

# THE STRATEGY PATH FOR FIRM'S INNOVATION SYSTEM (FIS) WITH CASE STUDY BASED ON HAIER GROUP CORPORATION

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## ABSTRACT

In view of the fact that most Chinese enterprises lack innovation vigor, this study explores the strategic theories of the construction of enterprises' technology innovation system on macroscopic, mesoscopic, and microscopic levels, and systematically studies the relationships among resource endowment, innovation engine, innovation behavior, and innovation performance. Besides, based on the problem-oriented philosophy, this paper starts with tracing theoretical origin and explores the model for the firm's innovation system (FIS): innovation capability system and innovation engine system.

**Keywords:** innovation capability; innovation ability; theoretic origin

## 1 Introduction

The driving force of innovation on economic growth has been a hot topic for many years (Cruz-González & Amores-Salvadó, 2011). China is also paying more and more attention to the role of innovation in economic growth. Over the past decade, China's total R&D investment has been increasing by an annual growth rate of more than 20%. In 2015, the R&D investment amounted to 1.4 trillion Chinese Yuan. China has had the world's second largest R&D investment after that of the United States. Every country has to develop science, technology and industrial policies to guide the economy to maintain sustainable prosperity (OECD, 2012). Despite the impact of the 2008 financial crisis, China's economy remained in steady growth. The growth rate of GDP remains at around 7% in recent years.

Despite that China's R&D investment grows rapidly, R&D efficiency is still relatively low. The national economic growth are mainly resource-driven and investment-driven (Xu, 2013). This is mainly due to China's long-standing economic and technological models or patterns.

Moreover, the vitality of indigenous innovation has not yet been fully released; the marginal contribution to the transformation of the mode of economic development still has much room for improvement. Therefore, the Chinese Communist Party's 18th Party Congress clearly put forward the implementation of innovation-driven development strategy, with a view to truly solve the high resource consumption and low efficiency of China's national economy. The call has become the response from local Chinese governments. Therefore, from the perspective of national comprehensive competitiveness, it is of great significance to study the strategy of enterprise technology innovation system construction.

## **2 The Main Problems in the Technology Innovation System of China's Enterprises**

Enterprises are the major actor of innovation. They are also the micro foundation of innovation driven economic development strategy. Because of the weak technology foundation, large enterprises in our country have experienced the stage of technological catch-up. Some state-owned enterprises and large private enterprises undertook significant historical mission during such a process and played important strategic role in absorbing and transferring foreign advanced tech. The rising of more and more Chinese enterprises impels foreign transferors of technologies to be conservative in licensing technologies. The "ceiling" effect of technology import gradually manifested itself. Therefore, some state-owned enterprises and large private enterprises have built-up the advanced technology innovation system, planned to implement major technological breakthroughs and realized indigenous innovation and innovation-driven growth. At the same time, as part of an integral part of the market economy, China's small and medium enterprises facing the pressure of survival and development. Some SMEs mainly rely on imitation in the manufacturing process, with lower quality for low cost. Some of them seem powerless toward innovation, even though some of them are willing to innovate.

However, some enterprises still only focus on the technology management when they were trying to construct technology innovation system. In their view, innovation has always been understood as technology innovation, wasn't to be extended to include a comprehensive paradigm containing market, organization, institution, strategy and culture innovation, etc., following the logic of "innovation is the new combination of elements". This situation may relate to our long-term call for independent innovation policy, which calls for enterprises to "import and digest absorption re-innovation", "integrated innovation" and "original innovation" as the guideline to build technology innovation system. And these three kinds of independent innovation mode are all stress technology itself, ignoring the importance of non-R&D factors. Therefore, realizing the concept changing from the "technology management" to "innovation management" could be greatly help to maintain sustainable competitive advantage in today's environment. So, in order to successfully implementing innovation-driven development strategy, small and medium enterprises need to stimulate the potential of innovation and enhance innovation capability, coordinating their short-term goals with long-term goals.

