

# Technology Policy for the Promotion of Knowledge-based Industry

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## Introduction

### Necessity of this Study

It is evident that in the 21st century, the structure of our economy will take the shape of a 'Knowledge Society' or 'Knowledge Economy'. The world's economic organizations are proposing a 'Knowledge-based economy' concept for the future economies of developed countries. On the other hand, they are interpreting economic development along the lines of information, and therefore 'Knowledge Economics' will be the new economic parody of the 21st century which will be on everybody's lips.

It is said that the Korean economy must overcome its current economic crisis by creating information and enhancing production. It is now essential not to catch-up with the developed countries, but rather to leapfrog over them by the creation and distribution of information. The problem is that the creation and distribution of information does not happen over a short period of time.

However, the domestic economic state of information, which is determined through the creation and investment of information and its results, is very frail. Most of all, the process of creating is very inefficient. This means that the profits are low compared to the costs for information creation. Information investment such as R&D is at a similar level as that of developed countries, but the accompanying results such as new technological development are very poor. The basic reason for these poor results is that infra-information such as computers are unsatisfactory and the use of information resources are ineffective. Especially, results from various studies were not being generously commercialized and the percentage of R&D being done at universities was found to be low.

Our society must enhance the efficiency of the information creation process which also must be accompanied by government support in order to overcome the economic crisis and develop grounds for growth.

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## Purpose and Contents of this Study

Several people have asserted the necessity of creating a knowledge-based industry as if it would bring about a Knowledge-based economy. yet, there are several problems related to the establishment and execution of policies for a knowledge-based society. For example, we establish policies for a high-tech industry as if would bring about a knowledge-based society, or devise polices by copying what foreign countries have developed, ones which are not suitable to our current political, economical, and social conditions. In fact, many research institutions and policy executive organs are mistaking the development of a knowledge-based society as that which is breaking away from the manufacturing industry and developing the hi-tech industry. There are many cases in which they are simply copying the policies of the developed countries.

This study aims at deducing an argument by going over the cases in which the current related organizations are following the policies of developed countries and at pointing out the mistakes that can occur by executing those policies. In addition, it aims at setting forth the policies which must accompany with the development of a knowledge-based industry .

# The Necessity for Development of a Knowledge-based Industry

## The Level of the Knowledge-based Industry in our Country

The indices which show the current condition of the knowledge base are known as the 'knowledge formation index' and 'information results index'.<sup>1)</sup> The knowledge formation index shows the speed and size of knowledge formation, and the knowledge results index shows the results of knowledge and its influence. It is essential to measure the results along with the effects of knowledge in order to determine not only the quantity of knowledge but also the quality of it.

In our country there is a very distorted level of knowledge. According to the Hyundai Research Institute(1998) based, on an average of 100 in five different developed countries, our country recorded an average of 104.8 in the knowledge formation index in contrast to an average 37.2 in the knowledge results index. This means that the knowledge formation index which is represented by GDP compared to R&D investment, GDP as compared to education expenditures, GDP compared to the costs for importing foreign technology, number of researchers per ten thousand workers and percentage of university graduates, all were the same or on a higher level

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1) Refer to Kim, Chang Wook (1998) for details.

as compared to developed countries. On the other hand, the knowledge results index which is represented by the number of patents per ten thousand people, number of dissertations per ten thousand people, amount of contribution that knowledge has given to economic development, percentage of knowledge intensive industries within the added value of manufacturing and GDP compared to the profit earned from exporting technology, was remarkably lower than that of the five developed countries.

The level of GDP compared to the knowledge-based industry in our country was merely 1/2~1/2.5 of that of many major developed countries. Knowledge-based industries occupied 8.2% of our country's industry which is far behind that of developed countries. This means that knowledge-basing of the industry has not yet become rooted in our society, and that the creation of added value in our industry is low. In short, it shows that our industry consists mostly of low level technology and knowledge intensity. Lately, the knowledge-based industry is progressing at a rapid rate, but the percentage of production and added value remains at a low level.

#### The Necessity for Reorganization into a Knowledge-based Industry Structure

Developing a knowledge-based industry can be the solution to the problems of our industry structure which were formerly mentioned. Development of a knowledge-based industry can strengthen international competitiveness, which has been indicated as the biggest problem of our country, by making the production structure flexible, accelerating development of technology and diversifying the industry structure. This can bring about epoch-making transformation of our trade structures and solve the problem of the lack of flexibility concerning domestic · foreign supply and demand. Positive effects are also expected, such as direct and second-hand diversification · stabilization of the export structure and the increase of the flexibility of the labor market and development of new products along with high value-added products.

