

Motivation Factors of Technological Innovation in Emerging Industry

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Abstract: Strategic emerging industries are typically innovation-driven. Promoting technological innovation in emerging enterprises and accelerating the development of emerging industries is a key point to gaining global competitive advantage for countries. Therefore, identifying motivation factors of technological innovation has important theoretical and practical value for promoting the development of emerging industries. This paper mainly analyzes the motivation factors that influence the technological innovation of enterprises in emerging industries. The motivation factors of technological innovation can be divided into two main categories, including internal and external factors. Only when the internal and external factors are complete, can the innovation system work well.

1. Introduction

According to the historical experience of global economic development, emerging industries can always breed and grow in the process of overcoming major economic crises, and become a new economic growth point with their unique vitality to promote the economy into a new round of prosperity. Since the international financial crisis in 2008, the economic forces of various countries in the world have become unbalanced in the post-crisis era, and the international division of labor system has been forced to adjust. At the same time, the pressure of global environmental degradation, such as global warming and the energy crisis, has also had a restrictive impact on the development of countries around the world. Under such circumstances, every country in the world has realized the urgency of changing the original production lifestyle to adjust the direction of industrial development, and promoting economic and social development with emerging industries. Through the development of new technologies and the cultivation of new industries, countries strive to speed up the distribution of new technologies and industries so as to take the lead in seizing the strategic commanding heights of the new round of economic growth, thus gaining a favorable position in the reconstruction of the international crisis.

Emerging industries refer to new departments and industries that can meet the needs of the society and are formed with new scientific research achievements or the invention and application of new technologies. The theory of technological innovation was first put forward by J. A. Schumpeter, an Austrian-American economist, in the book *Economic Development Theory*. In this book, Schumpeter pointed out that “technological innovation is the main source of capitalist economic growth” and

considered innovation as a process concept. He also pointed out that important innovation does not occur randomly, but tends to erupt centrally in the certain period of time and economic sectors, and manifests itself in the form of “long wave” [1, 2]. Along with the rapid development of science and technology, the role of technological innovation in the economy has been increasingly valued by people. The theory of modern technology innovation has been derived and developed on the basis of Schumpeter's innovation theory.

At present, the most rapid and influential research idea is that the core driving force for the development of emerging industries is technological innovation. And the core issue of innovation research is exploring motivation factors of technological innovation. Technological innovation can rationalize and heighten the industrial structure, promote industrial restructuring and upgrading, enable emerging industries to meet the new market demand, and help to improve the utilization of resources. The differences in macro-innovation behavior between enterprises in different industries and even between enterprises in different countries are all influenced by the factors of innovation motivation. Considering that the enterprise is the basic unit of technological innovation, and that the main body of innovation in Schumpeterian originally refers to enterprises and entrepreneurs (now including countries, regions, cities, industries, non-enterprise organizations and individuals, etc.), thus it can be a scientific and effective research angle to study the innovation motive force of the industry from the perspective of enterprise. This paper holds that technological innovation in emerging industries is a system, and the driving factors of innovation are divided into internal and external parts. The external factors mainly include government system, market competition, market demand and scientific basis; the internal factors include enterprise innovation resources and capabilities, as well as the characteristics and strategic orientation of enterprise managers. Only when the internal and external factors are complete, can the innovation system work well.

2. Motivation factors of technological innovation in external environment

2.1 Government institution

As a new industrial posture, emerging industries have unique characteristics different from traditional industries, such as high risk, high investment and high income. In practice, they mostly appear in the form of high-tech industries. Their development laws, patterns and institutional needs are quite different from those of traditional industries. Therefore, government policy guidance and institutional guarantees are particularly important in the industry. Government management institution is a formal institution, including fiscal and taxation system, legal system and industrial policy. It is an important support for the development of emerging industries, and can play the role of “guiding”, “incentive”, “service” and “normative” in the development of emerging industries. Governments can influence innovation activities through relevant institutional arrangements, innovation policies, or direct intervention. Therefore, the development of emerging industries needs a series of institutional innovations to promote the aggregation of various resources in emerging industries, adjust the industrial structure in the new round of economic development, and seize the commanding heights of industrial development. According to the theory of New Structural Economics, the government should provide “hard infrastructure such as transportation, electricity, ports, and soft institutional environment such as laws and regulations” for the development of emerging industries, offer basic scientific research support for new technological innovation and industrial upgrading close to the frontier, and provide necessary incentive (such as tax incentives, financial subsidies, credit rationing, etc.) for entrepreneurs who dare to invest in this process.