In summary, this paper argues that the essential problem of China's enterprises technology innovation system can be attributed to the lack of innovation vitality. Therefore, innovation engine and innovation capability should be two aspects as a starting point to enhance the innovation vitality of them. The following part will be the introduction of innovation dual-cores model theory, and for case study based on this theoretical framework.

## **3 Theoretical Origin of the Strategy of Constructing Technology Innovation System**

### **3.1 Marco research: technological change and economic growth**

Joseph Schumpeter, an Austrian-American economist who came up with the concept of "innovation" first, comprehensively reviewed the long-term development of economy and society from the economic, sociological and historical perspectives and accordingly regarded innovation as the force to drive the technological, economic development and social reform (Schumpeter & Backhaus, 2006). According to Schumpeter, innovation is a process of creative destruction during which entrepreneurs constantly introduce the new combinations of production factors and production conditions into the production system, thus reforming the economic structure internally (Schumpeter & Backhaus, 2006).

Afterwards, Schumpeter put forward business cycle theory (Schumpeter, 1964). The volatility of business cycle further proved the important role played by innovation in economic development. Until the 1960s, however, the thought of Schumpeter had not been widely recognized by economists. During the Cold War period, the United States realized that the national competitiveness mainly came from the excellence of its technology capability.

A number of economists, sociologists and management scientists were engaged in the in-depth research on innovation. After that, the innovation research also began its multi-polarity development. Europe gradually became a global center of the research on innovation management. In 1965, British economist Science Policy Research Unit founded Science Policy Research Unit in the University of Sussex and devoted himself to studying the mechanism by which the innovation acts on economic development. In his classic work, *The Economics of Individual Innovation*, Freeman comprehensively and systematically analyzed the main phenomenon and laws of innovation economics from the perspectives of historical analysis, economics and science and technology policies, and established the first theoretical system of innovation economics (Freeman, 1982). Then, based on Schumpeter's Long-wave Theory, Freeman investigated the long-term economic cycle in terms of technology innovation and the employment relationship, established "Freeman Long-Wave Theory", and put forward "the development of new technologies or emerging industries is the important force to drive the long-wave rise of economy" (Clark & John, 1982). Besides, one of the most important contributions made by Freeman is that he has cultivated number of outstanding innovation economists, such as Bengt-Ake Lundvall (1985) who advanced "System of Innovation" theory, Giovanni Dosi (1993) who put forward "Technological Trajectory" and "Technological Paradigm", and Jan Fagerberg who compiled *The Oxford Handbook of Innovation* (Fagerberg et al., 2005). Since then, the research on innovation sprang up all over the world. From the systematic perspective, American economist Nathan Rosenberg took technological change as the endogenous variable of economic development (Rosenberg, 1974), verified the role of technical advancement in promoting economic development with massive cases and data (Rosenberg, 1984), and further expanded the boundary of innovation research. Afterwards, Freeman, Lundvall and Nelson deepened such systematic perspective, advanced the famous theory of "National Innovation System", and emphasized the effect of the integrity and interactivity of elements in innovation system on the economic development (Lundvall, 1995; Rondonelli, 1993).

### **3.2 Meso research: scientific and technological progress and industrial upgrading**

As the macro research on innovation-driven economic development became increasingly mature, some scholars tried to explore the internal mechanism of innovation-driven economic development on meso-level. Impacted by Rosenberg who deconstructed the Black Box of technological and economic development, Pavitt (2000) discovered that significant differences existed between different industries and different regions and the mechanisms by which the innovation drives the economic growth were also different. Cooke (1997) also advanced the theory of regional innovation system and considered systematic studying and interactive innovation capability as the key mechanism of regional economic development. Such interactive innovation capability emphasizes the systematic view of regional economic development: constructing rational innovation system, facilitating the all-around and network-based model of collaborative innovation of innovation subjects, and eventually stimulating the regional economic development (Bell et al., 2002). Such a thought also expedited the research on Innovation Cluster (Hertog et al., 2001). Organization for Economic Co-operation and Development (OECD) considered Innovation Cluster as a network of technology innovation formed by subjects with

complementary competitive advantages, which interact with each other on the product chain and value chain, and also an important driving force to promote the construction of national innovation system and economic development. The concept of Innovation Cluster also fully embodied the high amalgamation between scientific and technological progress and economic development on the industrial level. Besides, some scholars also advocated the creative industry as the new strategic highland to drive the sustainable economic development in the context of knowledge economy (Howkins, 2002), and industry-university-research cooperation as the new paradigm to drive innovation (Freitas et al., 2013).

