Innovation in China's Electronic Information Industry

Gou Zhongwen
Vice Minister, Ministry of Information Industry, China

ABSTRACT

While giving a review of the innovation process of China's electronic information industry, the paper has analyzed the problems associated with the innovation in the electronic information industry, has highlighted the importance of improving the independent innovation ability from the perspective of the composition of the industry's innovation system, and has identified the need for promoting innovation in the information industry by increasing the innovation effort in five aspects, i.e., technological innovation, industrial chain innovation, industrial group innovation, application innovation, and policy innovation.

Key words: electronic information industry, innovation, problems, solutions

I. INTRODUCTION

China's electronic information industry has enjoyed a high-speed growth for more than 20 years, and has become the No.1 pillar industry for the nation's economy. This also shows that the development of electronic information industry must have possessed its special innovative vitality and driving force. In 2005, China's electronic information industry realized a sales revenue of 3.8 trillion yuan. In terms of the size of the electronic information industry, China has already become the second largest country in the world. Although China's electronic information industry has a big size, we also must clearly see that there are some prominent problems associated with the innovation ability of the industry that have to be addressed urgently. Understanding and handling these problems properly is key to promoting the improvement of the abilities of China's information industry and its healthy development.

The innovation ability here refers to the innovation ability of the electronic information industry, and it is addressing the innovation issues from the industry's perspective. It is different from the technology innovation system at the micro-level, and is also different from the national innovation system at the macro-level. The innovation system in the electronic information industry requires addressing the innovation issues of the industry from a systematic point of view, and the main purposes and functions are to enhance the competitiveness and competitive advantages of the industry by improving the levels of the industry and accelerating its development through innovation. Industry innovation focuses on three

aspects: the first is to improve the inner quality of the industry, and to move towards the production of products with high technology content and high added values, aimed at enhancing the competitiveness of the industry; the second is to aim at enhancing self-adjusting and development mechanisms, to actively explore the advantages and uniqueness of industrial development, to continuously penetrate into other industries, to create new markets by taking advantage of the major trend of economic growth, and to make efforts to nurture and develop alternate industries and emerging industries so as to maintain the long-term vitality of industrial development; and the third is to explore and reform the internal organizational forms of the industry, to perfect the industrial chain, to promote industrial concentration, to lower the cost of industrial development, and to enhance the risk-resisting ability in the course of industrial development. To this end, we summarize the innovations in the electronic information industry into five aspects, *i.e.*, technological innovation, industrial chain innovation, industrial group innovation, application innovation, and policy innovation. The innovation elements in these five aspects constitute the innovation system in the electronic information industry.

This article plans to outline the status quo of innovation in the electronic information industry, to analyze the problems associated with the innovation system of the electronic information industry, and, on the back of this, to make recommendations on improving and enhancing innovation in the electronic information industry, and to point out problems that also need to be solved to ensure the success of innovation in the electronic information industry. In this sense, studying the problems and their solutions associated with the innovation in the electronic information industry can guide the ability building in doing innovations in the electronic information industry, and also has profound theoretical and practical implications for the development of other industries and even for building China into an innovation-oriented country.

II. THE STATUS QUO OF INNOVATION IN CHINA

From the status quo of innovation in the electronic information industry of China we can see that the electronic information industry has relatively strong innovation ability in two aspects: industrial concentration and industrial polices. In terms of the innovation in regional concentration, the level of economy of scale and the level of industrial concentration have been obviously improved, and the spatial distribution of industries is increasingly getting reasonable, with the powerful manufacturing capacity in the Pearl River Delta, the Yangtze River Delta and areas around the Bohai Bay having been able to influence the global market, and having formed a relatively strong regional competitiveness. This is inseparable with the fact that China has been actively introducing foreign capital for many years, the electronic information industry is oriented to the international market, and that the electronic information products are highly market oriented. It also shows that China's policies for the electronic information industry are, generally speaking, quite effective. In terms of innovation in product concentration, China is leading the world in output of a wide range of products including VCD/DVD players, color TVs, mobile phones, desktop computers, radios/recorders, telephone sets, loudspeakers, magnetic heads, stored-program controlled switching systems, monitors, CD drivers, hard drivers, and printers. In terms of innovation in company concentration, the backbone role and dominating position of top 100 companies are becoming more and more prominent, a great number of major companies that are doing business across different regions, across different industries, across different ownerships and across different countries have rapidly emerged, and their competitiveness in the marketplace has significantly improved. In 2005, the combined sales income of the top 100 companies in the electronic information industry accounted for 21% of the total number of the industry, with 1 company in the industry having a sales volume of

over 100 billion yuan and 22 companies having a sales volume of over 10 billion yuan. In terms of the policy environment for industrial management, funds, technologies, talents, and government procurement, with the continuous perfecting of China's market economy system and the continuous deepening of the administrative management system, the change of government functions and the innovation in government management methods have created a relaxed environment for the development of the electronic information industry and related companies. Especially, promoting innovation in industrial management of the electronic information industry and emphasizing the so-called dual-wheel movement principle featuring the combination of government's "guidance, standardization, regulation, and service" with market forces have objectively formed a favorable macro development environment.