In addition, if the industry structure is reorganized into a knowledge-based industry, not only will the competitiveness be strengthened through employment mediation and the flexibility of structure, but unemployment, the major problem which our country is confronted with, can be thoroughly solved through the creation of jobs. The main problem which may occur in the course of transformation into a knowledge-based industry, is the increase of unemployment and occurrence of unequal distribution. This takes place in the process of enhancing efficiency of enterprises. In this aspect, creation of new jobs must be extended through new types of occupations and industries in order to prevent the fixation of long term unemployment. Especially, new types of industries must be developed in order to reabsorb the unemployed workforce which originates from the reformation currently in progress of particular industries and enterprises. Furthermore, it is anticipated that diversification · high growth of the consumption structure and advance in services will occur due to the globalization of economic activities, the aging society, environment

preservation and the expansion of female labor participation in public affairs. Therefore, the development of new industries which focus on a knowledge-based industry, is needed in order to cope with this situation.

## The Knowledge-based Industry Programs of Major Countries

The leading countries are preparing for the dawn of the 21st century which will be based on a knowledge society. They are planning strategies and leading the line of the knowledge revolution in order to transform into knowledged countries. The United States, Canada, Germany, Finland, Sweden, the Netherlands and even China are preparing a national master plan to ensure knowledge competitiveness.

### The New Industry Policy of Japan<sup>2)</sup>

Japan acknowledged the fact that their long-term depression was due to the stagnation of new knowledge which focused on industries such as information, communication, and the environment. They have selected 15 new industries which have great potential to create demand, and are promoting policies to support them.

Japan's economic stagnation is viewed as the most prominent situational change which calls for new industrial policies. The new industrial policy aims at overcoming overcome stagnation and once again filling the economy with vigor.

### The New Industrial Policy of America

There are two outstanding aspects of America's new industrial policy. First, the government does not give direct support, but intervenes through the support of technology development and commerce, and strengthens industrial competitiveness. They especially intervene with the field of technology development which is not contradictory to the WTO regulations forbidding subsidies. Second, their industrial policy ultimately inclines to create a maximum number of jobs. This is also the reason for supporting the technological development of small and medium enterprises and new enterprises.

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2) Refer to Kang, D. (1998), *Japanese Industrial Restructuring Policy via the Promotion of New Industry*, KIET.

## Technology Policy for the Development of a Knowledge-based Industry

### The Criticism of a New Industrial Policy<sup>3)</sup>

The new industrial policy entails the following two concepts: 1) An industrial policy which differs from the already existing one 2) development of a new main industry.

### *An industry structure policy focusing on a knowledge-based industry<sup>4)</sup>*

The background of the appearance of these new industrial policies are: in the short-term, inducing domestic market activation through the promotion of investment into the new industries, and long-term, fundamentally converting the industrial structure to adapt to the changes in the environment of the 21st century. The Ministry of Commerce, Industry, and Energy plans to invest 119.6 trillion won in 27 promising new Korean industries<sup>5)</sup> of the 21st century starting in 1999 up till 2003.

### *Criticism of new industry policies : advancement of the major industries<sup>6)</sup>*

The Korea Development Institute(KDI) believes that international competitive power will be obtained through knowledge intensification of already existing major industries such as electronics, automobiles, chemistry and machinery. In this process, they expect 'hi-tech industries' such as hi-tech electronics, new material and biological industry to gradually develop.

The current government's industrial structure advancement policy focusing on an information based industry and KDI's major industry advancement policy differ in the following aspects. First, the evaluation of competitiveness of the major industries differ. The former supposes that improvement of competitiveness in the major industries is limited, while the latter gives a positive evaluation of the possible of improvement of the major domestic industries. Second, is the difference of viewpoint in each approach. The former is a short-term development 'risk bearing' approach which carries the burden of failure of a new industry without foundation.

The latter is a 'risk avoiding' approach which intends to develop new industries in the process of high value adding of the competitive major industries. Third, the priority in policy execution

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3) The current direction of our government policy is mainly based on the promotion of knowledge-based industry by the Ministry of Commerce, Industry, and Energy. Although the other Ministries also pursue similar policies, it is meaningful to focus on the policy of the MOCIE since it is the one which is in charge of industrial policy.

4) Refer to MOCIE (1999), Visions and Development Strategies of Korean Industry for the 21st Century.