### **3.3 Micro research: innovation capability and competitive advantages**

Finally, a group of scholars began to gradually explore the micro mechanism by which the innovation drives economic development so as to truly open the black box of innovation-driven economic development. Inheriting the thoughts of Schumpeter, Nelson and Winter, in *An Evolutionary Theory of Economic Change*, advocate enterprises undergoing dynamic evolution and natural selection-based market mechanism as two key mechanisms that impact the economic changes (Winter & Nelson, 1982). Drucker continues to open the black box for enterprises undergoing dynamic evolution, and proved with massive cases and data that the creative and enterprising spirit and practices of entrepreneurs constantly drive the transformation of American economy from traditional economy to entrepreneurial economy. Porter also analyzes the external industrial environment and internal operation capacity of enterprises by using economic methodology, discriminated the methods used by enterprises to establish the strategy of gaining competitive advantages, and deemed the enhancement of enterprises' innovation capability as the foothold to drive innovation (Porter, 1997). Following the logic of Porter, Prahalad and Hamel point out that the competitive advantages of enterprises came from the core competences of enterprises, i.e. developing the differentiated and innovative product with lowest cost and highest efficiency (Prahalad & Hamel, 2006). However, the viewpoint on core competences does not take into consideration the role of environmental factors in disturbing the performance of enterprise. As a master in such field, Teece integrates the core competence theory of Prahalad and Hamel and the competitive advantage theory of Porter, included environmental elements into the analytical framework, put forward the concept of "dynamic capability", and offers milestone guiding significance for the sustainable innovation of enterprises and economic development. Besides, Dosi clarifies the micro mechanism to enhance enterprises' innovation capability, i.e. "personal skills → organizational path → organizational capability" (Dosi et al., 2004): the organizational routine and path determines whether the enterprises "do right things" and "do things rightly", so the organizational routine and path is the foot stone to construct enterprise competence.

## **4 The Structure of Technology Innovation System: Dual - Cores Model**

Since Schumpeter first put forward the concept of "innovation" from the perspective of economics, the field of innovation has been developed over the past century. However, the status quo of innovative research is like "blind people feel like the elephant" (Fagerberg et al., 2005). Scholars are more familiar with the perspective of their entry, leading to the decentralization of innovative research. Therefore, there is an urgent need for comprehensive perspective integration.

In addition, the construction of enterprise technology innovation system is still a hot issue; some key issues still are not resolved. On the construction of enterprise technology innovation system, three

problems need to be discussed: first, whether there is suitable environment to provide support for the construction of enterprise technology innovation system; second, in appropriate circumstances, whether enterprises have the ability to build the technology innovation system of enterprise; third, when the environment and capability are meet requirements, whether firms have engines to innovate and get bonus from it. Therefore, in the external environment is to support enterprises to build technology innovation system, the key to building a technology innovation system lies in the construction of enterprise innovation engine system and innovation capability system. Only the sustainable innovation engine and innovation capability can guarantee the enterprise to maintain the sustainable competitive advantage. In addition, the relationship between innovation capability and innovation power is just like "stock" and "flow": the innovation capability is kind of stock, and the innovation engine provides the flow support for the innovation ability. This is consistent with Teece (2009), in order to maintain sustainable competitive advantage, enterprise's innovation ability should be dynamic change, need to continue to improve in the "movement". As a result, the following will be a brief analysis in the construction of enterprise technology innovation system from innovation capability system and innovation power system.

#### **4.1 Innovation capability system**

The researches on the construction of innovation capability system are abundant. The most systematic view is the total innovation management paradigm. It emphasizes the coordination and interaction of all elements to enhance the ability of innovation. Based on this theoretical framework, this paper focuses on these four dimensions: technical system, capital system, cultural system and all-staff system.