III. PROBLEMS IN INNOVATION IN CHINA

At the same time, there are also some common problems in the innovation activities in China's electronic information industry, and these can be summarized as below:

The first is that the ability to do original technological innovations is weak, and the industry is badly in short of technological innovation abilities. This results in an industry that is big but not strong. The investment of China's electronic information industry in the R&D of core technologies has been small. According to the survey conducted by related authorities to the nation's key companies, more than 70% of them do not have adequate investment in technological R&D, their technological R&D investment accounts for less than 1% of their total assets, which is far lower than the 10% level of major companies in developed countries. Due to low R&D investment and inadequate innovation ability, most companies do not have products and technologies that are independently developed by themselves and have their own IPRs, the technologies of their mainstream products are far behind internationally advanced levels, and their production technologies and facilities are also far behind internationally advanced levels, leading to a series of problems including the lack of sustainability in growth, the weak core competitiveness and the difficulties encountered in venturing into international market. In recent years, the IPR disputes arising from the export of the electronic information industry are increasing, and the cost problems resulted from IPR factors are becoming more and more prominent. Take the charging of a patent fee over China's DVD makers by international companies for example. According to investigations, if paying all the patent fees, the cost of China's DVD makers will increase by 30%, and this will greatly weaken the competitiveness of Chinese products in international market. Other electronic products also face similar problems. With the increase of production capacity and export scale, the problem of patent fees will become even more prominent.

The second is that it is still inadequate in application innovation. The biggest characteristic of information technologies is that they have a powerful penetration effect on the economy of a nation. Information technologies can be used in various sectors and industries, so as to improve the operational efficiency of the economy and optimize the operational models of the economy. China is in the industrialization stage, and this industrialization is the one in the modern age. It is the industrialization accompanied by precision control, energy saving and environment protection. These all require information technologies to realize.

Therefore, in China, various sectors and industries are waiting for using information technologies, and this also creates a huge application space for information technologies, and along with it, comes the application innovations for the information industry. The information industry will lose a growth space if it cannot get hold of the application innovations. However, in terms of the current situation of China's electronic information industry, its potential to support the nation's economy is far from being fully tapped. This is mainly reflected in

the fact that apart from some MNCs, China essentially does not have relatively big and independent IT service companies. China's software companies are small in size and low in specialization level and market adaptability level. These all indicate that China's electronic information industry is still not strong in application innovation, and is yet to transform China's huge market advantage into industrial development advantage.

The third is that the industry is weak in key aspects of industrial chain innovation. As a result, the added value of the entire industry is low. Especially the development of the basic industries of microelectronics, optoelectronics and materials is seriously lagged behind, the critical ICs and important materials needed for whole-system products essentially rely on importing from abroad, and there is a lack of interaction along the industrial chain. For example, the import volume of IC products accounts for about 70% of the total need of the whole country. Between Jan and Nov of 2002, the accumulated volume of imported ICs and microelectronic assemblies in Guangdong Province reached USD12.472 billion, and the total number reached 21.618 billion pieces. The import has been growing at a big rate annually since 1998. Compounded with the fact that core technologies of major products are in the hands of foreigners, this results in a high reliance of industrial development on foreign companies, a limited effect in taking along domestic manufacturers, and a lack of independence. In recent years, although China's information products export is rapidly growing, the export concentrates in processed products with low technology content and a low added value, and products with our own IPRs and high added values are rare. As a result, we are at the low end of the international industrial chain. We have used lots of materials and energy, but the profit margin is low, and we also have to be bullied by some MNCs in the forms of IPR abuse and monopoly in technology standards.

In general, lack of innovation ability has long been the Achilles' heel of China's information industry, and has seriously constrained the core competitiveness and sustainable development of the information industry. To maintain the high-speed growth and to make China into a powerhouse of information industry in the world, China's information industry must make substantial breakthroughs in innovation-related ability building. Improving industrial innovation ability is a systematic process, which not only includes scientific innovation, but also includes industrial chain development, industry concentration, market innovation, management innovation and policy innovation. Innovation ability is embedded in the innovation system, and only when the innovation system is made perfect, can the long-term and sustainable innovation ability be obtained.

