Study on Innovation Impetuses in Northeast Manufacturing Industries

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Abstract

This paper based on current status of domestic and foreign researches, connotation of dynamics of industrial independent innovation, as well as that of industrial independent innovation dynamic system is studied. The connotation of industrial independent innovation dynamic system of manufacturing industry in Northeast region is made clear. Dynamic factors of independent innovation dynamic system of manufacturing industry in Northeast region are elaborated.

Index terms— northeast region; manufacturing industry; independent innovation; dynamics.

1 I. Introduction

his paper puts forward the definition of industrial innovation impetus after reviewing and summarizing research at home and abroad. Industrial innovation impetus refers to direct factors that propel industrial innovation activities, or the driving forces that motivate enterprises in the industry to invest a lot of manpower, materials and financial resources in independent research and development, and thus promote the independent innovation ability of the industry. For manufacturing industries in northeast China, Study on Innovation Impetuses in Northeast Manufacturing Industries is an effective means to promote the development in northeast China.

2 II. Dynamic Factors of Independent

Innovation Dynamic System of Manufacturing Industry in Northeast Region a) Influence of Entrepreneurs' Innovation Trait In enterprises, independent innovation behaviors are to "realize new combinations", while entrepreneurs are the "people who promote the realization of new combinations". Their behaviors are driven by the pursuits of monopoly profits or excess profits and the aspirational "entrepreneurial spirit" beyond profits. The goal or ultimate result is to achieve new combinations, namely "independent innovation" **??**Song X M,1993). Industry is composed of enterprises. Within an industry, entrepreneurs share some common traits. Let's take the world's auto industry as an example. Henry Ford, Karl Benz, Sakichi Toyoda and Author: School of Economics and Science, Chang Chun University of Science and Technology, The first building 403room, Satellite road 7989, Chang Chun, China. e-mail: zmzsl0118@163.com Soichiro Honda are all entrepreneurs passionate about innovation. It can be clearly seen that entrepreneurs' innovation trait that arises from their spirit, personality and temperament is a not-replicable critical key to the success of independent innovation of the industry they belong to. Looking back on the world's industrial development history, we can see that the rise of a nation's industry in essence is the birth of a combined model of production factors and that entrepreneurship is the "glue" that combines all these key factors of production.

Innovation trait of entrepreneurs in manufacturing industries in northeast China also affects the independent innovation activities of the entire industry. There are a huge bunch of manufacturing enterprises in northeast China. During the planned economy, manufacturing enterprises in northeast China mainly relied on projects, fund and policies granted by the government and conservative entrepreneurs lacked or even had no spirit of independent innovation. This trait of entrepreneurs hindered innovation activities in manufacturing industries in northeast China and the cross-industry and blocked cross-region technical communication. With the proceeding

of reform and opening up and the successful reform of SOEs in northeast China, entrepreneurs in manufacturing industries in northeast China also began to change their concepts. There emerged a host of entrepreneurs with innovation spirits, such as WEI Hualiang from HMCT Group, CHEN Huiren from Shenyang Machine Tool and DONG Qingfu from Dalian Machine Tool etc. The era bestowed challenging historic missions on a new generation of entrepreneurs, and meanwhile offered them great opportunities to make success and contributions. By advocating and leading enterprises to carry out independent innovation activities, these entrepreneurs turned their businesses around and made breakthroughs. diverse categories. The manufacture of some capital goods or durable consumer goods may reach up to thousands and even tens of thousands of pieces, so the industry chain is much longer than that of the agricultural and service industries. Demand of an enterprise in the industry chain will induce a series of independent innovation activities of other enterprises associated with that enterprise. Therefore, industry chain's demand is the major and sustaining force that propels independent innovation of the whole industry **??**Song X,1997).