**Technology innovation capability** is the core of the enterprise innovation capability system construction. Yam (2011) divides the enterprise technology innovation capability into learning ability, R&D ability, resources allocation ability, manufacturing ability, market ability, organization ability and strategic ability. The core of technology innovation capability lies in R & D ability. So far, the construction mechanism of R&D capability has gone through three stages: R&D-driven technology innovation capability→ internal resource integration capability→ open innovation capability. In China, the mode of building and upgrading technological innovation capacity is mainly composed of three types: secondary innovation, integrated innovation and original innovation. The corresponding capacity enhancement mechanisms are substitution, conversion and evolution. More details could be found in Xu Qingrui (2013)article.

**Capital and finance** support the implementation of enterprise technology innovation strategy and cultivating core competence. Therefore, the accumulation of capital is an important guarantee for the sustainable development of enterprises. One of the important means of capital accumulation is to carry out innovation and efficiency activities based on labor saving. Chen Jin (2001), shows that the proportion of the average income growth rate and the rate of labor productivity growth of the appropriate employees has an important impact on the long-term development of enterprises. In addition, the accumulation of funds for the entrepreneurial activities within the enterprise provides a strong financial guarantee; the ability to enhance its innovation is of great significance. Finally, researches on venture capital and innovation found that venture capital in the enterprise and the regional innovation ecosystem construction plays a very important role, which not only provide financial support but also knowledge support on management and organization.

**Organizational culture** influences the innovation capability of organization by guiding, regulating and coordinating the behavior of organization members. For example, to support the courage of taking

risks and changing, fault tolerance culture conducive to cultivating a good atmosphere for innovation. On the relationship between organizational culture and innovation capability, the research results also mature. Relevant research could be seen in Chen Feng's (2011) article.

**All-employee system** is another important part of capability system. The duality perspective of innovation tells that innovation deals with both creativity and efficiency. That is, some innovations require expert knowledge and skills as they involve fundamental change and high technology (Bessant, 2003); however, most valuable innovations are efficiency issues on how to do it better. The latter one is more benefit from the high participation of front-line staff. Therefore, all employee participation could enhance the ability to innovate. The rise of the Japanese automobile industry supports power of all-staff innovation.

#### **4.2 Innovative engine system: four-wheel driven**

Compared with the innovation capability system, the research on innovation engine system is scarce. It is mainly because previous research focuses on the top of innovation management, that is, how to improve performance through innovation, lacking of study on the basis of innovation management which is innovation engine source interface management. This topic will be briefly discussed below.

**Leadership and governance systems.** In the process of enterprise innovation, managers play an important role, especially the entrepreneur and executive team. Their ability on the environment perception and interpretation will affect the evolution between enterprise and the environment (Kaplan, 2013). Executive team's heterogeneity has Positive impact on enterprises' strategic decision-making. Zahra (2000) has found that the size of the board of directors has an inverted U-shaped relationship with the firm's innovation performance. Yermack (1996) finds that introducing a certain amount of independent- Directors can provide heterogeneous suggestions for enterprise's innovation strategy decision-making. Meanwhile, CFO's participation in innovation decision-making is more favorable for enterprises to carry out innovation strategy through financial support and leverage. In summary, the enterprise's leadership and governance system is important driving factor leading the direction of innovation and development of enterprise.

**All-employee system.** With the intensification of globalization, the competition among enterprises has intensified. Research has shown that all-staff innovative activities conducive to innovative groups to achieve individual creativity and the implementation of the organic integration of innovation (Xie Shupeng, Yang Zhirong, 2006). Therefore, the full innovation system is also driving enterprises to innovate a powerful power source. They can accelerate the innovation activities through "learning by doing" and make the innovation activities develop better and faster.