As early as the end of the 1980s, innovation research has risen to the national level, and some scholars have proposed the concept of “National Innovation System”. National innovation system

refers to an innovation network composed of various institutions in the public and private sectors of a country whose activities and interactions promote the development, introduction, improvement and diffusion of new technologies. The theory of national innovation system plays an important role in guiding national macro-policies. The core of this paradigm lies in institutional relations, it holds that institutions, capital, technology, and human capital constitute endogenous elements of emerging industries, but as the primary factor, institutions are higher than technology and capital. Freeman (1987) first studied the Japanese case based on this theory, and believed that the government's support for industrial innovation (the establishment of Japan's national innovation system) is the most important reason behind Japan's economic prosperity after the Second World War [3]. Since then, scholars around the world have come to realize the importance of technological innovation, especially with the rapid development of science and technology and the intensification of market competition, governments all over the world have promoted the development of enterprise innovation activities by establishing national innovation system and formulating innovation policies.

2.2 Market competition

Market competition is the product of the market economy. According to the degree of market competition, market competition is usually divided into complete competition and incomplete competition. According to the form of market competition, market competition is usually divided into price competition and non-price competition. Benign market competition allows companies to maintain crisis awareness, improve product quality and performance, keep managers motivated and pursuing higher market performance and more efficient asset allocation.

Kenneth Joseph Arrow, an American economist, believes that in a more competitive market, innovative results have greater value. Selling or utilizing innovative results can bring excess profits to enterprises, so it will promote the emergence and development of enterprise innovation. Arrow (1962) takes monopoly market and competitive market as background, compares the profit of technological innovation under these two market conditions through empirical model analysis, and finally comes to the conclusion that the stronger the market competition, the more the innovation activities of enterprises will be promoted [4]. The results of KAM IENM I and Schwartzn L. (1978) also support the conclusion of Arrow hypothesis [5]. The author believes that if enterprises have the ability to obtain monopoly profits, they will not be inclined to carry out innovative activities, and the incentives for new research and development will become smaller, thus making the production cycle of innovative achievements longer. On the contrary, in a highly competitive market environment, enterprises are eager to gain market competitiveness through innovation activities and turn innovation output into revenue. Levin, Chhen and Mowery (1985) examined the relationship between innovation and market structure using data from 73 UK industries [6]. The study finds that there is a virtuous circle of mutual promotion between market competition and enterprise innovation. Generally speaking, enterprise innovation activities will increase with the decline of market concentration, which will further aggravate the decline of market concentration. Koeller (1995) constructed a two-equation model with more than 1000 manufacturing enterprises as samples, the results show that high market concentration will have a negative impact on innovation output of enterprises [7]. Correa & Ornaghi (2014) introduced the variable of technological progress into their study, by selecting the sample of American enterprises and setting up two control groups of manufacturing and non-manufacturing industries, it was concluded that market competition was negatively correlated with innovation activities and technological progress, thus verifying the conclusion of Arrow hypothesis [8].

2.3 Market demand

Market demand, which is related to consumer preferences, income, and product quality, is also one of the driving forces behind technological innovation. Technological innovation activities are guided and constrained by market demand. According to J. Hicks's "Induced Innovation Theory", market price reflects changes in consumer demand, while technological innovation tends to reduce relatively expensive factors of production, thus market demand guides innovation through price signals. In the 1960s, American economist J. Schmookler put forward the demand-pull theory, saying that demand drives the innovation model, and technological innovation originates from market demand [9]. By analyzing the time series of investment, output, employment and invention activities of four specific industries in the United States from the first half of the 19th century to the 1950s, Schmoockler found that the time series of investment and patent showed a high degree of synchronization, and the patent sequence lagged behind the investment sequence. He introduced the demand factor to explain that the pursuit of profit maximization by economic entities is an investment activity in response to market demand, which triggers the synchronous response of the invention activity and represents as synchronization of investment and patent time series. American scholar D. Marquis sampled 567 examples of innovation, of which 3/4 were based on market demand or production demand, and only 1/5 were based on the development of technology itself.

2.4 Scientific Basis

The pace of technological innovation activities also depends on the progress of science. The high-tech characteristics of emerging industries determine that technological innovation in such industries is inseparable from the accumulation of scientific knowledge and the development of basic disciplines. It can be said that the scientific basis determines the possibility and cost of innovation activities. Long and rich scientific results can give emerging companies more technical choices and innovative inspiration, thus stimulating technological innovation. Moreover, the development of science often leads to fundamental technological innovation, semiconductor technology and laser technology are typical examples. The United States has published a report entitled "Science: The Endless Frontier", which has important implications for science, technology, and innovation in the United States and around the world. The report points out that scientific research is the cornerstone of a country's development, and investment in basic research can lead to a large number of technological inventions and new products, thus benefiting a country's economy.