In manufacturing industries in northeast China, mainframe enterprises coexist with parts enterprises. Because of significant technical correlations, the demand for a product in the market will be transmitted to the upstream industries (or enterprises) and downstream industries (or enterprises) through the technical chain and activate associated industries (enterprises) to make constant incremental innovations and breakthrough innovations in share technologies, thus forming a "demand-innovation-and innovation" virtuous f upward cycle. This paper takes HMCT Group as an example to illustrate this point. Three Gorges generators are machine sets with the largest capacity, the largest diameter, and the largest weight in the world. The design difficulty, manufacturing complexity and demanding requirements pose great challenges even to the world's leading hydraulic turbine manufacturers. When Three Gorges generators called for bidding in 2003, HMCT Group was even not qualified to attend the bidding due to technical reasons. In order to fill the gap in the project of Three Gorges generators, HMCT Group established cooperation with foreign investors and made constant attempts and explorations, eventually grasping foreign advanced technologies after just a few years. In the subsequent tendering of right bank machine sets of the Three Gorges, HMCT Group obtained the qualifications for bidding due to its own strengths and advantages. Through the extremely rigorous and competitive process, HMCT Group managed to pass the test and win the bidding by virtue of its innovation in generator cooling technology and runner design, scooping an order of four machine sets for the right bank of the Three Gorges. Among these four machine sets, the 26# machine set was independently designed and manufactured by HMCT Group, becoming China's first super-large turbine generator set with independent intellectual property rights. The 26# machine set's two key technologies in new runner and cooling took the lead in the industry for three to five years. Meanwhile, independent innovation activities in HMCT Group were also transmitted to other associated enterprises in the industry chain through industry chain's demand and successfully triggered off innovation activities of these associated enterprises.

3 c) Inducing Force of Added Value of Industrial Technologies

The added value of technology refers to the surplus value incurred from advanced technology that reduces costs or improves quality and hence increases the sales in the production process. Application of science and technology is an effective means to improve the technical content and added value of products. Technical content is also known as technological content, independent innovation is the source of products' technical content **??**Gupta,1991). Only with the presence of technical added value can the whole industry make profits. The pursuits of benefits and realization of interests are all the impetuses that inspire independent innovation activities. Therefore, for manufacturing industries in the northeast region, the added value of industrial technologies is an important force that induces industrial innovation.

To break the long-standing technical monopoly of imported CNC machines over some of China's core manufacturing areas and increase the added value of developed and expanded its products from general machine tools to CNC machine tools, and even to intelligent and complex CNC machining centers, making incessant technological improvements. Now its output rate remains above 50%; among five domestic CNC machine tools, one belongs to "Shenyang CNC" tools. A bulk of mid-end and high-end CNC machine tools are working in core manufacturing areas in the equipment manufacturing industry in northeast China. When monopoly of imported CNC machine tools was being broken through independent innovations, Shenyang Machine Tool Co. also achieved huge economic benefits by increasing the technical added value.

4 d) Support of Industrial Innovation Policies

As an external economic activity, innovation in an industry not only promotes the progress of the industry but also gives a strong impetus for the development of other industries. This holds particularly true for innovation activities of great economic significance. Therefore, it would be inadequate to rely on the market and technology and other factors to promote independent innovation. There should also be support of innovation policies. For this reason, almost all governments have implemented supporting and incentive innovation policies and means. Governments of some countries have a long history in innovation policies. For example, Britain and France sought after methods for the precise measurement of longitudes with a large bounty in 1714 and 1716 respectively. The

British Committee of Technology and Industry Awards also set up an award to encourage the reform of the spinning machine in 1761 **??**Cooper,1983).

As "the elder son of the People's Republic of China", northeast China encountered setbacks in the early stage of transition from a planned economy to a market economy. However, strategy of rejuvenating the traditional northeastern industrial base of China gave a great boost to people's confidence in revitalizing manufacturing industries in northeast China. The government also introduced a lot of policy support to promote independent innovation activities in northeast China. The State Council released in 2006 the Several Opinions on How to Rejuvenate the Equipment Manufacturing Industry in Northeast China, offering a strong strategic support and policy guarantee for independent innovation in the equipment manufacturing industry in Northeast China. Now innovation impetus in the equipment manufacturing industry in Northeast China continues to increase, with an obvious rise in the ratio of R&D investment to sales revenue, promoting steadily forward a new market-oriented independent innovation system led by enterprises through cooperation among industries, universities and research institutes.

5 e) Support of Industrial Innovation Talents

Manpower is one of the most important production factors and an important asset of great significance. A certain number of innovation talents with a certain degree of quality are the basic guarantee for innovation activities in the northeast manufacturing industry. Therefore, talents are the main force of innovation in manufacturing industries in northeast China, mastering professional skills in all aspects. Talents are also a source and an important impetus for innovation in manufacturing industries in northeast China.