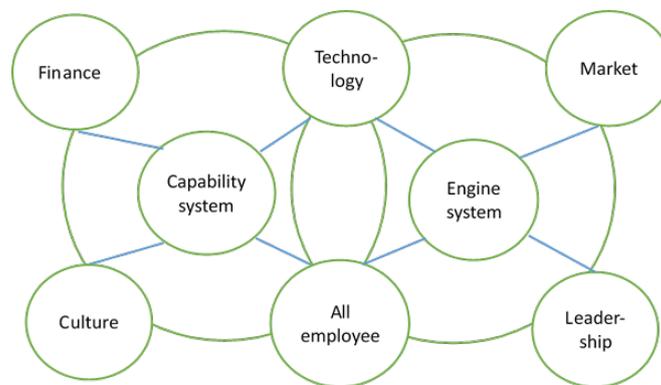
**Technology Driven** is the power that drives companies to derive innovative revenue from R&D and technology innovation activities. This is mainly due to successful technology innovation can help companies get profit higher than the average margins of industry from R&D activities (Christensen, 1997). Risk and return are often positively related. Therefore, different enterprises choose different innovation strategies. Some enterprises emphasis on exploratory innovation, while others emphasis on exploiting innovation. How to ensure sustainable technology innovation has been the blind spot in the field of innovation management. Technology-driven engine mechanism needs to be discussed and summarized urgently.

**Market-pull force** refers to the market forces that drive enterprises to perceive market demand in a timely manner, to gain market feedback, and constantly to adjust their own innovation direction. This is mainly due to the existing resources of innovation is difficult to meet the needs of customers

fragmental need. Driven by the market, companies tend to have market-oriented. Market-oriented enterprises can more easily access and control the market information related to innovation and better understand customer needs (Dougherty & Hardy, 1996). Through appropriate response to market information, firms make full use of existing resources to develop new products closer to market demand and customer demand. Therefore, we should strengthen the market perception and responsiveness of the enterprises and complete the innovation-driven process by constantly "perceiving→ responding→ re-perceiving→ re-responding" loop.

### 4.3 Dual-cores model

In summary, the construction of enterprise technology innovation system should have two cores: one to enhance the innovation capability of enterprises, the other to enhance the enterprise's innovation engines as shown in figure. Among them, the innovation capability system and innovation power system have intersection: technical system and all-staff system.