IV. NDEPENDENT INNOVATION

The basic nature, external effect and strategic importance of information technologies have decided that IT innovation needs government intervening and the support of public policies. From the development history of information technologies we can see that all the major technological innovations are the results of the support of public policies. Developing countries need to accelerate the concentration of resources and to promote technological innovation through public policies, so as to take leading positions as latecomers.

Implementing public policies that specifically encourage innovations in information technologies in accordance with the actual situation of a country is also the common practice in the world. Countries with relatively advanced information industry, such as the US, Japan and Korea, are supporting the development of critical and core information technologies in some R&D organizations with a huge budget, and then transferring advanced technologies to businesses from these R&D organizations. With the intensifying of international competition, different countries in the world are continuously increasing their support for IT innovations.

To change the situation in China's electronic information industry, which is marked by weak ability in original innovations, we must greatly enhance ability building in independent innovations. Indepen-

dent innovation is the new strategy for China's science and technology development in the new century. The government attaches great importance to the progress and innovation of science and technology, and has clearly reaffirmed the central role of the ability to do independent innovations in promoting restructuring and in improving the competitiveness of the country, in a bid to accelerate the construction of the nation's innovation system. During the "Tenth Five-Year-Plan Period", in order to rapidly take a number of commanding heights in science and technology in the 21st century, and to make breakthroughs in major key technologies and to realize industrialization, the state had implemented 12 major R&D programs involving two fields of the electronic information industry, i.e., ICs and software. As a result, we have made some major breakthroughs in chip designing, system software, functional genomes and bio-chips, have grasped some key technologies, have formed some high & new technology products and leading industries with China's own IPRs and international competitiveness, have narrowed the gap with world leaders, and have taken a position in the electronic information technology arena of the world. As a developing country, China takes the electronic information industry as a strategic industry for improving its comprehensive national power. It should also take the initiative to build the innovation system for its electronic information industry, so as to enhance industrial innovation ability through the construction of the innovation system, and to realize the development objective of "driving industrialization with informatization and promoting informatization with industrialization".

V. INDUSTRIAL INNOVATION SYSTEM AND INDUSTRIAL INNOVATION ABILITY

Industrial innovation ability is embedded in the industrial innovation system. Enhancing ability building in innovations is a system project, requiring systematic solutions, and only when the innovation system is made perfect, can the long-term and sustainable innovation ability be obtained. The electronic information industry should be based on innovation. By analyzing the practices in the electronic information industry of the world, we can see that the electronic information industry has some prominent characteristics: a high development speed of technologies, more and more detailed industrial segmentation, prominent regional concentration, continuous increase of the width and depth of application, and policy support and guidance. These characteristics have centrally demonstrated the five components of the innovation system of the electronic information industry.

We can say that the innovation system of the electronic information industry is a system consisting of five components, i.e., technological innovation, industrial chain innovation, industrial group innovation, application innovation, and policy innovation. These components interact and mutually promote each other within the same system to drive the continuous development of the electronic information industry. The innovation system of China's electronic information industry is essentially formed spontaneously under the work of the market mechanism, but there are also government intervening factors, and basic driving factors include technical benefit motivation, market competition motivation, regional competition motivation, application demand motivation, and industrial policy motivation. Among them, technological innovation has its own source of growth, through which it can accumulate and grow by itself. Technological breakthroughs can take along the development of the industry. Application innovation guides the direction of technological innovation and expands market for technological innovation. Industrial chain innovation promotes further segmentation of the industry, enabling the results of technological innovation to be enlarged, to form novel industries one after another. Industrial group innovation mutually compensates with industrial chain innovation, promotes technology concentration and the spill-over of knowledge, improve the efficiency of industrial development, and consolidate the results of technological innovation. Policy innovation is the system assurance and driving force for the other innovation

components, creating a suitable social environment for the other innovation components to play their respective roles properly. Therefore, we can see that all the components of the innovation system of the electronic information industry are mutually dependent and supporting each other, and together, they constitute a whole system that can cycle and grow by itself.

Specifically, enhancing the innovation ability of China's electronic information industry also needs to start from these five components constituting the industry's innovation system.

First, in technological innovation, we need to build the technological innovation ability focusing on core technologies.

Based on the international environment of China and its basic national situation, we must highlight the state's objectives and rely on independent innovations to realize leapfrogging development in key IT fields, which are of strategic importance, are the direction of future development, are forward-looking, and are of a basic nature. While emphasizing principle innovation and technological innovation, we should also pay attention to concept innovation, so as to form new ideas, new theories, new technologies, and new processes on a continuous basis, to enhance the sustainable innovation ability, and to have more and more IPRs, especially the invention patents. We need to enable the overall technological level of China's information industry to have a significant improvement and to increase the number of IPRs by enhancing technological innovation.