3 Motivation factors of technological innovation in internal organization

3.1 Innovation resources and capabilities

Wernerfelt (1984) defines enterprise resources as "anything that can be seen as a given enterprise's strengths or weaknesses, or more formally, those semi-permanent tangible and intangible assets belonging to the enterprise at a given time." [10]. As a scholar who supports the resource-based theory, in Wernerfelt's view, enterprises are a unique aggregation of resources, and the long-term competitive advantage of an enterprise comes from its own or controlled special resources and strategic resources that are difficult to imitate and difficult to trade. The difference in resources is the reason for the different profitability of enterprises and the key factor for the success of enterprises. Scholars who support the theory of competence believe that enterprises are unique aggregates of competence, and their long-term competitive advantage comes from their core competence. The ideas of these two theories are basically the same, that is, the enterprise is essentially a unique collection of elements, and the long-term competitive advantage stems from the enterprise elements with special characteristics. On the other hand, Schumpeter hypothesis reveals the relationship among firm size,

market structure and technological innovation. Schumpeter argues that technological innovation is positively correlated with market concentration and that market dominance is necessary in promoting technological innovation [2]. Therefore, the hypothesis holds that large enterprises with stronger market power have obvious advantages in technological innovation and social progress. Fisher & Temin (1973) supports Schumpeter's hypothesis that R&D investment is positively correlated with enterprise size, they believe large enterprises have better innovation resources and environment than small enterprises, which are more conducive to enterprises' innovation activities, and innovation achievements can play a greater role [11]. The research of ASC Z J and AUDRETSCH D B. (1987) found that small companies are more prone to innovative activities in the initial stage, while large companies have more innovative contributions, but they are not applicable to all industries. Companies in advertising-intensive, capital-intensive and highly concentrated industries are more willing to carry out innovative activities [12].

3.2 Traits and strategic orientation of enterprise managers

The characteristics and strategic orientation of enterprise managers are important factors influencing the direction of enterprise innovation. Mark Garrett Brendle (2002) questionnaires 335 SME owners and managers, and concludes that the personality characteristics of owners and managers will affect the support and innovation probability of enterprises for innovation, and then affect the growth performance of SMEs [13]. The initiative of owners and managers, the openness of ideas, the tolerance of actions, and risk appetite are all closely related to innovation support. Through empirically comparing the relationship between innovation probability and growth performance, the author points out that the corporate culture that supports innovation has an important impact on the probability of innovation, and that the initiative, risk appetite, sales performance, and innovation support of owners and managers of growth-oriented SMEs are higher than those of owners and managers who only focus on profitable income.

The strategic orientation of business managers is mainly divided into market orientation and entrepreneur orientation. Market orientation means that managers tend to constantly adjust their business strategy according to their perception of market demand and their response to consumer feedback. Market-oriented companies can more easily perceive market information related to innovation, better understand consumer demand, and develop new products and services that are more in line with market demand by fully responding to market information, thereby enhancing the innovation performance of enterprises. However, such companies that focus their strategies on consumers tend to engage in incremental innovation and short-term development activities that lack vision. Because consumers may not be aware of what new products and services they need in the future, market-oriented companies may lack real insight into technological innovation activities, thereby damaging their long-term competitiveness. Entrepreneurial orientation means that managers are entrepreneurial and tend to demonstrate this spirit in business operations and innovation activities. Entrepreneurship drives the company to continue to grow, and countries around the world attach great importance to the research of the relationship between entrepreneurship, corporate growth and economic growth. In the United States, entrepreneurial behavior is an important means of promoting economic development and increasing social employment, it is considered to be an important driving force for national technological development. Entrepreneurship includes a spirit of innovation, a spirit of risk taking, and a strong sense of mission and responsibility. Under the influence of innovation motivation and enterprise endowment, enterprise managers with entrepreneurship will ultimately achieve institutional innovation, technological innovation and value innovation through exploring and identifying innovation opportunities and integration process. Entrepreneurs optimize the

allocation of resources through innovative management, thereby leading the healthy growth of enterprises.

4 Conclusions

Motivation of technological innovation is the core issue of innovation research, and the differences in macro-innovation behavior of countries can be attributed to the differences in incentive systems. No matter in which field, technological innovation is undoubtedly a high-input, high-risk and long-term investment activity. If we fail to identify the motivation factors of technological innovation and build an effective incentive system to promote technological innovation, high-level and large-scale technological innovation will be difficult to achieve. This paper argues that in the field of emerging industries, external factors consisting of government institutional policies, market environment and scientific foundation have an important impact on technological innovation, while in terms of internal motivation factors, sufficient R&D resources and capabilities, as well as the manager's strategic orientation of innovation, can inspire the company's innovation and development. It can be concluded that the formation of technological innovation motivation is based on government decisions, and those internal and external factors affect technological innovation by influencing decision variables.

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