**Fig.1 Dual-cores model**

## 5 Case analysis: Haier Group

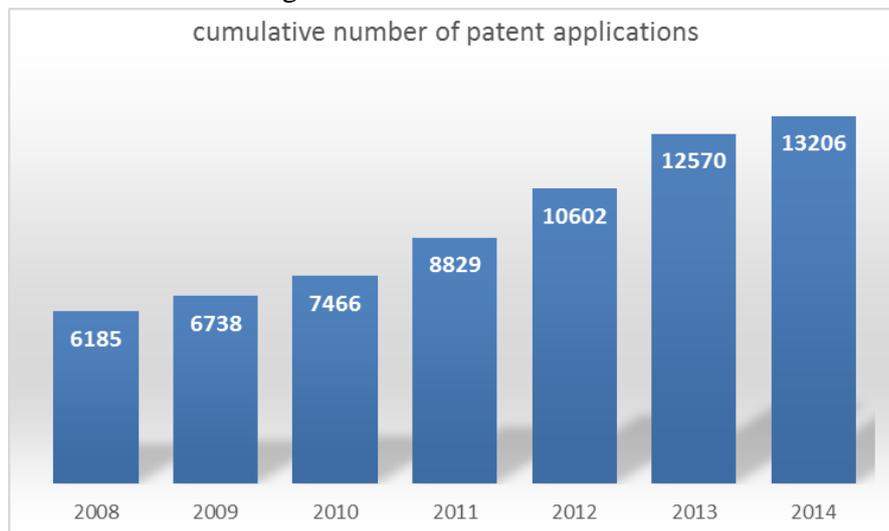
### 5.1 Case background

Founded in 1984 based on a small and insolvent factory on the verge of collapse, Haier has developed itself to the No.1 brand of white goods in the world through 33 years of entrepreneurial innovation. For 33 years, Haier Group has effectively implemented and completed the great-leap-forward development through brand strategy, diversification strategy, internationalization strategy, globalization strategy and networking strategy. In 2009, Haier Group established an open innovation center, which devoted itself to integrating global R&D resources, establishing technology innovation system based on collaborative innovation, and building “P+D” (Partner + Development) innovation network. Based on the preliminary construction of technology innovation system, Haier has continuously released innovative products and won 2011 National Prize for Progress in Science and Technology with a creative project, named “innovation system with the construction of open R&D platform as the core”. The underlying reason for Haier’s ability to maintain the sustainable innovation performance and innovation capability is its 20 years of unremitting efforts in the construction of enterprises’ technology innovation system. The following chapters will discuss in details the six sub-systems constructed by Haier for its technology innovation system.

### 5.2 Haier’s innovation capability system

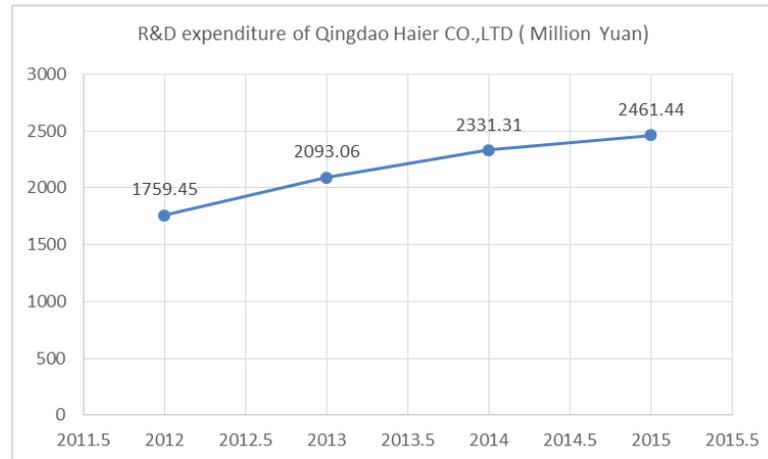
(1) Technology innovation system covers its core R&D system. In the middle of the 1990’s, when

Haier became one of the first innovation pilot enterprises in China to respond to the National Innovation Project, Haier established the enterprise technology center with Zhang Ruimin acting as the first technology innovation director and hosting monthly meetings of enterprise technology center. The technology innovation center guides and plans the technology innovation and R&D of the whole plant in a unified way. At the very beginning, Haier relied on the advanced foreign technologies. Officially founded on December 29, 1998, Haier Central R&D Institute devotes itself to independent research and development. Since its foundation, Haier Central R&D Institute has totally received 11 National Prizes for Progress in Science and Technology, and directed and participated in 152 national standards and 9 international standards. In 2003, Haier Central R&D Institute independently designed and manufactured the first digital television decoding chip with independent property right in China and put it into mass production. After 2009, Haier began to integrate global R&D resources to build an open technology innovation capability system, gradually established the “Culture of External Brain” and achieved the construction of a high-efficiency integrated innovation capability system. In 2016, Haier acquired General Electric Company of the United States and the number of its R&D center increased to 10 all over the world. The cumulative number of patent application in China of Haier Group from 2008 to 2014 is shown in figure 2.



**Fig2. The cumulative number of China patent application of Haier Group**

(2) Capital system. To maintain the sustainable innovation, Haier has insisted on high R&D investment, much higher than the average R&D investment in the industry, for a long time. For example, for over a decade from early 21st century, Haier has insisted on the R&D investment of 5% to 6%. After the implementation of networking strategy in recent years, Haier also adjusted its organizational structure to a “dynamic network structure based on closed-loop of nodes”, hoping to effectively integrate internal and external resources. Haier requires its employees and independent operating entities to realize “self-organization, self-driving and self-operation” and offers employees financial supports for their creativity. Due to the long-term R&D investment, Haier has continuously strengthened its indigenous innovation capability. Qingdao Hair CO., LTD, as an important part of Hair Group, which was founded in 1989, always focuses on user needs and continues to invest in R&D which contributes to the building of innovative system (figure 3).