5) In order to find 27 new industries, refer to MOCIE (1999).

6) Various opinions on this issue are well-presented in KDI (1998), Round Table for the Promotion of Knowledge-Based Economy.

and execution methods differ. The former gives relative priority to execution of knowledge-based industry development policies and utilizes the developmental strategies of certain industries. On the other hand, the latter emphasizes methods to add high value to the current major industries and also to strengthen the knowledge base of the economy in general.

### *Policy Recommendations*

The argument about the policy for the development of a knowledge-based industry suggests the following as desirable directions.

First, the current economic situation calls for the smooth reform of the industry. The priority must be set in a reasonable way and consequently produce a synergy effect of industrial policies, and efficiently use the limited financial resources which hold the key to the success of industrial policies. Therefore, it is desirable to promote industrial policies related to structural reform which aim at overcoming economic crisis. In the short-term, a policy strengthening the competitiveness of already existing major industries must be given priority, while in the long-term a policy for developing information-based industries must be promoted.

Second, the knowledge-based industry development policy must be an overall and systemized one in the sense that must strengthen the general national economy. It must not include only the industrial sector. Therefore, the policy must be established not at the individual ministry level, but at a nationwide level which includes the participation of the Ministry of Commerce, Industry, and Energy(MOCIE) · Ministry of Finance and Economy(MOFE) · Ministry of Information and Communication(MIC) · Ministry of Science and Technology(MOST) · Ministry of Education(MOE) and any private enterprises which are concerned.

Third, the principle of a market economy must be promoted. The enterprises must be allowed to freely enter and exit the new industries based on the market demand for each industry, which will naturally induce the development of new industries. The standards of government support and intervention must be built on laws in order to help avoid unnecessary government support and intervention.

Fourth, the active creation and development of knowledge-based industries must be supported second-hand by reinforcing the protection of intellectual property and promoting commercialization through revitalizing venture capital.

### Plans to Develop a Knowledge-based Industry

#### *Reinforcing the university-industry-research institute cooperation*

Shifts among school ties and joint research are being emphasized in order to make the knowledge transfer process at universities and government research institutes more smooth. In this way, knowledge-based industry is further developed. Therefore, the subjects of research at the gov-

ernment, universities and national innovation system must reform the related systems in order to enhance the economic contribution through reinforcement of the knowledge base.

### *Training a professional workforce*

The most important aspect of a knowledge-based economy is a systemized workforce. An education system which can produce a high-quality work force is essential. Activation of the supply and demand of the workforce is also necessary to improve the professional quality. The exit and entrance of the workforce between enterprises and organizations must freely occur. This relates to the flexibility of the labor market. The domestic employment conditions for the foreign workforce must also be loosened up. Otherwise, a device must be installed to activate technical and administrative cooperation with enterprises of developed countries, and obtain the necessary workforce.

### *Development and accumulation of knowledge · technology*

Considering our country's flimsy knowledge · technology level, we must continuously expand investment in research and development, despite evaluations showing the results of such actions as low compared to investment. Without R&D investment, transfer to a knowledge-based economy is but an illusion. In the long-term, tax benefits and government support are needed to promote R&D investment.

### *Reorganization of the system and modulation of the government's role*

In a knowledge-based industry structure, the government's role must be organized based on the ground of the market economy principle. This breaks from the government role of the past in which they intervened only in the case of market failure. The current role must be restricted to creating social vision and catalyzing.<sup>7)</sup>

### *Establishing infrastructure such as an information networks and locations*

It is impossible for an information industry to survive if they fall behind the current of international knowledge. Therefore, it is necessary to establish an information network which connects the flow of national and international knowledge. As for the representative general support system, a location which satisfies the following conditions is essential; easy to connect with university-industry-research institute consortia, easy to form a market of products and service and easy

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7) It is widely agreed that the government should be active in establishing a favorable environment especially at a transition period toward a Knowledge-based economy so that the restructuring of the industry can be fulfilled by market and firms. It is also important that the government assist in the formation of infrastructures in making sure that they are systematic and consistent, either in local or national level (OECD, 1997).

to connect specialized knowledge and technology. This site must entice national-international eminent enterprises and venture enterprises, institutes and universities. It must promote free competition and smooth connections. Therefore, the site must maximize feedback through synergy of technology and accumulation of information-based industries.<sup>8)</sup>

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8) For details, refer to Lee and Park (1998), *Plan for Scientia Techno Belt Policy*, Advisory Mimeo 98-029, KIET.



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