Second, in industrial chain innovation, we need to build the industrial chain innovation ability focusing on creating a complete supporting environment.

We need to aim at the development trend in the world market, consolidate and improve the processing and assembling industry, move towards emerging product fields including high-end products and digital products, and promote the upgrade of electronic information products; we need to increase the proportion of hi-tech products and products with a high added value and a high suitability, so as to form a product portfolio encompassing high-end, middle-end and low-end products; we need to focus on digital products and high-end electronic equipment, accelerate the industrialization of high technologies such as networking product, information appliances, and digital video products, and improve the added value of the products; we need to pay attention to the development of key industries and key products, to form industrial groups as the new growth points of the economy, to break the bottlenecks of the software and IC industries, and to attach great importance to information service industry focusing on e-business and network information service.

Third, in application innovation, we need to build the application innovation ability focusing on expanding both domestic and international markets.

We need to explore domestic market in an all-round way, and on the back of consolidating existing product market, to continuously explore emerging markets, to explore the market for informatization, especially the market for reforming traditional industries, and to actively explore western market, rural market and the markets in middle-and-small-sized cities; we need to explore diversified international market, pay attention to marketing, continuously increase the market share of China's IT products in developed countries including Europe, the US and Japan, explore foreign markets in South America, East Europe and Africa, implement the "going out" strategy, promote cross-border operations and cooperation, nurture and develop China's IT MNCs, improve international competitiveness, and improve the share in international market.

Fourth, in industrial group innovation, we need to build the industrial group innovation ability based on the principle of putting the regional advantage into play.

Developing information industries for different regions with their respective uniqueness and building a reasonably distributed industrial system through enhancing the comparative advantage are the important objective for the restructuring of China's information industry at present. Take advantage of the opportunities brought about by the nation's west development campaign to realize regional structure adjustment through industrial relocation, technol-

ogy transfer, targeted support and joint development in connection with IT application; and speed up the step of regional restructuring through utilizing each other's advantages, collectively inviting businesses, changing government ideas and functions, and improving investment environment.

Fifth, in policy innovation, we need to build the policy innovation ability focusing on public technical services.

The function and the role of government in the innovations of the electronic information industry need to be shifted towards public technical policies and public technical services. The government's public technical services need to be based on certain technology R&D infrastructures, i.e., public technology platforms. In view of the status quo of the electronic information industry, we need to build the following public technology platforms: key laboratories at ministry or provincial levels based on industry R&D centers; science and technology innovation platforms for the information industry; technological service platforms for public applications in the information industry; platforms for the sharing of scientific information resources in the information industry; and the R&D results transformation platforms and service systems in the information industry.

In summary, the electronic information industry is the main force in the national innovation campaign in China and the important component in the national innovation system. If the innovation system in China's electronic information industry focuses on changing China from a big country in terms of electronic information products to a powerhouse in this arena, combining integration innovation with independent innovation, accelerating breakthroughs in key technologies, perfecting industrial chains, venturing into the high-end of the industrial chain, enhancing the optimization, integration and consolidation of IT resources, building concentration abilities, speeding up the promotion and application of electronic information technologies, speeding up application innovation, and optimizing and perfecting industrial policies, we will surely be able to build an innovation system for the electronic information industry that is focused on businesses and based on the organic combination of industries, academics, R&D organizations and applications, and to improve the international competitiveness of the industry, so as to enable China's electronic information industry to have a world-class innovation ability.

BIOGRAPHY

Mr. Gou Zhongwen *was born in Zhenyuan, Gansu of China in June 1957. He graduated from the Electronics Engineering Department of the Northwest Institute of Telecom Engineering in 1981. In Jan, 1989, he received a master's degree in engineering from the Xi'an University of Electronics Science and Technology. He successively took the post of Deputy Director of the No.29 Research Institute of the Ministry of Mechanical and Electric Industry, Deputy Director of the No. 29 Research Institute of the Ministry of Electronics Industry, Deputy Director of the Division for Science & Technology and Quality Monitoring, and Director of the Research Center for the Development of Computers and Microelectronics under the Ministry of Electronics Industry. He became President of CCID in Oct, 2000, and he has been Vice Minister of the Ministry of Information Industry since Feb 2002. In recent years, he has been engaged in industrial administration in the information industry, and accumulated rich experiences in the mutual support and mutual promotion between information technology innovation and information industry development in China.*