**Fig3. The R&D Expenditure of Qingdao Haier CO., LTD**

(3) Culture system Haier is one of the earliest Chinese enterprises to set up a culture department in its organizational structure. The culture department lays emphasis on the development of innovation culture and all-involvement innovation activities. For example, Haier encourages every employee to be engaged in self-innovation and self-driving and offers them financial supports. Besides, independent operating entities have implemented the mode of “competing for post”, which also helps the most creative employees obtain ideal posts to fulfill their ideas and accelerate the hatching of creativity.

(4) All-involvement system. The earliest all-involvement innovation practices were mainly organizing workers at the production line to be highly involved in OEC and innovation, insisting on the mass innovation, and improving the creativity and efficiency of the organization through the unique mode of “integrating order with personnel”. In recent years, the all-involvement innovation practices of Haier try to construct a unique all-involvement innovation system in the global network: taking ten R&D centers in the world as the resource interfaces, establishing universal cooperative relationship with first-class suppliers, leading users, and academic institutions all over the world, forming an ecological system of innovation for 1.2 million scientists and engineers with virtual and physical network as the media, and offer intellectual supports for Haier’s collaborative innovation practices. Now it is trying to build an ecosystem for Co-Creation and Win-Win partnership, encouraging employees, customer, provider and other stakeholders to be entrepreneurs and set up their own microenterprise based on Haier Open Partnership Ecosystem Platform(HOPE).The HOPE was designed to create ecosystems for users and global resources, allowing all participating partners to share the value of co-creation. Through the community, technology, ideals, modules, the innovation process could be organic connected in an efficiency way.

### 5.3 Construction of Haier’s innovation engine system

The following part focuses on another two systems of the power system, i.e. leadership and administration system and market system.

(1) Leadership and administration system. As the leader of Haier, Zhang Ruimin has always devoted himself to leading, organizing and impelling Haier’s innovation. A number of management innovation modes, such as “OEC” management mode, “independent operating entity” and “integrating order with personnel”, originated from the senior management team led by Zhang Ruimin. Besides, Haier also keeps improving its corporate administration system in order to offer sufficient strategic supports and organizational guarantees for enterprise innovation. For example, the “innovation system with the

construction of open R&D platform as the core” built by Haier is helping Haier fulfill the strategic vision of building a “platform enterprise”.

(2) Market system. The market-driven innovation is always the strong point of Haier. “No-stopping refrigerator” designed by Haier for Indian market is the best example. In India, there are a great number of vegetarians, who demand the refrigeration function of refrigerator much more than the freezing function. Back then, almost all commercially available refrigerators in India had the freezing area on the upper part and the refrigerating area on the lower part. In view of such market characteristics, Haier’s designers released the first refrigerator with refrigerating function on the upper layer and freezing function on the lower layer in India. It was widely praised and accepted by consumers in Indian market. Such a product helped Haier lay a firm foundation for its refrigerators to take root and become bigger and stronger in India. Haier has established an extremely strong market system and accordingly formed its core competences. Besides, Haier has absorbed advanced technologies to improve its core technological competences through cooperation with transnational corporations. It is the construction of an enterprise technology innovation system with the above-mentioned six systems as the core that helps Haier strengthen its core competences and achieve high innovation performance. Figure 5 shows global turnover of Haier Group from 2008 to 2016.

## **6 Brief conclusion**

Firstly, this paper ascribes the essential problems existed in the construction of Chinese enterprises’ technology innovation system to the insufficient release of innovation vigor. Secondly, this paper systematically reviews the main achievements of previous innovation researches, puts forward the innovation research model of “resource endowment → innovation power source → innovation capability → innovation behavior → innovation performance”, and clarifies the key topics in the field of innovation research and the correlations between them. Finally, this paper puts forward the dual-core model for the construction of enterprises’ technology innovation system, namely innovation capability system and innovation engine system, and points out the interdependence between innovation capability system and innovation power system: the capability is a stock, while the innovation power constantly updates innovation capability as a flow to be adapted to the dynamic changes of environment.

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