2.3 The Particularity of Green Technological Innovation

The non-green technology has some certain external negative effects, that is when individual marginal cost less than social marginal cost or individual marginal gains over the social marginal gains, it appears external diseconomy. The application result will bring a certain degree ecological environment worsening. While compared with green technology and non-green technology, green technology has positive external effect, and the application of green technology can maintain or improve the ecological system, improve the ecological system of ecological productivity and increase environmental resources. While the non-green technology enables technology user's to pay more cost. However, the pure market economy is not with the mechanism distinguishing automatically between these two types technology and also cannot solve the externalities. Green technology and non- green technology in market terms are both restricted by market regulation. Because of the different cost, non- green technology in competition is a disadvantage compared with the green technology. Green technology has much regularity. It not only should comply with the requirements of technical innovation, but also conform to the requirement of ecology law, which causes the success probability is relatively low. Therefore, as for technical innovators, under the conditions of same revenue, the individual cost of green technological innovation is much more than the non- green technological innovation, so that its market competitiveness is lower than that of non-green technology.

2.4 Market failure

The so-called market failure is refers to, in the market mechanism, a series of phenomena that economic resources cannot be effectively acollocated. The main manifestation includes insufficient investment of research and development duo to the business risk and technical risk, and insufficient investment in basic research due to no monopolize the innovation returns. Because the green technology innovation with the particularity of positive external effect, market mechanism cannot spontaneously solve the externality and resource allocation often exist in the "market failure" phenomenon.

3. Function of institution innovation to green technology innovation

According to the explanation from New Institutional Economics, system is defined as the rules of regulating the people's behavior, which includes the formal system and the informal system. Institutional innovation is a dynamic process, which mainly refers to the changes of institutional arrangements, and the activity that the system main bodies build new system to gain additional benefit. The system environment for technological innovation exist deep effects, so different system environment generate different incentive and restraint mechanisms, then affects people's technical innovation. Our society advocates green technological innovation and need to build green technological innovation mechanism as soon as possible. Green technological innovation is produced in certain system environment, such as political and economic system, various concrete institutional rules and moral concepts, beliefs, ideology and custom. It

is accordance with the stage of social development, and different system environment generate different incentive mechanism, so that affect people's green technological innovation activities. But the system with relative stability, the formation process of a system will display its function in a long time. With the technology innovation changes, some systems that are favor of green technological innovation will be against it. At this time system is the main obstacles of restraining green technological innovation, so system innovation will became very urgent. If the system innovation is carried out, preferring a new, scientific and reasonable system to the one that is backward, and against for green technology innovation, it will promote green technological innovation and social productive force development. Therefore, to encourage green technological innovation, system innovation became more significant and urgent. The core function of system innovation to green technology innovation is to provide incentives for green technological innovation, that is to provide impulsion for the green technological innovation activities, stimulate innovation subject to generate innovation motivation and trigger green technological innovation behaviors. At the same time it should have the guidance and constraint function, that is through institutional arrangement to lead the development direction of green technology innovation, constraints or prevent exterior effects produced by green technological innovation and finally improve the overall efficiency and benefit of the green technological innovation. The incentive, restrictive and guiding function of system innovation to green technology innovation is mainly realized by the secondary function by eliminating uncertainties, the internalization of economic externalities and saving the transaction cost.

3.1. Providing incentive mechanism

When the American institutional economists analysis the reasons for the rise of the western world, he said that efficient economic organization is the key to growth, efficient organization need to build institutional facilities, and establish property ownership, make the economic subject's cost associated with the income to prevent others "free-rider" or gains with no pains. In the traditional model, the green technology innovation is often lack of the intrinsic motivation. Only under the action of the environmental cost, government regulations, market forces and public pressure, through system innovation, formulate special green patent protection system and implementing procedures, enterprise can adopt green technology possibly. Through system innovation, not only can stimulate enterprise `s innovation power, but also be able to make green technology innovation maximum the social and environmental benefits. By the means of system arrangement to standardize enterprise behavior, make "who use who compensated, who destroyed who restore" and incentive mechanism come true with both prizes and penalty.