Universities and research institutions in northeast China offer significant talents and strong technical support for innovation in the local manufacturing industry. Colleges and universities are clustered in Northeast China, delivering a large troop of technical talents to the northeast manufacturing industry every year, especially talents with automotive expertise. Research institutions share human capital and technical resources with enterprises through constant scientific research collaboration. The professional knowledge and skills of these talents are rooted deeply in manufacturing industries in northeast China, promoting continual innovational activities in that industry. Meanwhile, these talents can convert existing knowledge and technical resources into productive forces by applying R & D activities effectively into innovation practice, advancing the development of innovation in manufacturing industries in Northeast China. f) Driving Force of Industrial Innovation Technologies Science and technology, the primary productive force, is constantly applied in production. It is the most active and most revolutionary factor. Independent innovations in manufacturing industries in northeast China are technical and economic activities characterized by investments in new technologies. These new technologies are preconditions for carrying out innovation activities in manufacturing industries in northeast China, and the driving force for promoting innovation in that industry.

Manufacturing industries (especially the equipment manufacturing industry) in northeast China are an importance base for scientific research and production. Particularly in recent years, manufacturing enterprises in northeast China worked with research institutions and developed a large number of major devices and technologies, filling the technical gap in China. For instance, Shenyang Machine Tool Group completed the development of the overhead five-axis gantry machining center, the turn-milling machining center and other new products. Dalian Machine Tool Group independently developed the BK50 five-axis gantry machining center and high-speed spindles and linear guides. Changchun Institute of Optics, Fine Mechanics and Physics carried out research work around luminescence, shortwave optics, space optics and other fields and achieved forward-looking innovation achievements with independent intellectual property rights and a wide range of application prospects. A series of R&D activities and technological achievements played a very significant role in promoting innovation in manufacturing industries in northeast China. They became the technical base for further development of industrial innovation activities and provided an important guarantee for industrial innovation activities in northeast manufacturing industries. g) Fund Support for Industrial Innovation Any innovation activities should have sufficient fund as foundation. Innovation fund is an important impetus and guarantee for independent innovation in manufacturing industries in northeast China, and the source of scientific and technological reform within the industry. For this reason, countries around the world especially Western developed countries make a huge investment in innovation. According to the Western experience, huge investment in research and development is the main driving force for the country's economic growth and industrial technological progress (Tidd, 2001).

Because of a long and extensive industry chain, manufacturing industries in northeast China (especially the equipment manufacturing industry) need a huge amount of fund to carry out independent innovation activities. Innovation in northeast manufacturing industries is mainly funded by the government, enterprises and financial institutions. Innovation fund is one of the important impetuses for independent innovation in northeast manufacturing industries, ensuring the smooth proceeding of innovation in these industries. Meanwhile, the intensity of capital investment also directly determines the results and effects of innovation activities.

6 h) Adhesive Force of Information for Industrial Innovation

Human society has entered the information age today, so information resources play an increasingly important role in innovation activities in northeast manufacturing industries. Information is characterized by universality, sharing, convertibility, hierarchy, transmittability, transmission and diffusion, sustainable use, a certain degree of timeliness, and cyclicity. The preconditions for improving the innovation capability of manufacturing industries in northeast China are to collect, collate and study the latest technological information related to the industry. Information work is not only conducive to promoting independent innovation activities in manufacturing industries in northeast China, but also beneficial for saving innovation fund and increasing innovation efficiency (SUN Bing, 2008).

Agencies, one of the main interest entities in China's northeast manufacturing industries, are dedicated to providing relevant information for other stakeholders of industrial innovation. The information can link and bond enterprises, governmental departments, industry chain users, universities, research institutes, financial institutions, agencies and other main innovation stakeholders in manufacturing industries in northeast China, all of which work together to promote the development of innovation activities in northeast manufacturing industries. More specifically, innovation stakeholders in northeast manufacturing industries build a communication bridge, speeding up technical communication and resource exchange. Meanwhile, northeast manufacturing industries can be closely linked with the external environment to absorb "materials and energy" related to innovation and thus ensure smooth industrial innovation activities in northeast manufacturing industries.

7 III. Conclusion

This paper identifies the impetuses for the innovation system of manufacturing industries in northeast China, including Influence of Entrepreneurs' Innovation Trait, Pulling Force of Industrial Chain's [1]

Figure 1:

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Demand, Inducing Force of Added Value of Industrial Technologies, Support of Industrial Innovation Policies, Support of Industrial Innovation Talents, Driving Force of Industrial Innovation Technologies, Fund Support for Industrial Innovation, and Adhesive Force of Information for Industrial Innovation. How to utilize the role of these factors in promoting innovation activities in northeast manufacturing industries to promote the development of innovation activities in these industries will be a new research topic.

.1 IV. Acknowledgements

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