

# *Research on the Isomorphism of Innovation Diffusion and Technological Change*

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**Abstract:** The 21st century is an era of great change. In the face of changes in the pattern of economic globalization and pressures from all sides for sustainable development, China has realized the important role of technological innovation in promoting the transformation of social structure and the transformation of economic growth patterns. Therefore, how innovation diffusion works and promotes sustainable development has become a research hot spot. The paper discusses the isomorphism of technological change and innovation diffusion on the basis of comprehensively sorting out the theoretical viewpoints of the existing research. Results show that the process of innovation diffusion is equivalent to the process of technological change, technological change is accompanied by innovation diffusion, and innovation diffusion promotes the development of technological change.

## **1. Innovation Diffusion**

Innovation diffusion refers to the process in which technological innovation achievements (including technologies and products) are promoted and applied through learning or imitation, production scale expansion, etc., and gradually exert economic effects. Its essence is an interacting evolution process between technological innovation and the environment [1].

The communication theory represented by Rogers regards the diffusion of technological innovation as the process of information dissemination, and gives specific connotations to the diffusion of technological innovation from the perspective of communication. Rogers (2002) regarded that innovation diffusion was a process in which innovation spreads among members of a social system over time through a certain channel, that is the process of spatial dissemination from the source of innovation and adoption by other members of society through market or non-market channels [2]. Sahal (1985) believed that the process of technological innovation diffusion was actually the process of replacing old technologies with new technologies [3], and the diffusion process of innovation is linked to the process of technological development (including time dimension and space dimension) [4]. It can be seen that innovation diffusion is not only a time-expanding process of diffusion with time dynamic changes, but also a space-expanding process in which new technologies or new products are spread among potential adopters through certain channels [5]. Therefore, innovation diffusion is the wide application and promotion of a new technology (or new product) in the market, and it is an effective form of innovation technology

acting on the economy. In a broad sense, innovation diffusion begins with the recognition of problems or needs, and completes the entire process of innovation diffusion through research and development, commercialization, and large-scale diffusion and adoption [2].

Yang Yonghua (2014) believes that from the perspective of microscopic mechanisms, technological innovation diffusion includes two aspects: "expansion" and "spread" [1]. The so-called "expansion" means that the main body of technological innovation applies the technological innovation to a larger scope and extent through the expansion of its own scale, and continuously exerts and expands the economic effect and social impact of the technological innovation, such as the increasing market share. The so-called "spread" refers to the transfer or dissemination of technological innovation achievements among different subjects, and its essence is a learning process. For example, the continuous replication and application of a technological innovation in different enterprises, different industries, different regions and countries is a manifestation of technological innovation "spread" [1].

## 2. Related Concepts

**Technological change.** Scholars' research on technological change is mainly carried out from the perspective of evolutionary economics. Technological evolutionists believe that technological change is a process of technological evolution, a process of continuous accumulation and dynamic change of technology [6]. Technological change includes not only changes in technological structure, but also changes in technological elements, such as user practices, management, industrial networks, infrastructure, symbolism, and culture [7]. Technological change is the main technological innovation that enables social functions to be satisfied for a longer period of time.

**Technological paradigm.** Dosi first proposed the concepts of technological paradigms and technological trajectories. Dosi pointed out that technological paradigm is a model or mode in which people solve the problem of selecting technology based on certain technological expectations, process knowledge, existing technology level and resource utilization mode[8]. Rip and Kemp (1998) further enriched the concept, taking social connection as an entry point, pointing out that a technological paradigm was a set of rules or laws, including all technology-related systems and structures, the association with scientific knowledge, engineering practices, product characteristics, processes and procedures, etc [9].

**Technological trajectories.** Dosi put forward the theory of technological trajectories after an in-depth study of the technological paradigm. He pointed out that the technological trajectory is the path of technological evolution. The introduction of technological trajectories clarifies the important role of technology in the process of social and economic changes and development, and reveals the basic laws of technological innovation under the evolutionary mechanism [10].

Table 1: Main Concepts

Concept	Interpretations
Technological change	Technological change is a process of technological evolution, which occurs in the substitution between new and old technologies, and is a process of replacement and transformation between new and old technological paradigms.
Technological paradigm	Technological paradigm is "a model or mode for solving the problem of selecting technology", which determines the fields, problems, procedures and tasks of technological research and development.
Technological trajectory	The technological trajectory is the path of technological evolution and the trajectory of technological progress defined by the technological paradigm.
Innovation diffusion	It is the process by which a new technology or product is adopted by society.

Technological evolution. Dosi starts from the dynamics of technological evolution and points out that technological evolution usually follows a technological trajectory determined by a technological paradigm. Each technological paradigm will define the direction of technological trajectory development according to its specific technological, economical and other trade-off criteria. The development process of technology is a selective evolutionary activity that develops along the direction of the technology track under the stipulation of the technology paradigm. Main Concepts are shown in Table 1.

### 3. The Isomorphism of Innovation Diffusion and Technological Change

In technological changes, there are usually two ways for enterprises to change existing technologies or practices. One is to introduce new technologies to imitate innovation, and the other is to carry out independent innovation. Through innovation, a large number of alternative technologies appear in the economic system. Innovation leads to the diversity of technologies, and after selection, new technologies can be diffused in the economic system, resulting in changes in social group thinking and behavior patterns [11]. At the same time, innovation itself is a prerequisite for technological change, and only through diffusion can innovation have an impact on society [12]. Li Jin (2009) believes that innovation diffusion is the interaction of old and new technologies, and it is the process of new technologies replacing old technologies. At the same time, technological evolutionists have also conducted some research on the stages of technological change. The Neo-Schumpeterian school represented by Metcalfe, Winter, Foster, Anderson, etc. believes that the process of technological change can be analyzed in detail. It is divided into technological conception, technological invention, technological innovation and technological diffusion [13], which is similar to the whole process of technological innovation diffusion. It can be seen that the process of technological change is an important diffusion process of technological innovation, and it can also be regarded as an important long-term evolution of technological innovation.

Dosi believed that technological change occurred in the substitution between new and old technologies, and was a transition process between new and old technological paradigms; when a new technological paradigm was gradually established and formed, it would constantly weaken the role of the old technological paradigm. Chen Jin and Wang Huanxiang (2008) clearly stated in the book *Evolutionary Economics* (P171): “In the process of technological innovation, there are specific technological paradigms and technological trajectories, and technological change evolves on the basis of a series of innovation processes. The process of technological change is the evolution of technological systems, and the process of creation and diffusion of innovations is essentially the evolution of technological systems [14].”

### 4. Conclusions

The process of innovation diffusion and technological change is the evolution process of a technology or technology system. Innovation diffusion is the process in which new technologies or new products are adopted by society and new technologies replace old technologies; while technological change is the process in which mainstream technologies in the old paradigm are replaced by new technologies. It can be seen that the process of innovation diffusion is equivalent to the process of technological change. Innovation diffusion is a series of highly selective evolutionary activities that develop along a certain technological trajectory under a certain paradigm. Technological change is accompanied by innovation diffusion, and innovation diffusion promotes the development of technological change. It is reasonable and feasible to analyze the diffusion of technological innovation based on the theory and method of technological change.

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