3.2. Promoting external utility internalization

For the unsustainable problem in the human economy development, human beings have soberly realized that green technological progress is the key to solve the human survival and development. Green technology is under bondage of the existing system, the most important among them is the environmental resources using system for free in the market system, and the external produced positive effect on the basis of economic activities. Green technology external positive effects inhibit green technological innovation. Therefore, system innovation becomes the key link of realizing green technology innovation. Only by realizing the internalization of external effects, we can promote green technological innovation. Externalities not economic internalization is the internalization of external costs. It enables producers or consumer produces external costs enter into production or consumption decisions. And to be borne or digest by themselves. Now, many countries or regions have taken many beneficial measures which are

good for externalities of the internalization. These measures can be divided into economic economic incentives and macro-control, which is made of sewage charge system, market transaction methods, financial subsidies, and deposit system. Macro-control means such as the government should establish and maintain a system structure which can be able to maximum the use of transactions, and should be defined distribution property rights as clearly as possible. Taking the responsibility for develop the environmental monitoring in order to identify pollution source and receptors, and to open the monitoring information for the affected parties. Command control measure is that the government according to relevant laws, regulations and standards, etc. Directly provision the parties' permission number of external diseconomy and its way. Such as stipulated means in the minimum technical requirements. It is the specific requirements to the process of produce or main equipment prescribed, namely is the minimum technical requirement for the potential polluter.

3.3. Reducing transaction costs

Any one of the economic transactions, including green technological innovation achievement transaction, needs the contract agreed, contracting execution supervision, bargaining and knowing about the production and demand information, etc. These expenses exist, and sometimes they are too high to make trade to reach. John in 1986 the empirical research showed that 1970 American 45% of GDP is used in trade factors. Wuchang Zhang estimated that transaction costs is accounting for 80% of GDP in China Hong Kong. When transaction costs beyond zero, institutional arrangement not only affects allocate, but also has influence on the allocation of resources and output constitute. Because of the existence of transaction costs, some institutional arrangements which used to reduce these expenses are appearing. Institutional innovation is the framework to construct the relationship between people, is the choice set to define and restrict actors, constraining people's behavior under the standard, reducing transaction activity uncertainty, restraining the opportunismbehavior tendency, then to reduce transaction costs.

3.4. Reducing behave risk

In the process of green technology innovation，risk largely from its uncertainty. Kennedy (K, Arrow) in 1962 explicitly proposed the process of the technology innovation has three distinctive features: uncertainty, integral, and the non-exclusive of innovation profit. Taking the influence of technology innovation process into concerned, core feature is the uncertainty of technology innovation process. The institutional arrangements cannot eliminate the uncertainty of the green technological innovation thoroughly. Through constraining and regulating people's behavior to strengthen the certainty and expecting of behavior. So we can greatly reduce the behavior risk.

3.5. Overcoming market ineffectiveness

People can through system innovation to create a system. Through the market of continuing the adjustment to promote green the use of technology and innovation in order to realize the sustainable development. In other words, For example, we can create a kind of allowance system which can make a difference on the green technology innovation. Through giving allowances to the green technological innovator, we can transform the social benefit which forms by the green technological innovation into individual income.

4. Conclusion

The green technology innovation is an economic activity which matches ecosystem regulation and economic regulation. It has the vital significance to implement technical, economic, social and natural sustainable development. But the green technology innovation is an economic activity which has more regulation, greater risk and needs more investment. It requires system innovation provides continuous effective incentive. The institutional environment has deeply influence on technological innovation. Different system environment form different incentive and restrictive and guide mechanism, then affects people's technology innovation. System innovation has the constraint and the guidance function for the green technology innovation. The specific performance in providing incentive mechanism, promoting the internalization of external utility, reducing transaction costs, reducing behavior risk and overcoming market ineffectiveness.

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